

# ***Undergraduate Catalogue***

***2019 - 2020***



**UNIVERSITY OF PUERTO RICO**

**MAYAGÜEZ CAMPUS**

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In addition, UPRM is currently reviewing and restructuring many of its academic programs in an effort to enhance their quality and efficiency. In that process, some of the programs and courses mentioned in this catalogue may be modified, consolidated with other programs or courses, or eliminated. If you have questions about a particular program or course, you should contact the appropriate university college or department.

The UPRM Undergraduate Catalogue is available at: <http://www.uprm.edu/catalog>

A publication of the Office of the Dean of Academic Affairs.

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## **Undergraduate Academic Degrees Offered at UPRM**

### **BACHELOR OF ARTS**

Comparative Literature, Economics, English, History, French Language and Literature, Hispanic Studies, Philosophy, Physical Education in Teaching, Physical Education in Coaching and Officiating, Plastic Arts, Political Sciences, Psychology, Social Sciences, Sociology, Theory of Art

### **BACHELOR OF AGRICULTURAL SCIENCES**

Agricultural Sciences, Agronomy, Agricultural Economics, Horticulture, Animal Science, Crop Protection, Agribusiness, Agricultural Education, Agricultural Extension, Soil, and Agricultural and Environmental Systems

### **BACHELOR OF SCIENCE**

Biology, Industrial Microbiology, Pre-Medical Studies, Industrial Biotechnology, Chemistry, Geology, Mathematics, Computer Sciences, Mathematics Education, Nursing, Physics, Physical Sciences

### **BACHELOR OF SCIENCE IN BUSINESS ADMINISTRATION**

Accounting, Finance, Human Resources Management, Marketing, Operations Management, Computerized Information Systems, Office Administration

### **BACHELOR OF SCIENCE IN ENGINEERING**

Chemical Engineering, Civil Engineering, Computer Engineering, Computer Sciences and Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Software Engineering, Surveying and Topography

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## **Graduate Academic Degrees Offered at UPRM**

### **DOCTOR OF PHILOSOPHY**

Applied Chemistry, Bioengineering, Electrical Engineering, Mechanical Engineering, Marine Sciences, Chemical Engineering, Civil Engineering, Computing and Information Sciences and Engineering

### **MASTER OF BUSINESS ADMINISTRATION**

Finance, General Program, Human Resources, Industrial Management

### **MASTER OF ENGINEERING**

Bioengineering, Chemical Engineering, Civil Engineering, Computer Engineering, Industrial Engineering, Electrical Engineering, Materials Science and Engineering, Mechanical Engineering

### **MASTER OF SCIENCE**

#### **Agricultural Sciences**

Agricultural Economics, Agricultural Education, Agricultural Extension, Agronomy, Soils, Animal Science, Horticulture, Crop Protection, Food Science and Technology

#### **Arts & Sciences**

Biology, Chemistry, Geology, Marine Sciences, Physics, Applied Mathematics, Statistics Mathematics, Pure Mathematics, Teaching Mathematics at Secondary Level, Scientific Computing

#### **Engineering**

Bioengineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Industrial Engineering, Materials Science and Engineering, Mechanical Engineering

### **MASTER OF ARTS**

Hispanic Studies, English Education, Kinesiology

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## **Contents**

|  |           |  |           |
|--|-----------|--|-----------|
| <b>Historical Sketch.....</b>  | <b>1</b>  | <b>Office of the Dean of Students .....</b>                          | <b>59</b> |
| ▪ Accreditations and Affiliations                                      |           | ▪ Athletic Activities.....   | 59        |
| ▪ Vision and Mission   |           | ▪ Band and Orchestra.....  | 59        |
| ▪ Strategic Objectives   |           | ▪ Counseling and Psychological Services .....                        | 60        |
| ▪ General Education Student Learning Outcomes (SLOS)                   |           | ▪ Financial Aid.....   | 61        |
| <b>Organization of the University of Puerto Rico.....</b>              | <b>3</b>  | ▪ Health Services Department.....                                    | 62        |
| <b>Organization of the Mayagüez Campus ....</b>                        | <b>4</b>  | ▪ Placement Department.....  | 64        |
| <b>University Regulations ....</b>                                     | <b>5</b>  | ▪ Quality of Life Office.....  | 64        |
| <b>UPRM Student Regulations .....</b>                                  | <b>6</b>  | ▪ Campus Safety and Security .....                                   | 65        |
| <b>Research and Development Endeavors .....</b>                        | <b>11</b> | ▪ Social and Cultural Activities .....                               | 69        |
| <b>Special Programs .....</b>  | <b>26</b> | ▪ Student Organizations and Clubs.....                               | 69        |
| ▪ Puerto Rico Resource Center for Science and Engineering              |           | ▪ Student Governance .....   | 69        |
| ▪ Puerto Rico Transportation Technology-T <sup>2</sup> Transfer Center |           | ▪ Student Center.....  | 69        |
| ▪ Puerto Rico Strong Motion Program                                    |           | ▪ Student Exchange Programs and International Student Services ..... | 70        |
| ▪ Education and Research Internship Program (ERIP)                     |           | <b>Other Services.....</b>   | <b>70</b> |
| ▪ UPR Sea Grant College Program  |           | ▪ Alumni .....   | 70        |
| ▪ Center for Pharmaceutical Engineering Development and Learning       |           | ▪ Bookstore .....  | 70        |
| ▪ Center for Aerospace and Unmanned Systems Engineering (CAUSE)        |           | ▪ Campus Dorms.....  | 71        |
| ▪ OASIS Project  |           | ▪ Dining.....  | 71        |
| ▪ Pre-Engineering Program  |           | ▪ Information Technology Center.....                                 | 71        |
| <b>Publications.....</b>   | <b>31</b> | ▪ Press and Publications.....  | 71        |
| <b>Collections.....</b>  | <b>32</b> | <b>Tuition, Fees and Expenses.....</b>                               | <b>72</b> |
| <b>Office of the Dean of Academic Affairs .....</b>                    | <b>33</b> | ▪ Honor Registration Exemption.....                                  | 73        |
| ▪ Admissions Office .....  | 36        | ▪ Honor Registration Requirements.....                               | 73        |
| ▪ Department of Aerospace Studies .....                                | 37        | ▪ Regular Fees .....   | 72        |
| ▪ Department of Military Sciences .....                                | 39        | ▪ Regulations.....   | 72        |
| ▪ Division of Continuing Education and Professional Studies .....      | 43        | ▪ Reimbursements .....   | 73        |
| ▪ General Education .....  | 33        | ▪ Return of University Property .....                                | 73        |
| ▪ Interdisciplinary Courses .....                                      | 34        | ▪ Special Fees .....   | 72        |
| ▪ General Library.....   | 56        | ▪ Tuition Fees .....   | 72        |
| ▪ Office of Graduate Studies .....                                     | 55        | <b>Academic Standards.....</b>                                       | <b>74</b> |
| ▪ Office of Immigration Affairs.....                                   | 55        | ▪ Class Attendance and Examinations .....                            | 80        |
| ▪ Professional Enrichment Center.....                                  | 36        | ▪ Classification of Students .....                                   | 76        |
| ▪ Registrar's Office .....   | 58        | ▪ Course Coding System .....   | 78        |
| ▪ Teacher Preparation Program .....                                    | 44        | ▪ Curricular Sequences and Minor Concentrations .....                | 77        |
|  |           | ▪ Evaluation of Student's Academic Course Work.....                  | 80        |
|  |           | ▪ Freshmen Admission .....   | 74        |
|  |           | ▪ Grades .....   | 79        |
|  |           | ▪ Graduation Requirements.....                                       | 82        |
|  |           | ▪ Language of Instruction.....                                       | 76        |
|  |           | ▪ Maximum Academic Load .....  | 76        |
|  |           | ▪ Re-admission .....   | 75        |
|  |           | ▪ Registration .....   | 76        |
|  |           | ▪ Retention Standards .....  | 81        |
|  |           | ▪ Summer Session Programs .....                                      | 77        |
|  |           | ▪ Transfers.....   | 75        |
|  |           | ▪ Withdrawal.....  | 77        |

---

**College of Agricultural Sciences..84**

|  |           |
|--|-----------|
| Organizational Structure.....              | 84        |
| Areas of Study .....                       | 85        |
| Cooperative Education Program .....        | 85        |
| Agricultural Experiment Station .....      | 86        |
| Agricultural Extension Service.....        | 86        |
| International Programs in Agriculture..... | 86        |
| Courses of Instruction .....               | 87        |
| <b>General Program in Agricultural</b>     |           |
| <b>Sciences .....</b>                      | <b>88</b> |
| Program of Study.....                      | 89        |

**Department of Agricultural Economics  
and Rural Sociology .....**

|                              |    |
|------------------------------|----|
| Agricultural Economics ..... | 91 |
| Agribusiness.....            | 93 |
| Departmental Faculty.....    | 94 |
| Courses of Instruction ..... | 95 |

**Department of Agricultural Education ...97**

|                              |     |
|------------------------------|-----|
| Program of Study.....        | 97  |
| Agricultural Extension ..... | 99  |
| Departmental Faculty.....    | 100 |
| Courses of Instruction ..... | 101 |

**Department of Agricultural and  
Biosystems Engineering .....**

|                              |     |
|------------------------------|-----|
| Program of Study .....       | 103 |
| Departmental Faculty.....    | 105 |
| Courses of Instruction ..... | 105 |

**Department of Agroenvironmental  
Sciences .....**

|                              |     |
|------------------------------|-----|
| Agronomy .....               | 110 |
| Soil.....                    | 111 |
| Courses of Instruction ..... | 112 |
| Crop Protection.....         | 114 |
| Courses of Instruction ..... | 117 |
| Horticulture.....            | 119 |
| Courses of Instruction ..... | 120 |
| Departmental Faculty.....    | 122 |
| Departmental Faculty.....    | 124 |

**Department of Animal Science .....**

|                              |     |
|------------------------------|-----|
| Program of Study .....       | 127 |
| Pre-veterinary .....         | 128 |
| Departmental Faculty.....    | 129 |
| Departmental Faculty.....    | 130 |
| Courses of Instruction ..... | 131 |

**College of Arts and Sciences...135**

|   |     |
|---|-----|
| Degrees Offered .....                     | 135 |
| Graduation Requirements.....              | 136 |
| Professional Societies .....              | 136 |
| Department-Sponsored Student              |     |
| Organizations.....                        | 136 |
| Advanced Placement.....                   | 137 |
| Curricular Sequences in Film Studies..... | 137 |
| Arts and Sciences Interdisciplinary       |     |
| Courses.....                              | 137 |
| Industrial Biotechnology Program .....    | 138 |

**Department of Biology .....**

|                              |     |
|------------------------------|-----|
| Biology.....                 | 142 |
| Industrial Microbiology..... | 143 |
| Pre-Medical Studies.....     | 145 |
| Departmental Faculty .....   | 147 |
| Departmental Faculty .....   | 149 |
| Courses of Instruction ..... | 149 |

**Department of Chemistry .....**

|                              |     |
|------------------------------|-----|
| Program of Study.....        | 157 |
| Departmental Faculty.....    | 158 |
| Departmental Faculty.....    | 159 |
| Courses of Instruction ..... | 160 |

**Department of Economics .....**

|                              |     |
|------------------------------|-----|
| Program of Study.....        | 166 |
| Departmental Faculty.....    | 168 |
| Departmental Faculty.....    | 173 |
| Courses of Instruction ..... | 174 |

**Department of English .....**

|                              |     |
|------------------------------|-----|
| Program of Study.....        | 177 |
| Departmental Faculty .....   | 179 |
| Departmental Faculty .....   | 180 |
| Courses of Instruction ..... | 181 |

**Department of Geology .....**

|                              |     |
|------------------------------|-----|
| Program of Study.....        | 189 |
| Departmental Faculty.....    | 190 |
| Departmental Faculty .....   | 191 |
| Courses of Instruction ..... | 191 |

**Department of Hispanic Studies .....**

|                             |     |
|-----------------------------|-----|
| Program of Study.....       | 196 |
| Departmental Faculty .....  | 197 |
| Departmental Faculty .....  | 198 |
| Courses of Instruction..... | 199 |

**Department of Humanities.....**

|                                     |     |
|-------------------------------------|-----|
| Comparative Literature .....        | 206 |
| French Language and Literature..... | 207 |
| Philosophy.....                     | 208 |
| Plastic Arts .....                  | 210 |
| Theory of Art .....                 | 211 |
| Departmental Faculty .....          | 212 |
| Departmental Faculty .....          | 218 |
| Courses of Instruction.....         | 219 |

|  |     |
|--|-----|
| <b>Department of Kinesiology</b> ..... | 235 |
| Physical Education in Teaching.....    | 236 |
| Coaching and Officiating.....          | 238 |
| Departmental Faculty .....             | 240 |
| Courses of Instruction .....           | 241 |

|  |     |
|--|-----|
| <b>Department of Marine Sciences</b> ..... | 246 |
| Departmental Faculty.....                  | 247 |
| Courses of Instruction.....                | 247 |

|   |     |
|---|-----|
| <b>Department of Mathematical Sciences</b> .. | 249 |
| Pure Mathematics.....                         | 250 |
| Mathematics Education .....                   | 251 |
| Computer Sciences .....                       | 252 |
| Departmental Faculty.....                     | 255 |
| Courses of Instruction .....                  | 256 |

|                                    |     |
|------------------------------------|-----|
| <b>Department of Nursing</b> ..... | 264 |
| Program of Study.....              | 264 |
| Departmental Faculty.....          | 266 |
| Courses of Instruction .....       | 266 |

|   |     |
|---|-----|
| <b>Department of Physics</b> .....        | 269 |
| Program of Study - Physics.....           | 270 |
| Program of Study - Physical Sciences..... | 273 |
| Departmental Faculty.....                 | 278 |
| Courses of Instruction .....              | 278 |

|                                       |     |
|---------------------------------------|-----|
| <b>Department of Psychology</b> ..... | 285 |
| Program of Study.....                 | 286 |
| Departmental Faculty.....             | 287 |
| Courses of Instruction .....          | 287 |

|  |     |
|--|-----|
| <b>Department of Social Sciences</b> ..... | 290 |
| Social Sciences .....                      | 291 |
| Political Sciences .....                   | 292 |
| Sociology.....                             | 294 |
| History .....                              | 296 |
| Departmental Faculty.....                  | 300 |
| Courses of Instruction .....               | 300 |

## **College of Business**

|                                    |     |
|------------------------------------|-----|
| <b>Administration</b> .....        | 311 |
| Academic Programs.....             | 311 |
| Academic Regulations .....         | 313 |
| Cooperative Education Program..... | 313 |
| Internship Program.....            | 313 |
| Minor Concentrations.....          | 313 |
| Accounting .....                   | 319 |
| Computerized Information           |     |
| Systems.....                       | 320 |
| Finance .....                      | 322 |
| Operations Management .....        | 323 |
| Marketing.....                     | 324 |

|                                  |     |
|----------------------------------|-----|
| Human Resources Management ..... | 326 |
| Office Administration.....       | 327 |
| Faculty.....                     | 329 |
| Courses of Instruction.....      | 330 |

## **College of Engineering** .....

|  |     |
|--|-----|
| Aims and Objectives .....                                      | 347 |
| Student Chapters of Honorary &<br>Professional Societies ..... | 348 |
| Academic Offerings .....                                       | 348 |

|   |     |
|---|-----|
| <b>Department of Chemical Engineering</b> ..... | 350 |
| Program of Study .....                          | 351 |
| Departmental Faculty .....                      | 352 |
| Courses of Instruction .....                    | 352 |

|  |     |
|--|-----|
| <b>Department of Civil Engineering<br/>and Surveying</b> ..... | 357 |
| Civil Engineering .....  | 359 |
| Surveying and Topography.....                                  | 360 |
| Departmental Faculty .....                                     | 363 |
| Courses of Instruction .....                                   | 364 |

|   |     |
|---|-----|
| <b>Department of Computer Science and<br/>Engineering</b> ..... | 370 |
| Program of Study - Computer<br>Sciences and Engineering.....    | 372 |
| Program of Study - Software<br>Engineering.....                 | 373 |
| Departmental Faculty.....                                       | 375 |
| Courses of Instruction.....                                     | 375 |

|  |     |
|--|-----|
| <b>Department of Electrical and Computer<br/>Engineering</b> ..... | 379 |
| Program of Study - Electrical Eng.....                             | 381 |
| Program of Study - Computer Eng.....                               | 384 |
| Departmental Faculty.....  | 385 |
| Courses of Instruction.....  | 386 |

|   |     |
|---|-----|
| <b>Department of Engineering Sciences<br/>And Materials</b> ..... | 396 |
| Departmental Faculty .....  | 396 |
| Courses of Instruction .....                                      | 397 |

|   |     |
|---|-----|
| <b>Department of Industrial Engineering</b> ..... | 401 |
| Program of Study.....                             | 404 |
| Departmental Faculty.....                         | 405 |
| Courses of Instruction.....                       | 406 |

|   |     |
|---|-----|
| <b>Department of Mechanical Engineering</b> ... | 411 |
| Program of Study .....                          | 413 |
| Departmental Faculty .....                      | 414 |
| Courses of Instruction .....                    | 414 |

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### *Historical Sketch*

The University of Puerto Rico was created by an act of the Legislative Assembly on March 12, 1903 emerging as an outgrowth of the Normal School, which had been established three years earlier to train teachers for the Puerto Rican school system. In 1908, the benefits of the Morrill-Nelson declared applicable to the island, fostered the rapid growth of the University. Eloquent evidence of that growth was the establishment of the College of Liberal Arts at Río Piedras in 1910 and the College of Agriculture at Mayagüez in 1911.

It was in the College of Agriculture where the Mayagüez Campus as we know it today had its origin. Credit for the establishment of the College is given to the joint effort of D. W. May (Director of the Federal Experiment Station), José de Diego, and Carmelo Alemar. A year later, the school received the name that it bore for 50 years: the College of Agriculture and Mechanic Arts. The strengthening and diversification of the academic programs at Mayagüez were recognized years later when, in 1942, as a result of university reform, the campus was organized with a considerable degree of autonomy into the Colleges of Agriculture, Engineering, and Science under the direction of a vice-chancellor. The expansion continued through the 1950s when many programs flourished in the University. The College of Arts and Sciences and the Nuclear Center were established in Mayagüez. The Colleges of Humanities, Natural Sciences, Social Sciences, and Business Administration emerged in Río Piedras. The Schools of Medicine, Odontology, and Tropical Medicine were established in San Juan.

In 1966, the Legislative Assembly reorganized the University of Puerto Rico as a system of autonomous campuses, each under the direction of a chancellor. The College of Agriculture and Mechanic Arts became the University of Puerto Rico, Mayagüez Campus.

Today, the Mayagüez Campus of the University of Puerto Rico continues its development in the best tradition of a Land Grant institution. It is a co-educational, bilingual, and non-sectarian school comprising the Colleges of Agricultural

Sciences, Arts and Sciences, Business Administration, Engineering, and the Division of Continuing Education and Professional Studies.

The College of Agricultural Sciences includes the Agricultural Experiment Station and the Agricultural Extension Service. At present, the campus population is composed of 13,316 students, 1,181 regular staff members and 625 members of the educational staff.

### *Accreditations and Affiliations*

The Mayagüez Campus of the University of Puerto Rico is fully accredited by the **Council of Higher Education of Puerto Rico**. It holds membership in the **Middle States Commission on Higher Education** since 1946. Our academic programs are accredited by professional entities such as the **National Council for Accreditation of Teacher Education (NCATE)**, **Accreditation Council for Business Schools and Programs (ACSBSP)**, **The American Chemical Society, Accreditation Commission for Education in Nursing, Inc. (Formerly NLNAC)**, and **Accreditation Board for Engineering and Technology (ABET)**.

The Mayagüez Campus of the University of Puerto Rico is a member of Oak Ridge Associated Universities (ORAU) since 1966. ORAU is a private, non-profit consortium of 65 colleges and universities that acts as management and operating contractor for the US Department of Energy (DOE).



## ***Vision, Mission***

### **Our Vision**

*“To be a leading institution in higher education and research, transforming society through the pursuit of knowledge in an environment of ethics, justice, and peace.”*

### **Our Mission**

To provide excellent service to Puerto Rico and to the world:

- Forming educated, cultured, capable, critical thinking citizens professionally prepared in the fields of agricultural sciences, engineering, arts, sciences, and business administration so they may contribute to the educational, cultural, social, technological and economic development.
- Performing creative work, research and service to meet society’s needs and to make available the results of these activities.

We provide our students with the skills and sensitivity needed to effectively resolve problems and to exemplify the values and attitudes that should prevail in a democratic society that treasures and respects diversity.”

### ***Strategic Objectives***

- Objective #1: To institutionalize a culture of strategic planning and assessment
- Objective #2: To lead higher education throughout Puerto Rico while guaranteeing the best education for our students
- Objective #3: To increase and diversify the Institution’s sources of revenue
- Objective #4: To implement efficient and expedient administrative procedures
- Objective #5: To strengthen research and competitive creative endeavors

- Objective #6: To impact our Puerto Rican society
- Objective #7: To strengthen school spirit, pride, and identity

### ***General Education Student Learning Outcomes (SLOS)***

The Academic Senate of the University of Puerto Rico in Mayagüez, established by Certification 18-25, the General Education Student Learning Outcomes (SLOS). By the time of their graduation, UPRM students will be able to:

1. Become an intentional learner
2. Demonstrate creative and critical thinking
3. Communicate effectively
4. Identify, study, and propose solutions to problems; transform knowledge into action
5. Apply mathematical, scientific, and technological skills
6. Apply interpretative and integrative skills
7. Relate global contexts and issues of importance to Puerto Rico
8. Show moral autonomy; develop a sense of wellbeing; understand ethical conduct
9. Practice civic virtues
10. Value diversity

## ***Organization of the University of Puerto Rico***

The University of Puerto Rico is a well-established and mature institution, with a total enrollment of over 61,967 students. The University consists of the Mayagüez Campus, the Medical Sciences Campus, and the Río Piedras Campus, which are dedicated to both undergraduate and graduate education; and eight Campus at Aguadilla, Arecibo, Bayamón, Carolina, Cayey, Humacao, Ponce, and Utuado which provide undergraduate education. Each autonomous institutional unit has a Chancellor as chief administrator and academic officer.

### **Governing Board**

The Governing Board (JG) was created in 2013 as an independent and autonomous body that governs the system of 11 units comprising the University of Puerto Rico. Prior to its creation, these responsibilities were in charge of the former Higher Education Council and the former Board of Trustees (JS).

It is composed of 13 members, namely a regular undergraduate student, a regular graduate student, two tenured professors in the university system, the Secretary of Education, as an ex officio, a broad professional knowledge and experience in the field of finance, a resident of Puerto Rico who has participated with distinction in the social and community leadership, five residents of Puerto Rico featured in artistic knowledge, scientists and professionals, and a citizen residing in Puerto Rico, linked Puerto Rican communities abroad.

Except for the two students and two professors, who are elected, the other members of the Governing Board are appointed by the Governor with the advice and consent of the Senate. All members of the Governing Board serve for staggered terms laid down in the University Act and until their successors are appointed and qualified.

The Governing Board elects its president from among its members. It is responsible for:

- examining and reviewing the budgetary and institutional development plans of the University
- authorizing the institution of new campus, centers, and other institutional units appointing the President and chancellors of each autonomous unit

- defining rights and duties of various constituents in the institutional community
- defining student financial aid standards
- preparing an annual report to the Governor and the Legislature on the state of the University of Puerto Rico

### **President**

The President of the University, the chief executive officer of the University system, is appointed to an indefinite term by the Governing Board. Subject to the approval of the Board, he appoints chancellors to the various campuses and colleges. The President represents the University on corporate matters before courts and government agencies. He acts as an ex-officio member of all the UPR faculties, academic senates, and administrative boards.

The President is responsible for submitting an annual budget, an annual report, the institutional development plan and its revisions, regulations, contracts, and agreements which require university approval. He develops and maintains relationships with other cultural and educational institutions.

### **University Board**

The University Board is constituted by:

- the President of the University
- eleven chancellors representing each autonomous institutional unit
- a financial director
- three additional members appointed by the President with the approval of the Governing Board
- one faculty representative from each Academic Senate
- one student representative from each institutional unit

The Board is responsible for the preparation of the following documents:

- general bylaws of the University
- general bylaws of the student body
- university's strategic plan with recommendations from the Academic Senates

These documents are submitted to the President and to the Governing Board for their consideration and approval. The Board also considers the integrated university budget, and it is the first avenue of appeals against any decision taken by the Administrative Board or the Academic Senate of an autonomous unit.

## ***Organization of the Mayagüez Campus***

The Mayagüez Campus serves a student population of 13,316 students. It was organized as a result of the University Act (PL1), which was approved on January 20, 1966 and amended by Law No. 16 in 1993.

### ***Chancellor***

The Chancellor of the Mayagüez Campus is the chief executive officer of the institutional unit. The Chancellor's main responsibilities include:

1. Presiding over the Administrative Board, the Academic Senate, and faculty meetings
2. Appointing deans, departmental directors and university personnel
3. Resolve controversial appeals against decisions made by deans
4. Representing the campus at functions, ceremonies, and academic activities
5. Preparing the campus' annual report and budget petition for submission to the President

### ***Administrative Board***

The Administrative Board of the Mayagüez Campus consists of the Chancellor as presiding officer, the deans, two academic senators elected among those faculty members of the Senate who are not ex-officio, senators, and an elected student representative. The President of the University serves as an ex-officio member. The Board acts as an advisory body to the Chancellor, prepares the development plan of the Campus, approves the proposed budget prepared by the Chancellor, and grants tenure, promotions and leaves of absence.

### ***Academic Senate***

The Academic Senate at UPRM is composed by the members of the Administrative Board, the Director of the Library, the Director of the Counseling Office, representatives elected from the faculties whose total must not be less than twice the number of the elected ex-officio members, an elected member of the Library and Counseling Office, and ten student representatives. The Academic Senate is the official forum of the academic community. Its main task is to participate in the formulation of academic processes within the University's legal structure.

## ***Faculty***

The faculty is composed of the chancellor, the deans, department directors and the teaching personnel. The General Regulations of the University of Puerto Rico define the faculty's functions, privileges, duties, and, rights.

### ***Students***

The rights and duties of students are set forth in the General Student Regulations. The General Student Council represents students before the university administration, and individual student councils represent them before each of their respective colleges and schools. The students are also represented on the Academic Senate, the Administrative Board, the University Board, and the Governing Board.

### ***Student Ombudsman Office***

The Students Ombudsman Office was created on November 10, 1999. It is a direct result of the interest and effort of both the Chancellor and the Students General Council. Its creation reinforces our University's belief in dialogue and communication as the best way to pursue truth and the integral development of its students. It also provides adequate and appropriate conditions which enhance their quality of life.

The mission of the Students Ombudsman Office (Oficina de Procuraduría Estudiantil) is to provide an independent, confidential, neutral, and accessible individual support for our students. The informal process facilitates fair solutions to the situations and problems of the parties involved.

The Students Ombudsman Office does not do formal investigations. Instead we listen to people, examine their options for dealing with a particular situation and help guide them toward making wise and healthy decisions. Moreover, the Office offers timely and relevant information concerning campus policies and procedures. The Office welcomes all community members, including professors and employees that wish to present any situation related to students.

**Office:** Luis D. Celis Building, 3<sup>th</sup> floor, 324  
**Phone:** 787-265-5462; 787-832-4040 exts. 3588, 5462  
**Website:** <http://www.uprm.edu/procuraduria>  
**Email:** [procuraduria@uprm.edu](mailto:procuraduria@uprm.edu)



## ***UNIVERSITY REGULATIONS***

### **Rights and Duties of Students of the University of Puerto Rico**

#### **Article 1**

- A. The fundamental right of University students in the academic community is the right to an education. This right is not limited to the classroom but encompasses the aggregate of the students' possible relations and experiences with their fellow students, teachers, and administrators at the University and with their fellow citizens in the community at large. In like manner, the students' principal duty consists of fully exercising that right and conducting themselves in a manner that does not hinder other community members in the exercise of their rights or in the fulfillment of their duties.
- B. These regulations cover separately:
  - (1) student rights and duties inherent in the sphere of the educational program;
  - (2) those pertaining to extracurricular activities within the facilities of the University;
  - (3) those related to student participation in the different aspects of institutional services;
  - (4) those indicated by the standards and restrictions characteristic of academic life;
  - and (5) the sanctions corresponding to violations of regulations and the procedure for the imposition of these sanctions.
- B. The basis of the teacher-student relationship is trust and confidence which should be respected by both and by the administration. Opinions and beliefs expressed by students in the classroom are of a privileged nature, and students are entitled to have their teachers refrain from disclosing them to third parties. The preceding does not bar teachers from stating opinions about students' character and abilities or from discussing their progress with colleagues as part of the academic program and of the students' formative process.
- C. The relationship between students and teachers outside the classroom constitutes a part of the educational process. Students shall have the right to meet with teachers at specially designated times to request guidance on and clarification of aspects of their academic work.
- D. Academic and disciplinary files shall be kept separate. Any information relative to disciplinary files shall not be made available to unauthorized persons within or outside the University without the students' consent except by a court order. No record of the students' political beliefs shall be kept.

#### **Article 2**

- A. The work involved in the subject under study constitutes the basis of teacher-student relationship. Maximum integrity and intellectual honesty should govern the drive to attain knowledge. The teacher shall foster creative dialogue and freedom of discussion and expression among students. The student shall have the opportunity to present reasonable objections to the facts and opinions stated by the teacher if in disagreement. Both may examine any aspect of the subject under discussion in accordance with the standards of intellectual responsibility vital to all academic endeavors. Neither one nor the other shall use the classroom as a forum to preach political, sectarian, religious, or other doctrines alien to the subjects being taught.

The right to dissent from the opinion of the teacher does not release the student from the responsibility of complying with the teacher's requirements for the course. The student's grade shall be based on considerations relative to academic achievements measured in the varying ways in which this is possible.

- B. The basis of the teacher-student relationship is trust and confidence which should be respected by both and by the administration. Opinions and beliefs expressed by students in the classroom are of a privileged nature, and students are entitled to have their teachers refrain from disclosing them to third parties. The preceding does not bar teachers from stating opinions about students' character and abilities or from discussing their progress with colleagues as part of the academic program and of the students' formative process.
- C. The relationship between students and teachers outside the classroom constitutes a part of the educational process. Students shall have the right to meet with teachers at specially designated times to request guidance on and clarification of aspects of their academic work.
- D. Academic and disciplinary files shall be kept separate. Any information relative to disciplinary files shall not be made available to unauthorized persons within or outside the University without the students' consent except by a court order. No record of the students' political beliefs shall be kept.

The legal and academic tradition recognizes the rights of students as members of the University community and also the obligation of moral and intellectual responsibility concomitant with these rights. The legal and academic tradition also recognizes the responsible participation of students in assuring and maintaining order, safety, and normalcy of academic life. These rights and responsibilities, the disciplinary procedures for dealing with their violation, and many other matters of interest are described in the UPRM Student Manual (Reglamento de Estudiantes del Recinto Universitario de Mayagüez) available in the Office of the Dean of Students.

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## ***UPRM STUDENT REGULATIONS***

University law and tradition recognize the rights of students as members of the University community, and dictate the students' moral and intellectual responsibilities as members of that community. Also recognized is the responsible participation of students in insuring and preserving order, safety and normalcy of institutional tasks and procedures. The University graciously welcomes the democratic and responsible participation of its students in the institutional processes.

### **Rights and Duties**

Article 1. To the extent that they are collaborators in the University's mission of education, culture, and service, students are members of the University community and, as such shall be entitled to participate effectively in the life of the community. They shall have all the moral and intellectual responsibilities of members of the community.

Article 2. Students have the duty and right to engage in the search for truth and strive for its expression, always respecting opinions. Academic discipline, behavior intrinsic to the academic community, and the dictates of conscience, itself, shall serve as guides.

Article 3. University students have the duty to seek the elements of intellectual and spiritual formation which can lead to their full development as persons. They also have the right to demand them in view of their responsibility as members of the Puerto Rican community.

Also incumbent upon them is the duty and the right to preserve, enhance, and disseminate the values of learning and culture both universal and Puerto Rican.

Article 4. Students may hold, pursuant to established standards, any public function, meeting, or ceremony and invite any person they wish to hear speak on any subject of interest provided that the exercise of any of the aforementioned rights does not interrupt the educational, technical, or administrative work of the institution and that there is compliance with the provisions of the regulations in effect.

Article 5. Students may associate freely and may publish and circulate publications in accordance with the prevailing standards set forth by the office of the Dean of Students.

Article 6. No student may be deprived, by reason of sex, race, origin, social condition, or political or religious creed, of the right of association nor of the services and programs offered by the University.

Article 7. University students are entitled to have the University refrain from disclosing information or keeping records related to their political, religious, or philosophical beliefs.

Academic and disciplinary files shall be kept separate. The information contained in the academic and disciplinary files shall be confidential and shall not be made available for use by unauthorized persons within or outside the University without the written consent of the student or the student's parent or guardian, unless a court order to that effect has been obtained.

Article 8. Students shall have the right to meet with teachers at specially designated hours in order to receive guidance and clarification on matters related to their academic work.

Article 9. Students shall have the right and the duty to actively participate in classes and related activities, consult their teachers, express their doubts and differences on criteria, and be informed of their deficiencies and achievements in academic work.

Students shall be entitled to receive from their teachers at the beginning of each session proper guidance on oral or written contents of the course, which shall include: explanations of academic ends and objectives, teaching methods, topics of study, reading assignments, and other work requirements, grading criteria, and other pertinent data. All this must in no way affect the necessary flexibility of the courses.

Students shall have the right to discuss with their teachers the tests taken, the grades received, and the evaluation of the course as an essential part of the college learning process.

Article 10. Students have an obligation to exercise in a comprehensive and responsible manner all the rights and duties established in these Regulations so that the example they set inside and outside the classroom may serve as a bulwark for the continual enjoyment of such rights and duties by them and their fellow students.

(Copies of these Regulations including the remaining provisions are available from the Office of the Dean of Students.)

### **Equal Opportunity**

The Mayagüez Campus of the University of Puerto Rico guarantees applicants equal opportunities for employment and academic admission. It also guarantees student and employee equality in study and employment opportunities as well as in the benefits of the services and academic programs offered and the terms and conditions of employment. UPRM does not exclude from participation nor denies benefits to nor discriminates against any person by reason of age, race, sex, color, place of birth, social origin or condition, physical or mental handicap, political or religious beliefs, ancestry, marital status, gender, sexual preference, ethnic origin, or status of veteran of the armed forces. Any applicant for academic admission or employment or any student or employee, who feels discriminated against for any of the reasons cited above may file a complaint in writing with the Dean of Academic Affairs. The establishment of this policy as well as its compliance and publication are pursuant to Federal regulations for the implementation of Title IX, Educational Amendments of 1972 and Section 504 of the 1973 Rehabilitation Act.

### **Disabilities**

UPRM is committed to promote a safe atmosphere for disabled students where they will have access to all academic programs, support services, social events, and physical facilities.

Regulations specified in Section 504 of the Vocational Rehabilitation Act (1973) and the Americans with Disabilities Act (ADA) 1980, establish norms and procedures which guarantee people with disabilities equal access to programs and services.

At present, responsibility for the effective means of providing these services lies in the Office of the Dean of Students through the Coordinator of Services to Handicapped Students (OSEI).

Services for handicapped students stem from the following principles:

1. Request for reasonable accommodations must be initiated by the student.
2. Accommodations offered by the university have a shared responsibility among student, faculty, staff and Office of the Dean of Students.
3. Procedures and policies must be reasonable and easily understood by all parties involved.
4. The student's right to confidentiality will be protected at all times during the process of accommodation.
5. Appeal processes will take place in a fair manner and within a designated time frame.

### **Foreign Non-Immigrant Students**

The Mayagüez Campus is authorized by law to admit foreign non-immigrant students. Refer to the sections on "Academic Regulations" and to the section on "Special Fees for Non-resident Students" for additional information.

### **Use of Vertebrate Animals in Research**

This institution complies with all applicable provisions of the Animal Welfare Act and other Federal statutes and regulations concerning animals. It also complies with the U. S. Public Health Service policy on human care and use of laboratory animals. Its practices are guided by the U.S. government principles for the utilization and care of vertebrate animals used in testing, research, and training.

### **Protection of Human Subjects in Research**

This institution complies with all Federal regulations regarding human subjects in research, including those stated in the Code of Federal Regulations, the Department of Health and Human Services, Title 45 (Public Welfare), Part 46: Protection of Human Subjects (Revised January 15, 2009; Effective July 14, 2009).

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## Intellectual and Scientific Misconduct

It is the institutional policy of the Mayagüez Campus to observe the highest standards of intellectual and scientific integrity, and to pursue the prosecution of all violations. The lack of integrity and the perpetration of academic and scientific fraud include plagiarism, fabrication, falsification, false attribution, and other violations of the canons and practices of honesty generally accepted in the academic community, always excepting those which may result from involuntary errors or honest differences in the interpretation or handling of data or information.

## Sexual Harassment

This institution adheres to the principles and statutes concerning sexual harassment and discrimination because of gender in the areas of employment, conduct in the workplace, and provision of services. Grievance procedures are stated in the Certification #130 (2014-2015) approved by the Governing Board of the University of Puerto Rico on the 13<sup>th</sup> of April of 2015 and the Administrative Board Certification #93-94-303 of April 7, 1994.

## Smoking

Smoking is forbidden in all enclosed campus areas, including, but not limited to, classrooms, laboratories, lecture rooms, elevators, auditoriums, offices, museums, and all other places where people regularly meet. Smoking is permitted in public areas such as open hallways and other open spaces.

## Drugs

The University of Puerto Rico pursues a vigorous policy in combating the manufacture, distribution, supply, possession, and illegal use of controlled substances within its grounds as defined by Puerto Rico Law No. 40 of August 3, 1993, and further treated in subsequent Federal and Commonwealth legislation. The policy means and procedures for its enforcement are detailed in the Certification #033-1999-2000 approved by the Governing Board of the University of Puerto Rico.

## Satisfactory Academic Progress

Federal regulations require all institutions to establish a reasonable satisfactory academic progress policy to determine whether an

otherwise eligible student is making satisfactory academic progress in his or her educational program and may receive assistance under the title IV, HEA programs.

In compliance with the federal regulations, the Governing Board of the University of Puerto Rico, through Certification Number 55 (2016-2017), <http://136.145.18.247/PDF/CERTIFICACION/2016-2017/55%202016-2017.pdf> established the Institutional Policy on Academic Progress for Eligibility for Economic Assistance Programs. All students are hereby notified of the requirements to be satisfied at the end of the academic year to maintain their possible eligibility and participate in economic aid programs. For more information please, contact the Department of Financial Aid (extensions 3863, 3035).

Criteria considered in determining a student's satisfactory academic progress applies to all students, regardless of economic assistance. This criteria does not affect established academic norms regarding probation and suspension.

### Rules:

As established in Certification Number 55 (2016-2017) the academic eligibility of students for participation in the financial aid programs available at the University of Puerto Rico will be determined according to the following rules:

- A. **Classification in a degree-granting program** - In order to participate in any financial aid program, the student must be officially enrolled in a degree-granting academic program.
- B. **Minimum grade point average (GPA)** — In order to achieve academic eligibility from a qualitative standpoint, the student must have the minimum retention grade point average (GPA) required by his or her program, as established in each campus.
- C. **Progress toward graduation** — In order to achieve academic eligibility from a quantitative standpoint, the first year student must pass 57% of the credit-hours attempted during the year previous to the evaluation required by these rules. The second year student must pass 67% of the credit-hours attempted during the year previous to the evaluation required by these rules. The product of the computation will be rounded off to the lower whole number. The

evaluation will be carried out as explained in clause IV-O, infra.

**D. Maximum number of credits allowed -**

The student may attempt up to one hundred and fifty percent (150%) of the credit-hours required by his or her academic program. The University will monitor the student's progress to make sure that he or she will finish the degree without surpassing the 150% limit. If, at the moment of evaluation, it is determined that the **student will not** be able to finish the degree without surpassing this limit, the student will not be able to continue participating in the financial aid programs. The 150% maximum will apply regardless of whether the student has not received previous financial aid.

**E. Curricular sequences and other courses additional to the student's major -**

The student will be able to receive financial aid for all courses required by his or her major, including college requirements, general education requirements, and electives. Also, the student may receive financial aid for the following, according to the conditions outlined below:

1. *Additional required courses (prerequisites, basic skill courses, and remedial courses)* - The student may receive financial aid for up to 30 credit-hours in courses required by the institution in addition to the major.

2. *Curricular sequences* - Students admitted to a curricular sequence duly approved by the existing norms will be able to attempt up to 150% of the credit-hours required by his or her major plus 100% of the credit-hours required by the curricular sequence, without losing their academic eligibility.

a) *Caveat* - The By-laws of Title IV Programs of the Department of Education do not allow students to take teacher certification courses in addition to their major if the campus where the student is enrolled offers a complete teacher preparation program in the student's major.

**F. Transfers and major changes -** In the case of students who transfer from another accredited institution or from another campus of the University, as well as

students who change majors, academic eligibility will be determined as follows:

1. On the basis of only those credit-hours that are accredited towards the academic program to which the student has transferred or changed.

The University of Puerto Rico is duty-bound to perform all equivalency processes before the enrollment of these students, so that they will be aware beforehand of the credit-hour margin that they will have for participation in financial aid programs.

**G. Articulated transfers -** For the purpose of participation in financial aid programs, students enrolled in articulated transfer programs will be evaluated on the basis of the requirements stated in the corresponding articulation agreements signed by participating campuses.

**H. Readmissions -** A student who is readmitted to the academic program in which he or she was previously enrolled will be evaluated according to the rules in effect at the moment of readmission, and the evaluation will take place at the end of the academic year. Students who are readmitted to a new academic program will be evaluated according to the criteria outlined for major changes in clause V-D.

**I. In the case of curricular revisions -** Curricular revisions are not retroactive. They apply only to students admitted after the date in which the curricular revision goes into effect. However, if a student chooses to be bound by the revised curriculum, instead of the curriculum in effect at the moment of their initial admission, he or she will be evaluated according to the criteria outlined for major changes in clause IV-F.

**J. Withdrawal of courses and incompletes -** For the purpose of determining academic eligibility, all courses graded as incomplete (I) with A, B, C or D will be considered as approved. Courses graded as 1-F and dropped courses (W) will be considered as attempted and not approved, as is the case of failed courses (F). Withdrawal of courses (W) are not used for the computation of the student's grade point average (GPA).

**K. Summer courses in the campuses where the summer session is not part of the regular academic year -** Courses taken during the summer sessions may be used to

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compensate for deficiencies in grade point average (GPA) and in the percentage of courses approved during the previous academic year.

- L. **Repeated courses** - For the purpose of financial aid benefits, a student may repeat courses, according to current institutional rules, as long as he or she does not attempt more than 150% of the total number of credits required by his or her degree program.

However in order for a repeated course to be counted towards your enrollment status for financial aid purposes, you may only repeat a previously passed course once (a total of two attempts). If you enroll in a previously repeated and passed course for a third time, this course will not count towards your enrollment for financial aid purposes. The second time a student registers in a repeated course, the student will be charged a fee as established by University Bylaws.

- M. **Evaluation** - The evaluation of academic eligibility will be done at the end of each academic year, as defined by each campus.

### **Class Attendance**

Class attendance is mandatory at the University of Puerto Rico. Unjustified absences may have a negative effect on a student's participation in financial aid programs.

### **Notification procedure**

Students will be able to review their academic progress through the Student Portal at the end of the academic year. Students who do not meet Satisfactory Academic Progress requirements will also be able to view additional information regarding their Academic Progress evaluation. Students receive prior warnings which he or she can also review in the Student Portal.

### **Revision Procedure**

A student who has valid reasons for not complying with Satisfactory Academic Progress requirements may appeal in writing to the Institutional Committee of Revision for Financial Assistance. This Committee is composed of representatives from each Faculty and one representative from the Office of the Dean of Students

### **Appeals**

The student has the opportunity to appeal to the Dean of Students if the notification sent by the Institutional Committee of Revision for Financial Assistance is not satisfactory, within ten working days after receiving the notification.

### **Financial Aid Probation**

A student who has a successful appeal will be placed on Financial Aid Probation. If determined, based on the appeal, that the student will require more than one payment period to meet Satisfactory Academic Progress standards, the student will be placed on probation and an academic plan will be designed.

## **RESEARCH AND DEVELOPMENT ENDEAVORS**

In addition to the numerous research laboratories under direct faculty supervision, Mayagüez Campus has several research and development institutes that provide valuable support for research activities.

### **The Agricultural Experiment Station**

Established in 1910 by the Sugar Producers Association the Agricultural Experiment Station was ceded to the Government of Puerto Rico in 1913 and transferred to the University of Puerto Rico by legislative action in 1933. Its main objective is to conduct research, develop technology and improve agriculture and the quality of life in rural areas. The Station, a component of the College of Agricultural Sciences, has two main research centers, one at Mayagüez and the other at Río Piedras and six research substations located in Adjuntas, Corozal, Juana Díaz, Gurabo, Isabela, and Lajas. The Agricultural Experiment Station laboratories, research library, farms, and other facilities are available to graduate students for thesis research. The Station is an active member of the Southern Association of Experimental Stations. This Association serves as a regional link to the U.S. Department of Agriculture, U.S. Congress, National U.S. Association of State Universities and Land Grant Colleges (NASULGC).

### **Center for Excellence in Quarantine & Invasive Species**

Invasive pest species are affecting world agriculture, forests and natural areas, causing billions of dollars of losses. With globalization and increases in trade and movement of people, the frequency of species invasions has substantially grown in the last decades. Puerto Rico is geopolitically located in a key strategic position and has the potential to host and play a crucial role in studies of *Prevention and Preparedness for Invasive Species*. Puerto Rico is located in a region where the probability of interception of new pests coming to the Americas and US mainland is high and where a proactive approach could be the front line for management of invasive species. In addition, Puerto Rico has its own agricultural interests and it, along with the rest of the Caribbean basin, directly benefits from an US offshore quarantine facility that provides research and appropriate training on target pests

and potentially beneficial organisms. The 10,000 sq. ft. state of art laboratory and greenhouses facilities support the Center's mission that is to develop expertise, promote education and generate tools to aid in the quarantine and mitigation of invasive species and help support sound decision-making. This Center is an initial effort between University of Puerto Rico (UPR) and US Department of Agriculture, and have collaborations with several national and international institutions.

#### **Contacts:**

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### **Plant Diagnostic Clinic Agro-Environmental Sciences**

The aim of the Plant Diagnostic Clinic (PDC) is to provide fast and accurate plant disease diagnosis and pest identification. The clientele of the PDC are commercial growers, researchers, extension specialists, seed companies and homeowners. The PDC is part of the Southern Plant Diagnostic Network (SPDN), a plant pest diagnostic and reporting system, which helps with diagnosis of plant disease and insect samples, using digital images, and detailed crop information diagnosis. Specific areas of diagnosis include vegetables, fruits, corn, soybeans and ornamentals, fungal, bacterial and viral diseases. The PDC is part of the Citrus Clean Plant Network (CCPN) that promotes the use of tested citrus propagative material to ameliorate citrus greening in the island.

#### **Contacts:**

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### **Bio-Optical Oceanography Laboratory**

**BIOL** is the site of an active teaching and research program in water optics and satellite remote sensing. Interdisciplinary studies of coastal and oceanic waters of the intra-Americas' sea include: variability of inherent and apparent water optical properties, effects of ultraviolet radiation on tropical marine organisms and on public health, satellite data validation and algorithm development and estimation of oceanic primary production.

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### **Center for Applied Social Research**

**CISA**, established in 1991, is an integral part of the Department of Social Sciences. CISA promotes and coordinates practical applications of faculty expertise to the analysis and mitigation of problems arising from or inextricably linked to social attitudes and behavior. CISA's specific objectives aim to provide strong research training and mentoring to undergraduate students, to engage faculty and students in interdisciplinary research, to develop collaborative research projects with other research centers, programs and institutions, to enhance the professional development of researchers and students through participation in a diverse number of seminars, workshops, and conferences, and to increase the number of students pursuing a graduate degree in social sciences.

Since CISA's establishment, a diverse number of research projects has been generated by researchers affiliated to the Center such as: drug abuse, socioeconomic impact of resource management among fishermen, poverty and income inequality in the United States and Puerto Rico, public opinion and political participation, mitigation and preparedness regarding natural disasters, quantitative and qualitative aspects of urban rail transit systems, HIV/AIDS and mental health issues, female labor force participation in the tuna industry, comparative analysis of psychological depression in the Caribbean, and evaluation of the Minority Access to Research Careers (MARC) Program. A CISA research component that has been strongly developed focuses on outcome and process evaluation. Research projects in CISA have received funding from external (i.e., National Science Foundation, National Institute of Health, National Institute of Mental Health, National Fisheries Service, U.S. Army Corps of Engineers, Ford Foundation/American Sociological Association, National Forest Service), state, and local sources as well as from the University of Puerto Rico. All CISA projects involve direct student participation as research assistants, reflecting the center's commitment to undergraduate research training and mentoring.

### **Center for Hemispherical Cooperation in Research and Education in Engineering and Applied Science**

**CoHemis** is part of the University of Puerto Rico. It is housed in and primarily serves the Mayagüez Campus.

CoHemis was founded in 1991 at a hemispheric conference-workshop sponsored by the National Science Foundation. It brought together national science and technology organization (ONCyT) delegates from 13 countries of the Americas to discuss ways to increase hemispheric collaborations in science and technology. CoHemis today is the hub of a network of 52 institutions from most countries of the Americas and Spain interested in collaborations by such means as joint research faculty, student exchanges, short courses and workshops.

The Center promotes and facilitates the development of human resources, technology, and programs that help to organize research and educational initiatives in science and engineering for the benefit of the western hemisphere countries. The main objectives of CoHemis are: increase the industrial competitiveness of the Western Hemisphere, enhance the science and technology capabilities of the Americas and the Caribbean, stimulate the protection of the hemisphere's resources and environment, increase the knowledge of regional problems of high priority among researchers and educators in the Americas, increase the number and quality of Hispanic engineers and scientists in the global market.

For more information contact:

<http://cohemis.uprm.edu/>

### **Center Research Instrumentation Laboratory**

**CRIL** was founded in 1982 by the Department of Chemistry it contains sophisticated instrumentation for inorganic, organic and environmental analysis. The staff includes a director and two instrumentation assistants. Available instrumentation include a 500 MHz Bruker and 300 MHz Varian NMR, a System 2000 FT-IR coupled to a Gas Chromatograph and equipped with near and mid IR detectors, a Hewlett Packard Gas Chromatography/Mass Spectrometry system, a Perkin Elmer and Varian Atomic Absorption Spectrophotometers equipped with flame, cold vapor and graphite furnaces; a Leeman Labs Inductive Coupled Plasma-Optical



Emission Spectrometry system, a Dionex Ion Chromatograph equipped with conductivity detector; and a Finnigan GC/MS/MS equipped with direct insertion probe, electron impact and chemical ionization sources. The CRIL staff provides services to undergraduate and graduate courses, research groups of the Chemistry Department, as well as other academic departments, the community, government agencies, and local industry.

### **Laboratory for Applied Remote Sensing, Imaging and Photonics**

LARSIP is a multidisciplinary laboratory dedicated to the research and implementation of Remote Sensing, Hyperspectral Image Processing, Optical Imaging, Signal and Image Processing, Geographical Information Systems (GIS), Emergency Response Systems, Global Positioning Systems (GPS) technologies, Applied Electromagnetics and Bio-Optics applications. LARSIP is a facility located within the Department of Electrical and Computer Engineering at UPRM.

The objectives of LARSIP are to develop advanced data analytics and machine learning algorithms and technologies for information extraction and management (particularly from remote sensing sensors), and to educate and train students in the different technologies associated with remote sensing and signal processing. LARSIP provides a focus for multi-disciplinary research and education by promoting research and education projects that involve electrical and computer engineering researchers and students interacting with researchers and students in application areas such as marine sciences, geology, civil engineering, and chemistry, among others. LARSIP has extensive computing and image processing equipment as well as advanced hyperspectral optical imaging equipment (ranging from the visible and infrared spectrum) as well as portable spectrometers and underwater enclosures for fieldwork and collection of diverse imaging data.

The National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), and the American Telephone and Telegraph Corporation (AT&T) provided initial funding for LARSIP and its research projects. Currently, LARSIP receives funding from NSF, NOAA, Lockheed Martin Corporation and the DoD. LARSIP function as a training center in a

bilingual (Spanish and English) environment for current and future scientists and engineers of the Caribbean region and the South and Central Americas. The training centers are multidisciplinary in scope, serving Mayaguez and other UPR campuses. Universities and institutions in other countries are encouraged to form and establish liaisons with LARSIP through Memoranda of Understanding or other similar arrangements.

#### **Contact:**

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<http://larsip.uprm.edu/>

### **Manufacturing Automation Room**

Inaugurated in May 2004, **MAR** serves as a platform for hands-on experience on practical process control for undergraduate students. The room currently counts with two industrial control systems (Delta V, and PCS7) currently connected to six physical chemical processes. The students are required to configure control strategies for these 6 unit operations, validate the work done, and tune the control strategy. MAR was developed with industrial funds from Merck, Pfizer, Abbott, Automation Technologies, OSI Safety, and Coneco and participation of UPRM-staff and undergraduate students. Engineers from system integration companies support the students working in their projects with seminars on validation, configuration, and data managing, and direct support during the programming. Students from other programs, such as electrical (currently participating) mechanical, and industrial engineering, could use and benefit from the facilities. It can also be used to offer training in control strategies.

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### **ERC for Structured Organic Particulate Systems (C-SOPS)**

This engineering research center focuses on understanding the properties of organic particulate materials and the operations used in the pharmaceutical, food and agrochemical industries to process these materials. SOPS is led

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by Rutgers University with the participation of University of Puerto Rico at Mayagüez, (Chemical Engineering Department leaders), Purdue University, and New Jersey Institute of Technology. It started its operation on July 2006. Its vision is to transform the manufacturing of products of the aforementioned industries by enhancing the education experiences of undergraduate students, serving as platform for applied and basic research, offering training for professionals from the industry, and serving as technology transfer and demonstrations. The Center is backed up by most of the big pharmaceutical companies, such as Pfizer, Merck, Abbot, Lilly, Schering Plough, Bristol Myers Squibb, Glaxo Smith Kline and others.

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**Center for Nanostructure Characterization (CeNaC)**

The Center for Nanostructure Characterization is managed by the Department of Chemical Engineering and is located in an adjacent building in the UPRM Engineering Complex. It houses a high resolution JEOL 2100F Field Emission Transmission Electron Microscope and other advanced nanomaterial characterization instruments, such as XRD, XPS and confocal microscope. Its purpose is to provide access to unique advanced instrumentation capabilities to academic researchers and industry, and to promote competitive research.

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**UPRM Model Factory**

The UPRM Model Factory integrates modern equipment, materials, and people into a manufacturing system. Its mode of operation is through interdisciplinary working teams from several engineering and business disciplines. This is a coordinated effort between Industrial, Electrical & Computer, and Mechanical Engineering. The goals of these laboratory facilities are to provide the following:

- Basic training to students through course labs and project initiatives
- Practice based experiences dealing with all aspects of an actual manufacturing system.
- A space where local manufacturing industry issues can be studied.
- A place where modern production technology and techniques can be studied as they are applied in an integrated manufacturing system.
- The opportunity to assist local manufacturers in the development of their production system.
- Incubator facilities where products and process can be developed or improved.
- Serve as a meeting place where people from several disciplines can meet and learn to work in teams, and get an appreciation for the technical aspects of the other's area of knowledge.

Currently, this laboratory houses a for-profit manufacturing activity and provides students with an exemplary manufacturing experience inside the university. The factory hosts a surface mount technology (SMT) printed circuit assembly (PCA) line and a three-axes CNC milling machine in which production and prototype runs are performed.

As for-profit initiatives are defined, students receive pay for their involvement, similar to a COOP experience. These students are then ideal candidates for course projects and summer and COOP internship in related endeavors. Such young but experienced graduates are then positioned to initiate new business ventures or play lead roles in interested recruiters. Various companies (notably Hewlett Packard, Fuji America and FeatureCam) have contributed to this initiative, which has been active for over ten years.

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**Human Factors/Ergonomics and Work Measurement Laboratory**

This laboratory has been designed to provide students with hands on experience in the analysis and evaluation of humans and their working environment. Tasks are simulated and evaluated

based on anthropometrics, biomechanics, cardiovascular, and force requirements. The laboratory is equipped with modern equipment for the analysis of work systems and computers with software for the analysis of manual material handling activities. The following is a list of some of the equipment available in the laboratory: Computers with licenses of ErgoIntelligence for analysis and evaluation of workstation design as well as the analysis of lifting tasks with the NIOSH lifting guide; Chatillon digital force measurement gauges and equipment for the analysis of pushing and pulling tasks; hand dynamometers and pinch gauges to measure hand force; anthropometers and calipers for the collection of anthropometric data; heart rate meters and a treadmill for the evaluation of cardiovascular requirements of physical tasks; electromyography with data collection software for the analysis of muscular activity; goniometers and data collection software for the analysis of flexion, extension, and rotation of body members; heat stress monitors and Wet-bulb globe temperature meter for the analysis of environmental variables, among others.

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### **Manufacturing Automation Laboratory**

This teaching-learning facility is the hands-on laboratory for the Real Time Process Control course where students design, build, and control scaled models, mainly emulating real manufacturing operations. The emphasis is in the use of programmable logic controllers (PLC), industrial sensors and actuators, pneumatics, and computer-based human machine interfaces. The laboratory counts with 20 workstations equipped with all the necessary software and hardware. The facility is available for demonstration and custom trainings.

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### **Statistical Quality Control Laboratory**

The laboratory is equipped with Statistical software for data analysis, design of experiments, and validation procedures. It can also provide hands-on demonstrations for applied statistics courses and for simulation courses.

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### **International Service Systems Research Lab (ISSER)**

ISSER is a research and consulting laboratory within the Industrial Engineering department at the University of Puerto Rico at Mayaguez. The Mission is to support ongoing research and professional services that advance the understanding, design and evaluation of complex service-delivery systems. A service system (or value co-creation system) is a configuration of technology and organizational networks designed to deliver services that satisfy the needs, wants, or aspirations of customers. Marketing, operations, and global environment considerations have significant implications for the design of a service system as well as human considerations, given that most services are co-created by human providers and customers. Research areas are grounded in service science theory, operations research tools and techniques and statistical analysis of customer data. One important and emerging area of research is how culture and other behavioral factors affect inter-cultural service systems and how one can design them to minimize negative effects while maximizing benefits. Research thrust areas include:

- Survey research and qualitative customer data analysis
- Systems Thinking and Systems Integration
- Operations Research
- Data Envelopment Analysis
- Facilities Design

In the consulting arena, ISSER faculty aims at working with the private sector and government with the goal of recommending a system design that is capable of delighting customers while achieving world-class efficiencies. This is done through the application of scientific design principles to real life problems affecting the service industry such as specific IE and OR tools

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for the improvement of systems in specific research areas.

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**Bio-Industrial Engineering Laboratory (Bio IE Lab)**

The Bio IE Lab focuses on the use of engineering analysis methods to extract biological knowledge from scientific in-silico, in-vitro and in-vivo experiments. The laboratory integrates high computing capabilities and state-of-the-art algorithms to lead data-based biological discovery. The lab work relates statistical, soft-computing and optimization techniques to biological data analysis. In particular, the search and discovery of biomarkers of cancer is a central line of work of the Bio IE lab. Located in the Industrial Engineering Department, the laboratory is equipped with four MacPro workstations and one iMac capable of running UNIX, Mac and Windows software.

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**Lean Logistics (LeLo) Lab**

The Lean Logistics (LeLo) Lab is a student-centered lab seeking to provide hands-on experience while creating practical research-based solutions to contemporary logistics problems, particularly those of Latin American countries. Currently the lab has three main streams of research: facility logistics, humanitarian logistics, and supply chain networks security. Consulting and training at the supply chain, facility, or production line level are available through the lab. The LeLo lab is partly funded by the National Science Foundation and Department of Homeland Security.

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**Mechatronics Center**

The Mechatronics Center at the Mechanical Engineering (ME) Department is dedicated to study electromechanical systems. The center offers training and support to industry and existing ME courses while providing facilities and resources for research in the control of mechanical and electromechanical systems. Training facilities are equipped with eight laboratory work stations with basic equipment to perform experiments and projects in mechatronics. The center also includes a prototyping laboratory with additional equipment to conduct independent research projects; a design center where students will be able to share ideas and make presentations; and a full-time technician to support the center's activities. The prototyping laboratory provides students with access to specialized mechanical, electrical, and software tools for the design and realization mechatronics systems. The center also utilizes the equipment available in the Manufacturing Processes Laboratory to handle a wide variety of complex projects involving the fusion of mechanics, electronics, and software technologies.

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**Mechanical Response Research Laboratory**

The Mechanical Response Research Laboratory is located at the Mechanical Engineering Department and supports research efforts in areas that focus on mechanical/material component systems. Areas ranging from structural vibration control, material characterization, infrastructure health monitoring and diagnostics, and anomaly detection in turbine temperature measurement devices have been performed. Research that has been funded from various government agencies such as DoD, NSF-EPSCoR, NASA, and private industry has lead to peer review publications and patents.

Projects topics such as:

- Characterization of sandwich composite materials
- Vibration control using shape memory alloys
- Vibration shaker design
- Damage detection and health monitoring using neural networks
- Fluid structure interaction

- Novel dynamic material characterization techniques

The MSRRL laboratory is equipped for research in mechanical/material component systems. The laboratory has a laser vibrometer for structural vibration response, several dynamic signal analyzers, acoustic emission equipment, data acquisition equipment, transducers (acceleration, Laboratory facilities include a laser vibrometer, several electromagnetic shakers with corresponding amplifiers, data acquisition equipment, transducers (acceleration, force, and temperature), conditioning amplifiers, power supplies, oscilloscopes, and computer facilities.

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### Micro and Nano Devices Research Laboratory

The Micro and Nano Devices Research Laboratory is a Class 100 (ISO Class 5) cleanroom for photolithography located at the UPRM Research and Development Center. The facility houses a SUSS MicroTec Mask Aligner (MA-6) with backside alignment, a Reactive Ion Etcher with CF<sub>4</sub> chemistry, a multiple target (AC/DC) Sputtering System (AJA Orion Thin Film Deposition System), a Stylus Profilometer (KLA Tencor P-6), a chemistry hood and photolithography peripherals.

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### New Materials Development Laboratory (NMDL)

NMDL is responsible for matching many new differentiated materials and technologies with market needs in the areas of bioengineering, alternative energy and electronics. The NMDL include a materialographic laboratory, a mechanical testing facility (including a DMA), thermal chambers, tribometers Basic equipment for materialographic preparation, hardness testers, heat treatment furnaces and a sophisticated optical

imaging system are available. NMDL performs sponsored research from various government agencies such as: DoD, NSF, NIH, and various private industries for example Lockheed Martin.

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### Vehicle Design and Research Laboratory

Vehicle Design and Research Laboratory is involved with research and development of high performance and alternate fueled vehicles for current and future transportation needs. It is equipped with a Design Center and a Machine Shop, two chassis dynamometers both and emissions measurement equipment. Data acquisition instrumentation is available for vehicle development and optimization. Current research includes: energy management for solar powered, electric and hybrid vehicles, motorsport vehicle optimization, high speed maglev transportation systems and remote control aircraft. Undergraduate student projects include Formula SAE, SUN, SAE Mini Baja and SAE Aerodesign.

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### Biosensing and Microfluidics Research Laboratory (BMRL)

The Biosensing and Microfluidics Research Laboratory (BMRL), led by Dr. Rubén Díaz-Rivera and Dr. Pedro Resto, is 900 sq. ft. facility located in the Department of Mechanical Engineering at UPRM. The purpose of this laboratory is to facilitate the design, construction and use of microfluidic systems for cell studies and biosensing applications. The laboratory houses a small cell culture facility, a faraday-caged microscopy setup for electrical/optical characterization of microfluidic devices, and tools for performing PDMS soft lithography. The laboratory has a LabSmith Synchronized Video Microscope workstation with black & white and EPI-fluorescent optic modules, controlled with a Dell Precision T1700 desktop computer, for microfluidic visualization and data acquisition. In addition, the laboratory houses a workstation for fluid mechanics and multiphysics simulations. The workstation was built in-house and is



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powered with the latest generation of Intel's Core i7 processor and 32 GB of RAM. Licensed software includes COMSOL Multiphysics 4.4 and CD-adapco Star CCM+ Version 9 as well as the usual MS Office Suite. The laboratory has access to a rapid prototyping facility having a 3D printer, a small scale CNC and an electronics workstation. The laboratory also has access to a Dantec Dynamics Micro Particle Image Velocimetry System for the fluidic characterization of micro-scale devices, in collaboration with the Bubble Dynamics Laboratory.

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**Biomechanics and Biomaterials Laboratory (BBL)**

The Biomechanics and Biomaterials Laboratory is dedicated to research and education principally in the area of characterization and testing of biomaterials. This Laboratory is equipped with a Tribometer, a DMA, Minimat tensile tester, Potentiostat/Galvanostat and an Analytical balance. Characterization of the wear resistance, tensile, compressive and fatigue properties are performed in this facility. Corrosion resistance and behavior through potentiodynamic polarization, cyclic voltammetry and electrochemical impedance spectroscopy are measured in this laboratory.

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**High Performance Computing and Visualization Laboratory (HPCVL)**

The HPCVLab is located in room L-127 of the Lucchetti building in the Mechanical Engineering Department. It performs investigation in computational fluid dynamics of turbulent flows with heat transfer, algorithm development, parallel programming, high performance computing, and scientific visualization; particularly, for fundamental thermal-fluid research with applications to aerospace. The

facility is equipped with a powerful GPU cluster, two workstations (with 128 and 64 GB of RAM memory, respectively), a virtual reality kit, a high-resolution monitor, and several terminals for remote connection to supercomputers: Blue Waters, Stampede, and Comet in US as well as MareNostrum 4 in the Barcelona Supercomputing Center (Spain). The Air Force Office of Scientific Research (AFOSR), National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), and the Extreme Science and Engineering Discovery Environment (XSEDE) provided initial funding for HPCVLab and its research projects. The mission of the HPCVLab is to promote and facilitate thermal-fluid research by means of cutting edge computing and visualization technology for faculty, undergraduate and graduate students, and UPRM partners.

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**Human-Centered Design Research and Development Laboratory**

The Human-Centered Design Research and Development Laboratory purpose is to enhance quality of life by understanding human behavior and cognition to connect Design and Engineering for the development of knowledge and products for social well-being. Currently, the laboratory focuses in three areas: the intersection between Design and entrepreneurship, Design for aesthetics, and Virtual Reality for Engineering applications. The laboratory is equipped with various high performance computers and head mounted displays (e.g. Oculus Rift) for the virtual reality experiments. In addition, a range of input output devices is available for inclusion in virtual reality experiments. The laboratory offers visualization of complex engineering analysis and product assemblies in support of ME courses and other partnerships.

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### **The Bubble Dynamics Laboratory (BDL)**

At the bubble dynamics laboratory of the University of Puerto Rico – Mayaguez, cutting edge research is being conducted for understanding, producing and characterizing milli-micro- and nano-bubbles through the design of acoustic resonators. We develop experimental systems for validation and/or formulation of theoretical models involving the generation and collapse of bubbles with applications on the mechanical, naval, biomedical, agricultural and nuclear energy industry. The laboratory, located in the Mechanical Engineering Department at UPRM (Lucchetti Building), houses state of the art equipment including: a 3D stereoscopic PIV (Particle Image Velocimetry) system with the capability to perform shadow-sizing micro-PIV and Laser Induced Fluorescence (LIF), a Dynamic Mechanical Analyzer (DMA), an Asymmetric Flow Field Flow Fractionator (AFFFF), a Nanoparticle Tracking Analyzer (NTA) and a Static and dynamic light scattering (SLS-DLS) equipment. The BDL laboratory is also equipped with modern data acquisition and measuring devices and it is supported through research funded by the National Science Foundation, Department of Defense, Department of Energy, the US Nuclear Regulatory Commission and the Puerto Rico Science Technology and Research Trust.

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### **The NANomaterials Processing Laboratory**

This multiple user laboratory, located at Stefani 313/314, comprises 900 sq ft of space intended for basic manufacturing and advanced synthesis of materials. Among the instrumentation relevant, there is a Cee 200 Spin-coater system from Brewer Science, Inc., a Mercury-Xenon 200W-UV lamp from Oriel Instruments, Inc., and a Thermo Fisher vacuum oven. Additional pieces of equipment available in this laboratory are: a Buehler Beta manual polishing unit, a Sartorius T212 balance with two density determination kits, a Struers Lectropol 5 electropolishing unit that permits final preparation of samples free of mechanical polishing hardening, a Buehler ISOMET 1000 high-precision diamond saw, and a fully automatic Leco LCR-500 Rockwell-type hardness testing system. Three dispersing tools

available in the lab are: a high spindle speed homogenizer (KA T18 with S18N-19G dispersing tool), a low spindle speed Labmill – 8000, and a Cole Parmer ultrasonic processor. Additional equipment for materials synthesis and/or processing include: a 4575 model HP/HT Pressure Reactor from Parr Instruments Company, a 1100°C Vacuum Chamber Furnace (7.5"IDx 13"L, 7.6 Liter) with 30 Segments Programmable Temperature Controller - VBF-1200X-H8, and a model AUT-501 Automated Laboratory Titrator from DKK – TOA Corporation. The latest acquisition for materials synthesis is a Microwave Accelerator Reactor System, Model MARS 6 from CEM Corporation and a Siemens D500 X-ray diffractometer for structural analysis.

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### **The BioNANO Systems Laboratory**

This Laboratory is located on the first floor of the Main Engineering Building (Stefani 106) and is devoted to do research on nanomaterials-based platforms for nanomedicine and biomedical applications. This 426 ft<sup>2</sup> layout facility hosts chemical-resistant bench tops, sinks, cabinets and Class 100 acoustic panels. The lab has a safety shower, eye irrigation station, flammables and acids storage cabinets, and a first aid kit. All equipment and facilities for cancer cell culture are available for research and training purposes at the graduate and undergraduate levels. Among the most important pieces of equipment, this laboratory hosts 2 Forma Scientific cell incubators, a laminar flow hood, a chemical hood, one Olympus phase-contrast microscope, one Olympus Eclipse 8000 fluorescence microscope, one BioRad cell counter, a ThermoFisher Scientific spectrophotometer, PCR equipment, a CO<sub>2</sub> chamber and one cell counter for cell viability measurements.

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### **Engineering Office of the Associate Dean for Research and Innovation (DR&I)**

The DR&I proposes and implements the course of action of the College of Engineering (CoE) towards the strengthening of its leading position in Translational Research across UPRM, Puerto Rico and the Americas. The DR&I is in charge of overseeing of the research facilities within the CoE, recognizing emerging research areas, and promoting the development and implementation of strategic research clusters aligned to new graduate programs while up-dating of the current ones. The DR&I is also responsible for the guidance, evaluation, and verification of administration & compliance issues associated to research activities. Intellectual property (IP) matters are inherent to many of the activities within the CoE; therefore, a working understanding of IP becomes indispensable to manage related issues when interacting with academic peers, governmental offices or industrial partners. Accordingly, the Office of Intellectual Property and Technology Transfer (IP & TT), hosted by the DR&I, provides specialized support to UPRM at large, starting from education and training, passing through invention disclosures, patent application and final patent assignment.

The above described activities are complemented with a dynamic and effective dissemination of the achievements and contributions of the CoE to the well-being of Puerto Rico in concordance with a healthy and robust partnership with Academia and Industry partners. On this basis, the DR&I office has been re-structured to provide qualified technical and administrative support in: (1) Research & Compliance; (2) Innovation & Intellectual Property; (3) Corporative Image & Partnerships; (4) Research Infrastructure & Facilities, and (5) Project Support.

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### **JOUST: The Journal of Undergraduate Research Students**

JOUST is an initiative of the College of Engineering at UPRM motivated by the need to disseminate the very energetic, but often overlooked, undergraduate efforts in research. JOUST is a two-component forum for

undergraduate research: (1) an online technical journal with peer-reviewed short communications (5-pages maximum per article), and (2) a companion website to enrich the learning experience with pictures, interviews, videos and additional information especially prepared for the undergraduate audience. JOUST is issued online twice a year (once per academic semester) and accepts submissions from STEM fields and the Social Sciences both in English and Spanish. A submission entails a technical article as well as additional multimedia material geared to enrich the undergraduate learning experience. JOUST follows an Open Access format with articles distributed under the terms and conditions of the Creative Commons Attribution License. JOUST can be reached through Facebook: <https://www.facebook.com/JoustContact>

### **Puerto Rico and US Virgin Islands Climatology Center**

Located at the Department of Marine Sciences, this center provides the latest climate data and weather information available for the Caribbean. It has access to a network of over 120 stations located throughout Puerto Rico and over 20 stations around the U. S. Virgin Islands. The Climate Center is also a repository for a wealth of information on climate data obtained from many other organizations, such as the National Climate Center, Asheville, North Carolina, and the Climate Analysis Center, Washington, D. C. The Center receives journals on climate topics and holds a large collection of climate data on CD-ROMS.

### **Puerto Rico Water Resources and Environmental Research Institute**

**PRWRERI** is one of 54 water research centers established throughout the United States and its territories by an act of Congress in 1964 which presently operates under Section 104 of the Water Research and Development Act of 1984 (P.L. 98-242). Since its foundation, the Puerto Rico Water Resources Research Institute has sponsored a substantial number of research projects supported jointly by federal and university funds.

The PRWRERI is a component of the Research and Development Center of the University of Puerto Rico at Mayagüez. As such, it acts as the official liaison of the University of Puerto Rico with industry and government agencies for all water resources research activities. The Institute



also functions as an advisor to these two sectors on water resources issues. This role translates into multidisciplinary functions and activities which add relevance and impact to the Institute research efforts.

By virtue of the local relevance of its research and the prestige and leadership of its investigators, the Institute has become the focal point for water-related research in Puerto Rico. Meetings, seminars, technical reports, and a quarterly newsletter keep the water resources community and general public informed about advances in research. Approximately, once every two years, the Institute organizes major conferences on water-related research in Puerto Rico and the Caribbean in collaboration with other technical organizations in the region. All these activities facilitate the translation of Institute's sponsored research into practical applications of direct benefit to industry, government, and the general public.

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**External Resources Research and Development Center**

**R&D Center** was established in 1986 at UPRM to encourage and manage research and development activities in the areas of engineering, technology, and science, and to provide a technological basis to serve the Puerto Rican community. The R&D Center manages several research programs which include basic and applied research, research sub-stations for seismic investigation, industrial handling and disposal of hazardous chemical substances, natural resources renewal, and biotechnological research as well as technical support for the development of the Caribbean Basin. The R&D Center's mandate and principal functions are to promote, coordinate, and administer externally funded research projects conducted by faculty members of the Mayagüez Campus for clients from business and industrial segments, public and private organizations, and government agencies. The R&D Center's Advisory Board is comprised of fourteen members. It is chaired by the UPRM Chancellor, and includes the following members: the UPR President, the PR Industrial Development Company (PRIDCO) Executive Director, the Deans of Engineering, Arts & Sciences, Agricultural Sciences, Business

Administration, and Academic Affairs, a UPRM researcher and five representatives of the industrial community, designated by the Chancellor.

All funding for the Center's research projects comes from grants provided by government agencies (Federal and insular), educational institutions, and private sponsors within the industrial community of Puerto Rico.

The R&D Center offers technical and administrative assistance to the UPRM research community through its Accounting and Finance, Budget, Purchasing, Receiving, and External Resources Offices (ORE). The Center has its own reference library within the General Library of the UPRM, which holds a specialized collection in the fields of scientific and technological research.

The R&D Center acts on behalf of researchers in conjunction with the university community and the general public. It is the instrument of promotion for the development of research on the Mayagüez Campus and serves as an intermediary between the University, the government, and the private sector. In this role, the R&D Center represents the interests of researchers on academic and administrative forums, plans and establishes UPRM's research policy regarding the island's economy and technology transfer to the community, and administers research centers, institutes, and individual projects to encourage their development and to promote excellence.

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**NOAA Collaborative Science Center For Earth Systems Sciences and Remote Sensing Technologies (NOAA – CESSRST)**

NOAA-CESSRST conducts research, educates, and trains a diverse group of students, early career scientists, and engineers, in NOAA-related science missions. The goal is to help create a diverse STEM workforce for NOAA and its contractors, Academia, Industries and the Private Sector. Established in 2016 through a national competition, and funded by the National Oceanic and Atmospheric Administration, CESSRST is led by The City University of New York (CUNY) and brings together Hampton University, University of Puerto Rico at Mayaguez; San Diego State University, University of Maryland

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Baltimore County, and University of Texas at El Paso. CREST also incorporates several industrial partners like STC, AER, Nobilis, SSAI, ERT, and IMSG. The consortium brings together world class research capabilities for remote sensing technology consisting of exemplary faculty and research staff, advanced computational facilities, instrumentation for direct readout of satellite data and calibration/validation, experience in state-of-the-art remote sensing technology development for satellite and surface-based remote sensing, and in situ sensor systems. These capabilities drive an ambitious and research agenda for new applications of remote sensing and advancing the understanding of Earth System processes and improving predictions of weather and climate.

Faculty, scientists, and students from the Departments of Electrical and Computer Engineering, Computer Science and Engineering, Civil Engineering and Surveying, and Marine Science comprise the UPRM CESSRST team. The focus of the UPRM team research work is in remote sensing of land and coastal ecosystems, using satellite and UAV-mounted sensor data.

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**NSF-CREST: Nanotechnology Center for Biomedical, Environmental and Sustainability Applications**

With National Science Foundation support, this Center for research and excellence in science and technology further develops the Nanotechnology Center for Biomedical, Environmental and Sustainability Applications at the University of Puerto Rico-Mayaguez (UPRM). The Center's mission is to combine transformational and interdisciplinary research and education efforts in the area of nanoscale materials by focusing on: biomedical, environmental remediation, and sustainability applications. Faculty members involved in the Center will investigate application-oriented processing of materials with properties and applications that depend on phenomena occurring at the nanometer scale: (1) Medical and Biological Applications; (2) Remediation of Recalcitrant and Emerging Contaminants from the Environment; and (3) Sustainability. This project will establish effective means to institutionalize research and education

aimed at founding a sustainable platform at UPRM of international recognition. Through formative and summative assessments, a systematic project evaluation will provide information to ensure continuous improvement, focusing on achieving the proposed objectives.

This Center for Biomedical, Environmental and Sustainability Applications will develop technologies for cancer therapy, water disinfection and air cleaning, and sustainability. Despite dramatic improvements in cancer chemotherapeutics, there is still an unmet need to understand the underlying causes of treatment failures. The knowledge acquired through the proposed activities will become invaluable for the development of novel cancer therapies and materials with applications in medicine. Center goals will also address global environmental challenges associated with water and air. Sustainability-related research will also be impacted by the Center. At the undergraduate level, the Center will impact the Undergraduate Certificate in Materials Science and Engineering program, as well as undergraduate research courses in the various engineering departments.

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**Civil Infrastructure Research Center**

Founded in 1991, **CIRC** began operating within the Civil Engineering Department in January 1992. For 10 years CIRC received funds from the National Science Foundation through the PR office of the Experimental Program to Stimulate Cooperative Research (PR-EPSCoR). At the present, the center receives funds from Federal Agencies (NSF, DOD, NASA, FEMA, US DOT, DOE, US FRGD), the University of Puerto Rico and the Department of Transportation and Public Works. CIRC also participates in the organization of international conferences and workshops. CIRC's mission is to help government and industry design, maintain, manage, and improve Puerto Rico's infrastructure while contributing to the expansion and improvement of the College of Engineering's undergraduate and graduate programs in infrastructure-related disciplines. CIRC developed a comprehensive strategic plan which can be accessed at <http://civil.uprm.edu/circ/>. The Civil Infrastructure Research Center

has a computer center which is constantly updated with funding from projects and from the Department of Civil Engineering and Surveying.

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### **Puerto Rico Seismic Network**

PRSN is administered by the Department of Geology. The staff oversees a network of 25 broad and short period seismic stations and 6 tide gauges and weather stations installed in the Puerto Rico region. The main objective of PRSN is to process and analyze local, regional, teleseismic earthquakes. Data are made available to the general public and distributed among scientific and academic communities and emergency management organizations. The PRSN also operates a tsunami warning system monitoring seismic and tsunami events in Puerto Rico the Caribbean and adjoining regions.

### **Geological and Environmental Remote Sensing Laboratory (GERS Lab)**

GERS Lab was founded in January 2002 as part of the Department of Geology in the University of Puerto Rico at Mayagüez. Our mission is to promote and facilitate the education and research of the Earth System Science using remote sensing. Current research is mainly focused on environmental monitoring with bio-optical properties and digital images. We are also interested in developing Geographic Information Systems. Our vision is to become a prestigious laboratory in remote sensing of the Caribbean by generating innovative research and producing Earth System scientists well trained in the application of these tools. We conduct image processing and analyses of several sensors, including SeaWiFS, AVHRR, MODIS, ETM +, SAR, IKONOS, and Hyperion. Our research facilities include an image processing laboratory equipped with three Dell personal computers, two Silicon Graphics, scanners, a plotter, and color printers. We also have teaching facilities with twenty personal computers, scanners, and printers. ENVI and ArcGIS software are available in all our research and teaching computers.

### **Space Information Laboratory (SIL)**

SIL was founded as part of the NASA Tropical Center for Earth and Science Studies (TCEESS) with the purpose of receiving and distributing satellite data from different sources. The facility is currently housing a NOAA Direct Broadcast Satellite Receiving Station, with capability of receiving data from the Suomi-NPP, JPSS-1, Aqua, Terra, NOAA-18, NOAA-19, METOP-A, METOP-B, and GCOM-W1 satellites, among others. Data is primarily used by the Space Science and Engineering Center from the University of Wisconsin, Madison, for ingestion into their forecast models, and for developing diverse imagery. Data is also used by UPRM NOAA CESSRST researchers for remote sensing of coastal environments and for calibration and validation of localized optical and microwave sensors, and other researchers at UPRM. This data is available for academic and academic research purposes. In addition, SIL houses a University of Colorado project for Multi-Constellation Multi-Frequency GNSS Data Collection Arrays for Low Latitude Atmospheric Effects Studies.

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### **Weather Radar Network of Puerto Rico at UPRM**

A weather research network comprised of two types of X-band weather radars was developed thanks to funding from two NSF programs; Engineering Research Centers (ERC) and Major Research Instrumentation (MRI). The first type of radars are the small Off-the-grid (OTG) radars which measure only rainfall rate and are capable of operating with renewable (wind and/or solar) power in case of blackouts which are common during extreme weather events. The other type of radars are more sophisticated Doppler Polarimetric weather radars called Tropinet, which are capable of measuring rainfall, wind speed and other hydrometeors such as hail, among others. The network comprises 3 Tropinet and 5 OTG distributed mainly on the west side of the island of Puerto Rico and they could complement the data from the NWS radar located on the East of the island (in Cayey).

The new network uses a dense network of radars capable of very high spatial and temporal resolution, which is necessary for better

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prediction of landslides, flooding, tornado warnings and other meteorological phenomena. These systems operate collaboratively within a dynamic information technology infrastructure, adapting to changing conditions in a manner that meets competing needs of end users, the government, private industry, and the public.

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**Rapid System Prototyping Laboratory (RASP)**

The Rapid System Prototyping Laboratory (TI-ICDL) is located in Room 208, Stefani Building in the UPRM campus. The facility provides 420sq. ft. of space devoted to the tasks of developing technologies and applications for prototyping algorithms, circuits and electronic systems on quick turn-around technologies like Field Programmable Gate Arrays (FPGA) and advanced hardware platforms. RASP was established in 2002 with the sponsorship of multiple entities, including Texas Instruments, The National Science Foundation, IBM, Xilinx, Harris, and Lockheed-Martin, among others. The main mission of the RASP Laboratory is to enable graduate students acquire the necessary training, skills, expertise, and capabilities to conduct academic and industrial research work in the field of rapid prototyping digital and mixed-signal electronic systems..

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[http://ece.uprm.edu/index.php/About\\_RASP](http://ece.uprm.edu/index.php/About_RASP)

**The Power Electronics Laboratory**

The main focus of this laboratory is for advance undergraduate education on power electronics and aerospace systems using graduate research techniques. Graduate students are welcome to do partially their related research work in the facility, and serve as mentors to the undergraduate research students. This facility is located in Stefani building (S101) and occupies about 100 sq ft. This laboratory has one Printed Circuit Board Rapid Prototyping System, 3D Printers, High temperature PCB Oven, Portable Drill/Saw Machinery, Network/Impedance/Spectrum

Analyzer 10Hz-500 MHz, Milling/Drilling Machinery, and Lead-Free Soldering Station. This facility also includes the usual assortment of oscilloscopes, waveform generators, multi-meters, computers, etc. The laboratory has Software Licenses for SABER, P-spice, Matlab, and others useful for the design unmanned systems. This facility is useful for fabrication, characterization, and testing unmanned system prototypes and renewable energy systems. The UPRM's Power Electronics Laboratory is sponsored in part by the UPRM's ECE Industry Affiliates Program, Sandia National Laboratory, CIESESE Program and the US DoEnergy/NNSA.

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**Texas Instruments Integrated Circuits Design Laboratory (TI-ICDL)**

The Texas Instruments Integrated Circuits Design Laboratory (TI-ICDL) is located in Room 210B, Stefani Building in the UPRM campus. The facility provides 800 sq. ft. of space devoted to the tasks of designing and testing analog, digital, and mixed-signal integrated circuits and systems. The facility was established in 1999 with the sponsorship of Texas Instruments (TI) under the UPRM-TI Collaborative Program. It provides 16 design workstations running industry-grade software tools for the design entry and verification of integrated circuits developed in bipolar and MOS technologies. In addition, the lab provides four testing stations with state-of-the-art test and measurement tools used by senior and graduate students, in advanced and graduate course projects in electronics as well as graduate research students for their projects.

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**Parallel and Distributed Computing Laboratory**

The PDC Group performs research in the design, implementation, and efficiency measurements of parallel algorithms. It also addresses research issues related to parallel and distributed computing systems with an emphasis in high-



performance cluster computing and Grid computing. Our work includes a wide spectrum of experiences from computing systems to modeling and simulation of physical and biological phenomena.

The mission of the PDCLab is to stimulate and facilitate the growth necessary to extend the state of the art in parallel and distributed computing systems, while fostering a multidisciplinary research and educational environment for faculty, undergraduate and graduate students, and partners at UPRM.

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### Microgrid Laboratory

The Microgrid Laboratory offers several experimental research, development, and education platforms, integrated in a single operational system. The facility is designed to run experiments at all levels of controls. It is composed of a DSPACE system and an inverter-based setup, two electronic DC power sources, loads, and two computers. The setup consists of four inverter-based generators, which can simulate different microgrid configurations. The microgrid setup includes the following equipment: 1×dSPACE system, which includes: 1 CPU board (ACE1006), an expansion box (PX10), a 16-channel A/D board (DS2004) and a connection (CP2004), 2 digital I/O boxes (DS4003), output board (DS5101) and connector (CP5101), the box of the whole system, and the digital bus cable, 1×10kVA transformer for grid connection; 4×2.2kW DANFOSS inverters; 1×Data logger; 2×screens; and 1×PC. In addition, to generate the DC link that supply each DC/AC inverter the facility has a 5kW AC/DC power electronics supply.

Also, an electric motors and drives setup is dedicated to component testing and prototyping, component modeling, and simulation. There is a test bench for implementation of control and identification algorithms for drives and power electronics applications. The test bench is based on the rapid prototyping system for control algorithms using the Dspace 1104 board. The laboratory also has the following equipment:

UPRM built 3 phase rectifier/inverter for motor control, 1 HP; Controllable DC power supplies.

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### Microwave and Millimeter-wave Antennas and Remote Sensing Systems Laboratory (MAREs)

MAREs was created in 2000 through a Major Research Instrumentation grant from NSF. The laboratory instrumentation includes microwave and millimeter-wave instrumentation that allows us to perform circuits and antenna measurements up to 67 GHz, rapid prototyping equipment for printed circuit boards up to 10 GHz, and design workstations with commercial software for microwave circuits and electromagnetic simulations. The laboratory facilities have supported numerous research projects throughout the years, including projects under the NSF Engineering Research Center for Subsurface Sensing and Imaging Systems (CenSSIS), NSF Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere (CASA), and the NASA Tropical Center for Earth and Space Studies (TCESS). The laboratory has also supported projects from the Army Research Office, the Air Force Research Laboratory, the Department of Energy, and the Puerto Rico Science, Technology and Research Trust, in addition to NSF and NASA. The laboratory currently supports the NOAA Cooperative Science Center for Earth System Sciences and Remote Sensing Technologies (NOAA CESSRST), and the NSF project “*CRISP Type 2: Interdependent Electric and Cloud Services for Sustainable, Reliable, and Open Smart Grids*,” as well as other unfunded graduate and undergraduate projects. The laboratory has been a central component in obtaining more than \$7.35M in research funding since its creation in 2000, with an initial investment of \$677,000 by NSF.

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## ***SPECIAL PROGRAMS***

Several comprehensive programs on campus have a special impact on research and education.

### **Puerto Rico Resource Center for Science and Engineering**

**RCSE** is a consortium of the major institutions of higher education on the island, which includes the University of Puerto Rico System, Inter-American University System, and the Pontifical Catholic University of Puerto Rico. RCSE's mission is to achieve excellence in science technology, engineering, and mathematics (STEM) education in order to promote full participation of Puerto Rican students in these fields and to develop the human resources and research base needed to support the island's economic and technological development. Created in 1980 with joint funding from the National Science Foundation and the University of Puerto Rico, RCSE has been extremely successful in pursuing its goals and has experienced a sound and steadfast growth in the scope of its programs.

The high level of success at RCSE is in great part due to its development as a consortium based on a collaborative network among major institutions of higher education, while providing access to a broad pool of resources by promoting excellence. Its goals range from efforts to improve science and mathematics curricula from grades K-12 in the island's schools to the establishment of research and development capability on the island. Due to the multi-institutional nature of its structure and complexity of its goals, RCSE was established as an administrative unit of the University's Central Administration. As a special entity which is not identified with any particular academic program, level or unit, the RCSE has effectively promoted maximum collaboration among all institutions, facilitating a synergistic effect through the improvement of STEM education on the island. RCSE has acted as an intermediary among consortium institutions, bringing them together to identify major problems and needs in STEM education and to develop innovative programs to address these needs. Key academic and administrative officials from all member institutions participate actively in the planning and implementation of the RCSE programs. Offices for RCSE are located on Río Piedras and Mayagüez Campuses.

### **Puerto Rico Transportation Technology - T<sup>2</sup> Transfer Center - Local Technical Assistance Program: PR-LTAP, FHWA**

The Puerto Rico Transportation Technology Transfer Center, also known as the T<sup>2</sup> Center was created on April 1, 1986 in the Civil Engineering and Surveying Department of the University of Puerto Rico, Mayagüez Campus. The Center is funded by the Puerto Rico Department of Transportation and Public Works (PRDTPW) and the Federal Highway Administration (FHWA). Currently the T<sup>2</sup> Center is part of a network of 52 Centers (one in each state, one national tribal center and Puerto Rico). All Centers are members of the National Local Technical Assistance Program Association (NLTAAP). At the national level, the LTAP Centers are under the Center for Local Aid Support (CLAS) of the FHWA.

Since 1996 the Puerto Rico T<sup>2</sup> Center is part of the reorganization of the FHWA the Center is part of the Southeastern region with the states of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee. Each region has a member in the Executive Council of the NLTAAP. The Centers Directors of each region collaborate in organizing a regional meeting and conferences and sharing technology transfer materials and instructors. At the local level, the Puerto Rico T<sup>2</sup> Center receives assistance and guidance from an Advisory Committee consisting of members from the state Department of Transportation and Public Works and the Puerto Rico Highway and Transportation Authority, Metropolitan Bus Authority and Municipalities.

The T<sup>2</sup> Center Director and Administrative Staff are very active as spokesperson for the Decade of Action for Road Safety in Puerto Rico, the Dwight David Eisenhower Transportation Fellowship Program for Hispanic Serving Institutions (DDETFP-HSI) and the State Transportation Innovation Council (STIC).

#### *Seminar Program*

The seminar program of the T<sup>2</sup> Center is geared to local transportation officials from the 78 municipalities in Puerto Rico and the Puerto Rico Department of Transportation and Public Works. The annual program includes at least 50 seminar days. The level of training and the selection of the instructors depend upon the topic and the audience to be addressed. Three major categories

of seminars are offered: technical seminars, hands-on demonstration seminars and webinars. Technical seminars correspond to topics of technical nature related to transportation, such as pavement design, pavement rehabilitation and management, materials, drainage, highway safety, traffic engineering, geographic information systems, surveying, geotechnical and environmental. In addition, seminars that complement routine transportation related activities of administrative nature, including motivational aspects, supervisory and management skills, tort liability, and ethics are also offered.

All seminars are accredited by the *International Association for Continuing Education and Training (IACET)*, through the College of Engineers and Surveyors of Puerto Rico. Engineers and Surveyors that are in good standing can register on our seminar program for contact hours applicable to the renewal of their professional license.

#### *Technical Library & Audiovisual Material*

The T<sup>2</sup> Center provides technology transfer materials in the form of technical publications and audiovisual materials to municipalities and transportation officials upon request. The T<sup>2</sup> Center also maintains a library of technical reports associated with the field of transportation. The library includes over 3,000 research reports, technical magazines, transportation and highway engineering textbooks, proceedings of transportation related conferences, and catalogues of information services that assist in the acquisition of technical information not available at the Center. This library is complemented with newsletters received from the other LTAP Centers as well as CD's from the Transportation Research Board (TRB), the Institute of Transportation Engineers (ITE) among others.

The T<sup>2</sup> Center has audiovisual material from recognized profit and non-profit organizations associated with transportation such as International Road Federation (IRF), Federal Highway Administration (FHWA), American Road and Transportation Builders Association (ARTBA), American Public Works Association (APWA) and Transportation Research Board (TRB).

#### *T<sup>2</sup> Information Service / Technical Assistance*

The T<sup>2</sup> Center provides technical assistance and information services to municipalities as requested using university staff, Center Director and through its web page, [www.uprm.edu/prt2](http://www.uprm.edu/prt2). The information provided is in terms of advice, guidance, or referral to published materials, new video and CDs associated with highway safety, drainage, pavement maintenance, traffic congestion, roundabouts, environmental issues associated with surface transportation and other pertinent areas associated with the built transportation infrastructure in Puerto Rico. Letters, electronic mails and personal contact are also used to handle individual request. Many of these requests have been used to develop a seminar topic of interest to transportation officials from the municipalities and DTPW.

#### *Every Day Counts (EDC)*

The T<sup>2</sup> Center also performs training and research activities through the Every Day Counts (EDC) initiative, sponsored by the Federal Highway Administration (FHWA) of the US Department of Transportation (USDOT). This federal program includes innovation, ingenuity, invention and imagination as pillars in the selection of emerging technologies associated with highway transportation. The program is designed to identify and deploy innovation in strategic areas aimed at shortening project delivery, enhancing the safety of our roadways, and protecting the environment. Examples of the EDC initiatives implemented in Puerto Rico with the assistance of the T<sup>2</sup> Center includes safety edge, warm mix asphalt, pre-fabricated bridge elements, pavement preservation, high friction surface treatment, programmatic agreements, intersection and interchange geometrics, implementing quality environmental documentation, intelligent compaction, accelerated bridge construction, traffic incident management, road diet, data driven safety analysis.

#### *Special Projects*

The T<sup>2</sup> Center participates in short-term projects to complement its technology transfer activities. These projects are of interest to the municipalities and to the Puerto Rico DTPW. A sample list of special projects that the T<sup>2</sup> Center has participated are listed below:

- Development of microcomputer software associated with transportation.
- Identification of municipalities needs related to transportation.
- Development of guidelines for the municipalities on how to prepare Request for Proposal (RFP) related to public transportation projects.
- Translation and adaptation of Federal guidelines related to different aspects of the mass transportation program.
- Development of technical videos regarding the proper use of asphalt, concrete and soils, in road and bridge construction.
- Spanish translation of Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-85).
- Development of technical guidelines for traffic control in construction zones.
- Participation in the Strategic Highway Research Program (SHRP) Assessment Project regarding the documentation of successful stories associated to the implementation of safety products in highway construction zones, and the inventory of existing pavement distresses.
- Surveys to determine the need of municipalities with a population less than 50,000.
- American with Disabilities Act (ADA) and its legal implications.
- Evaluation of existent transportation facilities in municipalities with a population less than 50,000.
- Evaluation of marketing methods to promote public transportation in municipalities with a population less than 50,000.

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**Puerto Rico Strong Motion Program**

The Puerto Rico Strong Motion Program (PRSMMP) has the mission to minimize the fatalities and the economic losses during moderate and high intensity earthquakes through the seismic instrumentation and supporting

related research. The PRSMMP has two main divisions: the free field stations, and the seismic instrumentation of structures. Regarding the free field stations there are 110 strong motion stations in the main island, surrounding islands (Mona, Caja de Muerto, Culebra and Vieques) and countries US Virgin Islands, British Virgin Islands (BVI), and Dominican Republic. Fifteen stations are continuous recording and sending the data through Internet while other 46 are modem connected. In addition, there are twelve continuous recording joint seismic stations where accelerograph and broad band seismograph are one beside the other. The program uses both the Antelope and Earthworm Network Administrator.

Regarding the instrumentation of structures there are five buildings, nine dams, two bridges, and the Control Tower of the BVI main airport instrumented. Strong Motion records are available upon request. The program is housed in the Civil Engineering and Surveying Department. It is funded from a grant assign by the PR Legislature.

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**Education and Research Internship Program (ERIP)**

ERIP is a model Summer Education and Research Internship Program sponsored by the US ARMY Corps of Engineers and coordinated at the Department of Civil Engineering and Surveying at the University of Puerto Rico at Mayagüez for near three decades. Near 600 interns have participated in the program which serves as a pipeline to graduate programs, terminal degrees and competitive research and development jobs. It begins orientations every January. Students express this has been a life changing experience in their academic and professional careers. For 10 weeks the students will receive technical and scientific training in the different national laboratories of the Engineer Research and Development Center (ERDC). ERDC has seven research labs where our students may participate.

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### **UPR Sea Grant College Program**

Since 1980, the University of Puerto Rico Sea Grant College Program has been working to promote the conservation, sustainability and wise use of the coastal and marine resources of Puerto Rico and the U.S. Virgin Islands. This is one of 31 programs which conform the National Sea Grant Program created in 1966 with the signing of Public Law 89-688, the National Sea Grant and College Program Act. The aim of UPR Sea Grant is to better inform public policy makers, change resource user attitudes and practices, develop educational curricula and promote conservation and sustainable economic development. The UPR Sea Grant program achieves its mission through a multifaceted approach which includes research, outreach and formal(K-12) education programs.

UPR Sea Grant links the university setting, which focuses on the development of theoretical and applied research, with regional and national agencies, and stakeholders producing a better understanding of marine technologies, seafood production (including marine aquaculture), coastal ecosystem health, and coastal economic development (including human environmental impact, and public safety). Sea Grant provides research and educational opportunities to graduate and undergraduate students of all fields related to conservation of marine resources. The information produced by research activities is organized and disseminated through workshops and activities developed by the Marine Outreach Program and the education component of our program.

### **Center for Pharmaceutical Engineering Development and Learning**

CPEDaL is a center focused on providing services of process and product development, troubleshooting, training, materials characterization and related tasks to the pharmaceutical industry, contractors, and R&D groups among others. Companies such as Janssen, Lilly del Caribe, Neolpharma, BMS, Pfizer have used CPEDaL for specific needs in the last three years.

The center also supports the learning of undergraduate students through formal courses, for example InQu 4029 Pharmaceutical Operations, and undergraduate research.

In addition, CPEDaL receives students from junior and high schools to spend a day at the

laboratory performing experiments and learning about pharmaceutical engineering. Every summer the Pharmaceutical Engineering Summer Camp is held at the laboratory where 24 students from 10th and 11th grades spend a whole week performing experimental work.

This Spring 2016, a pharmaceutical engineering minor was approved to strengthen the academic offering in pharmaceutical engineering. For more details, please visit [cpedal.uprm.edu](http://cpedal.uprm.edu).

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### **Center for Aerospace and Unmanned Systems Engineering (CAUSE)**

Center for Aerospace and Unmanned Systems Engineering (CAUSE) is the First Center of Excellence in the Caribbean to provide a framework for broad-based, competitive, multi-institutional, multidisciplinary science and engineering research that will advance the aims of space, aeronautic, and astronautic Mission Directorates across the nation and world at large. The center will foster synergy between the following science and engineering directorates: (i) unmanned systems, (ii) aeronautic, and (iii) space. The center provides an interdisciplinary environment that enables and facilitates participants to carry out collaborative educational and research of a scope and complexity that is not possible through traditional funding models. The Center's overall mission is to leverage our strong theoretical, computational, and experimental programs to advance the frontiers of fundamental and applied research while educating a new cadre of STEM students. We intend to create strong collaborative relationships with the current aerospace industries, centers, institutes, schools and universities.

CAUSE allows students and faculty to learn and apply concepts about flight and unmanned systems, whether in the atmosphere or space.

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## OASIS Project

Electric energy networks are the cornerstone of the civil infrastructure of our society. These networks provide the energy essential to carrying out daily operations in education, health care, commerce, entertainment, defense, and government. However, electric energy markets, due to their vertical integration, often exclude customers from the processes associated with energy production, pricing, transmission and distribution. Smart grids and distributed generation schemes have been proposed as mechanisms to modernize energy grids and balance the current power structures in electric markets. In a smart grid, computers and communications networks are attached to the power generation, transmission, distribution and load elements, establishing a mechanism to gather information, control generation, control demand, diagnose problems, bid for prices in energy markets, and forecast energy consumption. However, a smart grid creates interdependencies between the energy network and the computer network since the energy network powers the computers that in turn control the operation of the energy grid. In this project, a team from the University of Puerto Rico, Mayaguez (UPRM) will study smart grids and the interdependency between the energy grid and the IT infrastructure that is setup to manage it. This project champions a transformation of the electric grid, moving it away from being centered on centralized utilities that supply most, if not all, power services. Instead, the grid becomes a marketplace of third-party power-service suppliers, who compete to sell their electric services over the Internet. These services include energy block purchases, storage, billing, weather forecasting, energy demand forecasting, and other ancillary services. This brings in an important societal element – it empowers common citizens, whose homes are now renewable energy generation systems, to become suppliers and key actors in the energy market. This project is thus aimed at designing and developing the basic science and technology for an Open Access Smart Grid in order to create truly sustainable energy markets.

In this project, the smart grid is modelled as a collection of interdependent electric and cloud services, whose collaborative interactions help manage the smart grid. All the electric services (e.g., energy, storage, billing) are exposed to users as REST-based cloud services, enabling the development of algorithms and applications for

customers, power producers, and other users to consume or subscribe to these electric services, collect operational data and customer feedback, and support analytics to predict electric energy demands. Microgrids and renewable energy systems will be important components in this framework, as they enable modularization of the grid into autonomous or semi-autonomous subsystems. The research team will develop methods to map reliable power microgrids into electric services that can be rapidly brought online to compensate for lost generation capacity or to obtain more affordable energy. A major challenge with microgrid systems is activating them without introduction major power disturbances in the system. Another challenge is forecasting the availability of renewable energy, which will be addressed this by developing rain-cell tracking frameworks for solar and wind output estimation services, and the determination of local sensors requirements to improve short-term forecasts services. Finally, the team will apply the social acceptance model to the development, implementation, management and assessment of the Open Access Smart Grid with the purpose of identifying the institutional change necessary for the integration of all stakeholders and the effective democratization of electric services.

### Contact:

Dr. Manuel Rodríguez Martínez

[manuel.rodriguez7@upr.edu](mailto:manuel.rodriguez7@upr.edu)

Electrical and Computer Engineering Dept.

Phone: 787-832-4040 Ext. 3630

<http://oasis.uprm.edu/>

## Pre-Engineering Program

This is a two-week summer-residential program designed to introduce talented high school students to the engineering profession. The program's main objective is to motivate participants to select and pursue careers in engineering. Upon completion of the program, participants are able to make informed career decisions. The program has served a total of 890+ students. Ninety-four percent of the students served by this program pursued careers in engineering. Funding for the program comes from corporate institutions.

### Contact:

Dr. Manuel Jimenez

Associate Dean for Academic Affairs

[decano.ingenieria@upr.edu](mailto:decano.ingenieria@upr.edu)

Phone: 787-832-4040 Ext 2038

<http://engineering.uprm.edu/academic-affairs/pre-ingenieria>

## **PUBLICATIONS**

### **Atenea:**

An academic journal published twice a year by the College of Arts and Sciences containing literary articles in Spanish and English.

### **Boletín de Avances Técnicos:**

A free monthly publication by the Technical Information Center comprising titles and abstracts of recently published articles and documents which informing of new advances and developments in the areas of engineering, technology, and related fields.

### **Boletín Informativo de la Facultad de Artes y Ciencias:**

The College of Arts and Sciences bulletin with information related to faculty members, departmental activities and achievements, serving as a link between faculty and students.

### **Boletín Marino:**

A monthly publication of the Sea Grant Program containing information about the program's activities.

### **Bulletins:**

A series of technical and informative bulletins about research in agriculture and related areas published by the Agricultural Experiment Station.

### **The Caribbean Journal of Science:**

A scientific journal published twice a year by the College of Arts and Sciences highlighting research work related to the Caribbean area.

### **Ceteris Paribus:**

#### **The Puerto Rico Economic Review**

An academic journal of socioeconomic research published online twice a year by the Department of Economics of the College of Arts and Sciences focusing on the most recent research on the socioeconomic aspects of Puerto Rico and the Caribbean.

### **Journal of Agriculture of the University of Puerto Rico:**

A scientific periodical published twice a year by the Agricultural Experiment Station including technical and scientific articles related to the agriculture of Puerto Rico and the Caribbean.

**Miscellaneous Publications:** The Cooperative Extension Service publishes a series of bulletins and leaflets of interest to farmers and housekeepers about livestock, agriculture, agricultural engineering, health and hygiene, nutrition, child care, home economics, clothing and textiles, 4-H Clubs, and other subjects.

### **Newsletter El Puente**

A bilingual newsletter (English/ Spanish) of the Transportation Technology Transfer Center published three times a year, serving as a bridge of information with local transportation officials in Puerto Rico and the US Virgin Islands and as a vehicle for reader response consisting of brief articles about the latest transportation-related technology. Keeping abreast on the latest technical publications and audiovisual materials available, it provides a schedule of seminars and workshops sponsored by the center as well as web sites related to training in transportation. An electronic version is available at [www.prt2.org](http://www.prt2.org).

### **Revista Internacional de Desastres Naturales, Accidentes e Infraestructura Civil**

An international Spanish Portuguese journal published twice a year by the Department of Civil Engineering and Surveying discussing areas of natural hazards, accidents and civil infrastructure problems, as well as fundamental and applied research case studies. Papers submitted to the journal are considered through a peer-review process. Its editorial board is formed by researchers from Puerto Rico, U.S., Latin America, and Spain. An electronic version is available at <http://academic.uprm.edu/laccei/>. It has been continuously published since 2001.

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## ***COLLECTIONS***

**The Art Gallery** located in the Carlos Chardón Building of UPRM was inaugurated in 1959. Works by both local and foreign artists are frequently exhibited. The Department of Humanities holds a permanent collection of copies of some of the great paintings and sculptures of the past.

A **Natural History Collection** located in Celis Hall and collections in the Departments of Geology and Marine Sciences serve as a nucleus for an expanding museum in the near future.

The **Geology Museum** displays a collection of fossils, minerals, and rocks, representative of the Geology of Puerto Rico. **The Planetarium** and the **Astronomical Observatory**, located in the Physics building, offer monthly evening shows.

The **MAPR** herbarium, founded in 1958, includes about 30,000 specimens of vascular plants, bryophytes, and fungi. Most of the collections are from Puerto Rico, Cuba, and the Dominican Republic; the herbarium is especially rich in collections from western Puerto Rico and the islands of the Mona Passage (Desecheo, Mona and Monito). The herbarium is located in the Biology building and is open to the university community and the general public.

A center of cultural and intellectual life on campus, the **Museo de Arte (MUSA)**, serves as a recreational space that promotes creativity through formal and informal learning. The museum hosts the legacy of the late local artist Marcos Irizarry as well as watercolors by botanical Dr. Agustín Stahl and a collection of contemporary works by Puerto Rican and Latin American artists.

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## **OFFICE OF THE DEAN OF ACADEMIC AFFAIRS**

### **Mission**

To develop socially responsible, responsive, creative, committed, and ethical leaders with an entrepreneurial spirit and a global approach, and to develop creative, research and service endeavors that meets the needs of society. Provide strategic direction and operational support to academic work to promote excellence in education.

Encourage an environment which promotes creativity with innovative and agile programs that incorporate theory and practice. Provide services that contribute to the well-being of our society, our academic community, and global economic development. Disseminate the results of creative work, research, and service endeavors so they are accessible to all.

Play an active role in the implementation and development of processes which promote ethics and academic integrity. Continue assessment cycles that support formal institutional research processes and serve as a basis for planning and decision-making processes.

### **Vision**

To promote and maintain the Institution at a national and international competitive level, recruiting, and graduating the best students, using technology to provide exceptional services and expedite academic processes. To be at the forefront of higher education in Puerto Rico by exercising leadership and providing the necessary expertise and resources to support academic, research, and service activities.

The Office of the Dean of Academic Affairs supervises and coordinates academic matters and activities of the four academic colleges and the Division of Continuing Education and Professional Studies. These include graduate programs, academic institutional research, continuing education programs, and the professional enhancement of the academic personnel. The office is responsible for the assessment, planning, and analysis of curriculum proposals or changes, updating and incorporating innovations in the curricula, and developing

research projects that contribute to academic excellence.

Other auxiliary services such as the enforcement of academic procedures and regulations are provided to sustain an efficient teaching and academic research system.

The office also serves as a liaison with other academic institutions in Puerto Rico, the United States, and other countries in order to promote a dynamic development with a global vision.

The Dean of Academic Affairs supervises the following units and programs:

- Admissions Office
- Center for Resources in General Education (*CIVIS*)
- Department of Aerospace Studies and Department of Military Sciences
- Division of Continuing Education and Professional Studies
- Graduate Studies Office
- General Library
- Professional Enrichment Center
- Registrar's Office
- Teacher Preparation Program
- Office of Immigration Affairs

## **GENERAL EDUCATION**

The Office of the Dean of Academic Affairs is responsible for the dissemination of the General Education philosophy adopted by the Academic Senate. The Office also oversees General Education offerings in all our academic programs.

### **Minimum General Education Requirements by Subject Area**

| <b>Subject area</b> | <b>Minimum Required Credits</b> | <b>Variations by College</b> |
|---------------------|---------------------------------|------------------------------|
| Spanish             | 6                               | Arts & Sciences: 12 credits  |
| English             | 12                              | None                         |
| Humanities          | 6                               | Engineering: 15              |

|                                |    |  |
|--------------------------------|----|--|
| Social Sciences                | 6  | credits (Socio-humanistic electives)   |
| Mathematics                    | 6  | -Arts & Sciences: some variations based on department<br>-Business Administration: 3 credits (Office Administration program)<br>-Engineering: 5 credits (MATE 3005)  |
| Sciences (Biological/Physical) | 6  | -Agricultural Sciences: 8 credits (QUIM 3131-3132)<br>-Arts & Sciences: 12 credits (courses determined by department)<br>-Business Administration: 6 credits (Natural Science electives)<br>-Engineering: 8 credits (QUIM 3131-3132) |
| Kinesiology                    | 2  | None   |
| Total number of credits        | 44 | -Agricultural Sciences: 46 credits<br>-Arts & Sciences: 56 credits<br>-Business Administration: 44 credits<br>Engineering: 48 credits  |

The fundamental elements of General Education are evidenced in UPRM's institutional student learning outcomes:

- a. Become an intentional learner
- b. Demonstrate creative and critical thinking
- c. Communicate effectively
- d. Identify, study, and propose solutions to problems; transform knowledge into action
- e. Apply mathematical, scientific, and technological skills
- f. Apply interpretative and integrative skills
- g. Relate global contexts and issues of importance to Puerto Rico

- h. Show moral autonomy; develop a sense of wellbeing; understand ethical conduct
- i. Practice civic virtues
- j. Value diversity

Information literacy is embedded in all courses of instruction.

## INTERDISCIPLINARY COURSES

The Office of the Dean of Academic Affairs oversees the following courses:

**INTD 3355. RESEARCH METHODS IN LIBRARIES.** Three credit hours. Three hours of lecture per week.

Organization and services of libraries with emphasis on the Library of the Mayagüez Campus of the University of Puerto Rico. Selection, evaluation, and use of bibliographic resources in print and non-print format; conventional research strategies through print resources; development of new research strategies through electronic formats.

**INTD 3357. ENVIRONMENTAL SUSTAINABILITY.** Three credit hours. Three hours of lecture per week.

The course discusses the most relevant issues related to the goals, principles, and practical applications of sustainability from the perspectives of science and engineering, businesses, and their policies.

**INTD 3706. TECHNOLOGY, WELLBEING AND JUSTICE.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week.

The course examines practices of technology innovation and design, and conceptions of human progress. The development of skills in critical scientific and philosophical reasoning to critique contemporary technological cultures. Compare alternative technological options oriented towards achieving sustainability and fostering human wellbeing in communities.

**INTD 3990. SELECTED TOPICS WITH MULTIDISCIPLINARY APPROACHES.** One to nine credit hours. One to nine hours of lecture per week.

Study of topics or contemporary problems with a multidisciplinary approach. This course has a general education perspective.

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**INTD 3995. EXPERIENCE IN COMMUNITY DEVELOPMENT.** One to six credit hours. Three to eighteen hours of workshop per week.

Design and implementation of community projects in coordination with the *University Institute for Community Development*. Field trips and team work required.

**INTD 4000. CONGRESSIONAL INTERNSHIP-CÓRDOVA PROGRAM.** Nine credit hours. A minimum of thirty-five and a half hours per week for fifteen weeks during the semester. Prerequisites: authorization of the Institutional Coordinator for the Córdoba Program and to be selected as participant by the joint Commission for the Córdoba Program in the state Legislature of the Commonwealth of Puerto Rico. Corequisite: INTD 4010.

Internship in the Congress of the United States of America. Supervised work experience in the office of a congressman or any other congressional office such as the Library, the Office for Science and Technology, and the offices of congressional committees or subcommittees.

**INTD 4010. ACADEMIC SEMINAR-WASHINGTON CENTER.** Three credit hours. Three hours of lecture per week for fifteen weeks during the semester. Prerequisites: authorization of the Institutional Coordinator for the Córdoba Program and to be selected as participant by joint Commission for the Córdoba Program in the state Legislature of the Commonwealth of Puerto Rico. Corequisite: INTD 4000.

Academic complement to the Congressional Internship. The student selects a seminar type course in his academic or professional area of interest among those offered by experts through the Washington Center each semester.

**INTD 4019. APPLICATIONS OF SOCIAL SOFTWARE FOR EDUCATION.** Three credit hours. Three hours of lecture per week.

Critical analysis of the socio-technological systems, mostly based on the Internet, that fosters human expression, communication and collaboration.

**INTD 4995. INSTITUTIONAL COOP PLAN.** Zero to nine credit hours. Six to ten weeks during the summer or twelve to fifteen during the semester, depending on the required duration of the internship. Requisites: to have approved one full year as a regular student before the internship begins. To have applied to the government agency, private enterprise or foundation of his (her) choice, and to have complied with the requisites established by it.

To have been selected by the host government agency, private enterprise or foundation.

Work experience supervised and evaluated by a faculty member in coordination with a government agency, private enterprise or foundation, according to the student's academic background and work requirements.

**INTD 5001. MULTIDISCIPLINARY ARCHAEOLOGY I.** Three credit hours. Two hours of lecture and two hours of laboratory per week.

Introduction to the systematic description of archaeological data, their recording procedures, analysis, and methodical synthesis of the information obtained. Includes the analysis of material remains using approaches and techniques from diverse disciplines of the natural sciences and engineering. Organized in modules of archaeometry, analysis of archaeological materials, and synthesis of archaeological data.

**INTD 5002. MULTIDISCIPLINARY ARCHAEOLOGY II.** Three credit hours. Two hours of lecture and one two hours of laboratory per week. Prerequisite: INTD 5001 or authorization of the Director of the Department.

Introduction to archaeological research in Puerto Rico and the Caribbean from a multidisciplinary perspective. Includes the study of archaeological sites and regions using approaches and techniques from diverse disciplines of the natural sciences and engineering. Organized in modules of introduction to archaeological theory; survey and remote sensing; excavation and geoarchaeology.

**INTD 5095. APPROPRIATE TECHNOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

General overview of technology from historical and philosophical viewpoints. Critical examination of choice inherent in technology. Traditional and new definitions of appropriate technology. Challenges and best practices to apply engineering and technology to underserved, under-funded, or wrong-development communities.



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## ADMISSIONS OFFICE

The Admissions Office is in charge of these tasks:

1. Receiving and processing all applications according to eligibility criteria.
2. Providing orientation regarding eligibility criteria.
3. Compiling, maintaining, and updating statistical data regarding admissions and serving as a facilitator to the academic community that utilizes this information for tuition evaluation and other procedures.
4. Enforcing University admission regulations.
5. Serving as a consultant to the Administrative Board regarding admission indexes.

**Office:** Celis Building, 1<sup>st</sup> floor, 101

**Phone:** 787-265-3811; 787-832-4040 exts. 2400, 2412, 2404, 2420

**Website:** [admisiones.uprm.edu](http://admisiones.uprm.edu)

**Email:** [admisiones@uprm.edu](mailto:admisiones@uprm.edu)

## PROFESSIONAL ENRICHMENT CENTER

**Professional Enrichment Center (Centro de Enriquecimiento Profesional - CEP)** was established in July 1996 with matching non-recurrent funds from the Central Administration. The concept for the Center originated in the Division of Continuing Education and Professional Studies under the Dean of Academic Affairs in coordination with the Project Pro-Excellence in Teaching and Learning (PEEA). The PEEA initiative arose mainly from a resolution from the Parents' Association presented to UPRM's Chancellor in 1990.

CEP was created in 1996-97 by the Administrative Board, through Certification number 596, which mandates professional development activities for all faculty personnel hired since August 1997. Faculty must comply with 29 contact hours during the first year of service. The professor's participation is kept on record and it is taken into consideration for the various personnel actions at the institutional level. Additionally, certifications number 11-12-105 (2011) and 14-15-247 requires all graduate students receiving assistantships to complete 21 hours of professional development during their first year to maintain eligibility. Furthermore, in response to faculty and administrative professional development interests, CEP formed an alliance with the Research and Development Center (R&DC) to

create the Research Academy for Faculty & Postdoctoral Fellows in 2012. The Research Academy's primary goal is to foster, energize, and promote research at UPRM. The Academy offers mentorship, professional development, and social activities for researchers.

Consequently, CEP's mission is **to expose faculty members to diverse educational strategies in order to promote academic excellence and ensure high-caliber student performance**. New faculty, permanent faculty, librarians, counselors, graduate students, and academic management personnel are all considered part of the Center's mission. The Center covers all aspects of professional development including teaching, learning, assessment, evaluation, technology, and research strategies. Its goal is to create a community of well-prepared and motivated individuals who will contribute to the academic excellence of our institution.

Services include annual orientations for new faculty and all graduate students, trainings for graduate lab assistants, retreats to recruit and develop interdisciplinary teams of resource professors, and seminars for faculty and graduate students during the academic year. Activities are tailored to fit the audience's needs, involve theory along with hands-on activities. Services also include workshops for academic management, educational research activities, and individual assistance for departments and faculty. In accordance with Certification 96-76-596, CEP keeps track of faculty and graduate student participation in professional development activities. Stakeholders can access this information via CEP web site and generate reports and certificates as needed.

To fulfill its mission, the CEP coordinates with various stakeholders in order to provide offer a wide range of activities. Partners include the Graduate Studies Office, Center for the Development of Information Literacy and Bibliographic Research (CEDIBI), Graduate Research and Innovation Center (GRIC), Research and Development Center (R&DC), Information Technology Center (CTI), and the Center for Distance Education Resources (CREAD).

For more information call (787) 832-4040, extensions 3829 or 3674, (787) 265-3829, Fax (787) 831-5249. E-mail: [cep@uprm.edu](mailto:cep@uprm.edu). URL: <http://cep.uprm.edu>.



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## **DEPARTMENT OF AEROSPACE STUDIES**

### **AIR FORCE RESERVE OFFICER TRAINING CORPS (ROTC)**

Air Force ROTC is designed to recruit, educate and commission officer candidates through college campus programs based on Air Force requirements.

#### **Mission**

Our mission is to develop quality leaders for the Air Force, Puerto Rico, and America.

#### **Vision**

The AFROTC vision is to be a highly successful organization, respected throughout the Air Force, the educational community and the nation.

#### **Program Overview**

The Air Force ROTC program offered at the University of Puerto Rico-Mayaguez is a 3 or 4 year undergraduate-level program by which young men and women are educated, motivated, and trained for Air Force commissioned service.

The program consists of the General Military Course (GMC) and the Professional Officer Course (POC).

#### **General Military Course (GMC)**

The GMC is a 1 or 2-year course, consisting of the following four courses: Aerospace Studies (ESAE) 3001, 3002, 3011, and 3012. These courses are designed to motivate and prepare cadets for entry into the POC. Each course meets once weekly and is two-academic hours course.

#### **Professional Officer Course (POC).**

The POC is a 2-years course, consisting of ESAE 4001, 4002, 4011, and 4012. These courses are designed to prepare cadets for active duty as Air Force officers. Each course meets twice a week and is a four academic-hours course.

#### **Leadership Laboratory (LLAB)**

LLAB is a dynamic and integrated grouping of leadership developmental activities designed to meet the needs and expectations of prospective Air Force second lieutenants and complement the Air Force ROTC academic program. It is a student

planned, organized, and executed practicum conducted under the supervision of the Professor of Aerospace Studies and Assistant Professor of Aerospace Studies.

#### **Field Training**

Students who are selected for the POC will attend a 13 days Field Training program that takes place in Maxwell AFB, AL. The primary objective of Field Training is to evaluate leadership potential to enter the POC through a transformational training environment.

#### **Membership Eligibility**

Each individual must:

1. Be a full-time undergraduate student enrolled at any of the following universities:

University of Puerto Rico:

Aguadilla  
Arecibo  
Mayaguez  
Ponce

Inter-American Universities:

Aguadilla  
Arecibo  
Ponce  
San German

Pontifical Catholic University of Puerto Rico

2. Participate in both AS classes and LLAB while enrolled in school to be considered a GMC or POC member.
3. Be age 14 or older.
4. Have an AFROTC calculated GPA of 2.5 or greater for all previous college-level coursework.
5. Pass the American Language Course Placement Test with at least an 80%.

#### **Program Goals**

Each student must demonstrate:

1. An understanding of the fundamental concepts and principles of military, naval, and aerospace sciences.
2. A basic understanding of associated professional knowledge.
3. A strong sense of personal integrity, honor, and individual responsibility.

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4. An appreciation of the requirements for national security.

### **Air Force ROTC Scholarships**

Air Force ROTC offers three different type of scholarships (up to \$18,000) for outstanding students. Scholarships include tuition, most fees and books. Upon activation, all scholarship cadets receive a monthly living expenses stipend during the academic year. Currently, the monthly stipend is \$350 for first year cadets, \$400 for second year cadets, \$450 for third year cadets and \$500 for fourth year cadets.

### **FACULTY**

**LIEUTENANT COLONEL ERIC E. HAMILTON**, *Professor Aerospace Studies*. M.S. Mechanical Engineering, North Carolina University. B.S. Mechanical Engineering, North Carolina University

**MAJ ROXANNA FIGUEROA**, *Assistant Professor of Aerospace Studies*, M.A. Industrial - Organizational Psychology, Carlos Albizu University, San Juan, PR. 2018. M.A. Human Relations, University of Oklahoma, Norman, OK. 2013, B.A. Psychology, University of Puerto Rico - Mayagüez, PR. 2005.

**CAPT JUAN CINTRON**, *Assistant Professor of Aerospace Studies*, P.S. Mechanical Engineering, University of Puerto Rico - Mayagüez, PR. 2014.

### **COURSES OF INSTRUCTION**

**ESAE 3001-3002. THE AIR FORCE TODAY.** Two credit hours per semester. One hour of lecture and one and a half hours of Leadership Laboratory (Corps Training) per week each semester.

This course is a survey course designed to introduce students to the United State Air Force and Air Force Reserve Officer Training Corps. Featured topics include: mission and organization of the Air Force, officers professionalism, military customs and courtesies, Air Force officer opportunities, group leadership problems, and an introduction to communication skills. Leadership Laboratory is mandatory for Air Force ROTC cadets, and it complements this course by providing cadets with fellowship experiences.

**ESAE 3011-3012. THE AIR FORCE WAY.** Two credit hours per semester. One hour of lecture and one and a half hours of Leadership Laboratory (Corps Training) per week each semester.

This course is a survey course designed to facilitate the transition from Air Force ROTC cadet to Air Force ROTC candidate. Featured topics include: Air Force heritage, Air Force leaders, Quality Air Force, an introduction to ethics and values, introduction to leadership, group leadership problems, and continuing application of communication skills. Leadership Laboratory is mandatory for Air Force ROTC cadets, and it complements this course by providing cadets with their first opportunity for applied of leadership experiences discussed in class.

**ESAE 4001-4002. AIR FORCE LEADERSHIP AND MANAGEMENT.** Four credit hours per semester. Three hours of lecture and one and a half hours of Leadership Laboratory (Corps Training) per week each semester.

This course is a study of leadership and quality management fundamentals, professional knowledge, Air Force doctrine, leadership ethics, and communication skills required of an Air Force junior officer. Case studies are used to examine Air Force leadership and management situation as a means of demonstrating an exercising practical application of the concepts being studied. A mandatory Leadership Laboratory complements this course by providing advanced leadership experiences in officer-type activities, giving students the opportunity to apply leadership and management principles of this course.

**ESAE 4011-4012. PREPARATION FOR ACTIVE DUTY.** Four credit hours per semester. Three hours of lecture and one-and-a-half hours of Leadership Laboratory (Corps Training) per week each semester.

This course examines the national security process, regional studies, advanced leadership ethics, and Air Force doctrine. Special topics of interest focus on the military profession, military justice, civilian control of the military, preparation for active duty, and current issues affecting military professionalism. Within this structure, continued emphasis is given to refining communication skills. An additional Leadership Laboratory complements this course by providing advanced leadership experiences, giving students the opportunity to apply the leadership and management principles of this course.

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## DEPARTMENT OF MILITARY SCIENCE

### US ARMY ROTC

#### Mission

Military Science at the University of Puerto Rico is presented under the provisions of the National Act of June 3, 1916, as amended, which established the Reserve Officers' Training Corps (ROTC) Program at colleges and universities throughout the United States.

The mission of the US Army ROTC Program is to obtain well-educated, commissioned officers in sufficient numbers to meet Army requirements. The objectives of the ROTC Program are to attract, motivate, and prepare selected students to serve as commissioned officers in the regular Army, Army National Guard, or the Army Reserve; to provide an understanding of the fundamentals, concepts, and principles of military science; to develop leadership, managerial skills, basic professional knowledge, and a strong sense of personal integrity, honor, and individual responsibility among students in the Program; and to develop an appreciation of the requirements for national security. The Army ROTC Program draws upon the many educational disciplines required for the modern Army. It ensures that men and women educated at a broad spectrum of institutions of higher learning are commissioned annually in the Army Officer Corps.

#### Vision

In the future, the Army ROTC Program will continue to be the major source of newly commissioned officers for the active Army and reserve components.

### GENERAL EDUCATION

The Army ROTC offers college students a four-year program composed of two separate year programs; the two-year basic course (CIMI 3011-3012, CIMI 3021-3022) and a two-year advanced course (CIMI 4011-4012, CIMI 4021-4022). Credits obtained in these courses will be included in the student's general grade point average. Deans may consider these courses as general electives for academic credit by granting up to a maximum of 12 credit-hours.

The basic course is conducted on a voluntary basis as an elective. Students may drop the course at any time as they would any other elective. Students must satisfactorily complete both years of studies, in order to be eligible for the advanced course. The advanced course is optional and selective. The ROTC furnishes all required uniforms and equipment for both basic and advanced courses. All students that contract with the ROTC with the intent of receiving a commission as an officer will receive from \$300-\$500 per month, depending on what year they are in.

Students may qualify to enter the advanced course without completing the basic course if they have attended Basic Training in the past as active duty soldiers or members of the National Guard or Reserves. Students may also qualify to enter the Advanced Course by attending a summer camp offered by the ROTC called the Basic Camp. Basic Camp is a paid summer camp that trains the students in basic military skills and incurs no obligation for service commitment. Students may attend the camp and decide not to pursue ROTC if they choose.

Students in the Advanced Course are required to attend a paid summer camp known as the Advanced Camp (AC) between their third and fourth years.

Students requesting admission to the advanced course, senior division, are screened and tested by the Professor of Military Science (PMS). These students must satisfy requirements established by the Department of the Army before they are formally enrolled.

#### A. Basic Course Requirements:

1. Enrollment in a baccalaureate or graduate degree program full time (12 credits or more).
2. 2.00 GPA or better to enter second year of basic course.
3. Enrollment in the ROTC English program or satisfy the English requirement by approving an examination.

Note: Cadets will not fail the basic courses for lack of English skills. ROTC will prepare cadets in this area.

#### B. Advanced Course Requirements:

1. 2.00 GPA or better.
2. Be medically qualified (Medical exam is free of charge).

3. Be a full-time student (12 credits or more).
4. Score 80 or more on Comprehension Level Test (ECLT)\*.
5. Having four semesters left including the ROTC classes according to the CC Form 104-R Academic Program Worksheet.

#### **Program Outcomes:**

The goals, objectives and assessment plans for the Military Science Department are outlined below. The ROTC Program objective and assessment strategies are consistent with the goals of the U. S. Army in preparing students to become commissioned officers. We are responsible for providing men and women valuable skills such as self-discipline, personal development, problem solving and knowledge to complete demanding missions entrusted to them.

A program for tomorrow's leaders. Army ROTC enrolls well-rounded students with the proven ability to set goals and achieve high standards of excellence in academics, fitness and leadership in their schools and communities.

#### **Critical Success Factors**

- Meet or exceed enrollment goals.
- Increase program retention rates.
- Pursue strategies to maintain a Corps demographic profile that promotes and reflects diversity.
- 100% graduation of Cadets from the Advanced Camp (AC)
- 100% graduation of Cadets from the Basic Camp (BC)

#### **ROTC Scholarship Program**

The Department of the Army grants scholarships to selected outstanding students enrolled in the ROTC Program. The scholarships, ranging from two to five years, include full tuition and laboratory fees, \$1,200 a year for textbooks, and a living allowance of up to \$5,000 per semester or \$10,000 for tuition each academic year that the scholarship is in effect. In addition, ROTC scholarship students receive approximately \$800 for attending Advanced Camp (AC).

#### **FACULTY**

**LIEUTENANT COLONEL ANGEL R. ORTIZ**, *Professor of Military Science*, M.B.A. in Logistics, 2016, Trident University International.

**MAJOR EMANUEL VELEZ**, *Assistant Professor of Military Science*, M.A. in Managerial Logistics, 2012, North Dakota State University.

**MAJOR CESAR SALICRUP**, *Assistant Professor of Military Science*, M.A. in Human Resources, 2012, Inter American University of Puerto Rico.

**CAPTAIN BRAULIO DE JESUS**, *Assistant Professor of Military Science*, M.A. in Business Administration, 2013, Phoenix University.

**MR. PEDRO J. ROSARIO**, *GS Recruiting and Operations Officer*, M.B.A., 2005 University of Phoenix.

**MR. FELIX CHICO**, *Chief English Language Program*, M.A., 1992, University of Puerto Rico, Río Piedras.

**MRS. MARIA DE LOURDES PEREZ**, *English Instructor*, M.A. ED, 2009, University of Puerto Rico, Mayaguez.

#### **COURSES OF INSTRUCTION**

**CIMI 3011. INTRODUCTION TO MILITARY SCIENCES.** Two credit hours. One hour of lecture and one two-hour drill period per week.

Introduction to the Basic Military Science concepts and principles. A brief history of the U.S. Army ROTC program. Emphasis on principles of leadership and land navigation.

**CIMI 3012. BASIC MILITARY SKILLS.** Two credit hours. One hour of lecture and one two-hour drill period per week.

Training in Basic Military skills such as First Aid, Physical Fitness, Military Drill, and Ceremony, and Land Navigation using a map and compass. Emphasis on the development of leadership and basic military knowledge.

**CIMI 3021. FUNDAMENTALS OF MILITARY TACTICS I.** Two credit hours. One hour of lecture and one two-hour drill period per week.

Study of basic military tactics at the squad level. Introduction to military geography and land navigation. Advanced techniques in the

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improvement of oral expression. Leadership laboratory.

**CIMI 3022. FUNDAMENTALS OF MILITARY TACTICS II.** Two credit hours. One hour of lecture and one two-hour drill period per week.

Continuation of basic military unit tactics. Principles of military strategies. Study of military formations, support and communication.

**CIMI 3041. BASIC ENGLISH FOR TODAY'S ARMY I.** One credit hour. Two hours of lecture, seminar or practical exercises per week.

Designed for those Military Science students who have demonstrated a limited proficiency in the English language as measured by the English Comprehension Level Test (ECLT), the official Department of Defense English Language proficiency test. Emphasis is on pronunciation, reading comprehension, vocabulary, and a general review of English grammar using a military functional approach. To be taken only as a free elective.

**CIMI 3042. BASIC ENGLISH FOR TODAY'S ARMY II.** One credit hour. Two hours of lecture, seminar or practical exercises per week.

Designed for those Military Science students who have demonstrated a limited proficiency in the English language as measured by the English Comprehension Level Test (ECLT), the official Department of Defense English Language proficiency test. Emphasis is on pronunciation, reading comprehension, vocabulary, and a general review of English grammar using a military functional approach. To be taken only as a free elective.

**CIMI 3043. INTERMEDIATE ENGLISH FOR TODAY'S ARMY I.** One credit hour. Two hours of lecture, seminar or practical exercises per week.

Designed for those Military Science students who have demonstrated an intermediate level of proficiency in the English language as measured by the English Comprehension Level Test (ECLT), the official Department of Defense English language proficiency test. Emphasis is on aural comprehension, speaking proficiency, pronunciation, vocabulary building, and a general review of English grammar using a military functional approach. To be taken only as a free elective.

**CIMI 3044. INTERMEDIATE ENGLISH FOR TODAY'S ARMY II.** One credit hour. Two hours of lecture, seminar or practical exercises per week.

Designed for those Military Science students who have demonstrated an intermediate level of proficiency in the English language as measured by the English Comprehension Level Test (ECLT), the official Department of Defense English language proficiency test. Emphasis is on aural comprehension, speaking proficiency, pronunciation, vocabulary building, and a general review of English grammar using a military functional approach. To be taken only as a free elective.

**CIMI 3051. MILITARY BRIEFING I.** Two credit hours. Two hours of lecture, seminar or practical exercises per week.

Designed for third year Military Science students who have demonstrated certain ability or dexterity in the English language as a result of the English Comprehension Level Test (ECLT), the official Department of Defense English language proficiency test. Practice in military briefings, with special emphasis on formal and informal outlines, and the correct use of military visual aids. Leadership evaluation, including an acculturation seminar. To be taken only as a free elective.

**CIMI 3052. MILITARY BRIEFING II.** Two credit hours. Two hours of lecture, seminar or practical exercises per week.

Designed for third year Military Science students who have demonstrated certain ability or dexterity in the English language as a result of the English Comprehension Level Test (ECLT), the official Department of Defense English language proficiency test. Practice in military briefings, with special emphasis on formal and informal outlines, and the correct use of military visual aids. Leadership evaluation, including an acculturation seminar. To be taken only as a free elective.

**CIMI 4011. COMMUNICATION AND PSYCHOLOGY OF MILITARY LEADERSHIP.** Four credit hours. One two-hour lecture and one two-hour drill period per week; approximately three one-day weekend training periods; additionally, a three-day field training exercise, plus the six week Advanced Camp at Fort Bragg, North Carolina.

Advanced course on communication techniques, both oral and written. Development of leadership by case studies and problems analysis that require psychological techniques. Army organization. Leadership laboratories.

**CIMI 4012. FUNDAMENTALS OF MILITARY STRATEGY.** Four credit hours. One two-hour lecture and one two-hour drill period per week; approximately three one-day weekend training

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periods; additionally, a five-day field training exercise, plus the six week Advanced Camp at Fort Bragg, North Carolina.

Study of the principles and fundamental premises in the development of military strategy. Command-staff functions and responsibilities in each level of command. Study of the principles for defense of a country. Leadership laboratories.

**CIMI 4021. MILITARY HISTORY, LEADERSHIP AND MILITARY ADMINISTRATION.** Four credit hours. One two-hour lecture and one two-hour drill period per week; approximately three one-day weekend training periods; and a three-day field training exercise.

Army writing style. Military administration. Compendium of military and world history from the war principles to the basic military movements, the Spanish American War, World War I, II, Korea and Vietnam. Leadership Laboratory.

**CIMI 4022. SEMINAR: LEADERSHIP AND MILITARY ADMINISTRATION.** Four credit hours. One two-hour lecture and one two-hour drill period per week; approximately three one-day weekend training periods; and a five-day field training exercise.

Analysis of leadership problems. Study of the administration of units and military personnel. Basic military justice, logistics management, command and staff responsibilities, duties and responsibilities of Army officers. Leadership laboratory.

**CIMI 4041. MILITARY WRITING I.** Two credit hours. Two hours of lecture, seminar, case studies, or practical exercises per week.

Designed for Military Science students who wish to improve their military writing skills in English. Emphasis on military writing styles and formats. Topics include military memorandums, autobiographies, military history analysis, and a military ethics paper. To be taken only as a free elective.

**CIMI 4042. MILITARY WRITING II.** Two credit hours. Two hours of lecture, seminar, case studies, or practical exercises per week.

Designed for Military Science students who wish to improve their military writing skills in English. Emphasis on military writing styles and formats. Topics include military memorandums, autobiographies, military history analysis, and a military ethics paper. To be taken only as a free elective.

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## **DIVISION OF CONTINUING EDUCATION AND PROFESSIONAL STUDIES**

### **History**

The Division of Continuing Education and Professional Studies was created during the 1958-59 academic year. It was established in order to integrate within a unit several UPRM programs which were not administered jointly: the summer program, the evening program and the Saturday course program. The inclusion of these three programs as a new academic unit has served as basis for innovative and extended services in non-traditional fields.

### **Goals and Objectives**

The goals of the Division of Continuing Education and Professional Studies are to attend the special educational needs at the university level or those related to university work that are not presently addressed by traditional offerings in order to foster a closer collaboration between the university's physical and human resources and the community's problems and needs.

#### **Objectives:**

1. To provide educational opportunities for the adult working population and for adults who have interrupted their schooling.
2. To provide educational opportunities to disadvantaged groups, minorities, and other sectors of the community not benefiting from traditional offerings.
3. To initiate educational programs and credit courses in response to educational needs that have not been fulfilled by traditional offerings.
4. To create continuing education offerings for professional groups.
5. To identify continuing education needs of the community at large and provide courses and educational experiences to meet these needs.
6. To provide the community with information and orientation services.
7. To develop awareness and sensitivity to the needs of the community and undertake initiatives to meet those needs.

The Division of Continuing Education and Professional Studies addresses its goals and objectives through various initiatives such as the creation of projects, educational offerings, and programs which are transitory in nature and short in duration.

At present, the work of the Division consists of the following programs:

1. Continuing Education Program
2. Special Training Programs
4. Community Services
5. Education Program
6. Online Education Resource Center

### **Continuing Education Program**

Continuing Education is recognized as a growing need for all adults. The Division offers educational options on weekdays, evenings, and Saturdays in order to enable working adults to further their education. It also fulfills different needs for children, adolescents, adults and elderly interested in developing their knowledge, talents, or abilities.

This non-traditional service offers continuing education hours/credits required to renew licenses and/or certifications pertaining to a variety of professions and provides educational alternatives in special areas such as business administration, microcomputer applications, technical skills, arts, language, handicrafts, and sports where professional and cultural growth might occur independently of traditional degree programs. Continuing Education embraces a wide field of strategies to fulfill the teaching-learning process at different stages in formal or informal settings. It is offered through non-credit courses, seminars, workshops, or special projects.

### **Special Training Programs**

The Division of Continuing Education and Professional Studies collaborates with community institutions, other departments and campuses of the University of Puerto Rico in the creation of these special training programs which blend the traditional offerings at the University, such as language, mathematics, and science courses, with special instruction emphasizing immediately marketable skills. Courses in these programs do not carry college credits and cannot be used to fulfill degree requirements. At the completion of a program, however, a certificate will be issued which might serve as credential for the job market.

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## **Community Services**

The Division of Continuing Education and Professional Studies in association with civic and professional groups offers educational services to the community.

Community activities include conferences, seminars, workshops, group meetings, continuing education courses, and short-term special training sessions.

## **Online Education Resource Center**

### **Mission**

Support and guide the faculty in the development of digital educational materials and multimedia technology based processes, ensuring compliance with the highest quality standards.

### **View**

Position the UPR-RUM at the forefront of the development of distance education modalities. In addition, study and develop educational methodological procedures supported by digital and multimedia resources.

## **TEACHER PREPARATION PROGRAM (TPP)**

### **Mission**

The mission of the Teacher Preparation Programs reflect the UPRM mission. The unit's mission is to serve society by preparing professional educators who are subject matter specialists with dispositions of social, cultural, humanistic sensibilities and ethical values, who also possess competence, skills and general knowledge, all of which will allow them to be highly effective teachers. The unit prepares subject matter specialists as professional educators, committed to vanguard educational paradigms, with an inquisitive attitude, capable of creative and critical thinking, and with mastery of pedagogical and conceptual knowledge in their discipline.

### **Vision**

In the context of the vision and mission of the institution, the Teacher Preparation Programs aspire to develop subject matter specialists who are active teachers and lifelong learners who are highly capable, effective, dedicated educators in their fields.

### **Goal of the Education Unit**

The DECEP Teacher Preparation Program principal goal, as stated in Certifications No. 27 2003-04 and No. 47 2004-05 of the Board of Trustees of the University of Puerto Rico, is to offer the curricular sequence for teacher certification in secondary education in accordance with the norms and regulations of the Department of Education of Puerto Rico. Consistent with the University's vision and mission, the program offers a sequence designed to update and strengthen knowledge and skills of professional educators, Certification No. 190 2000-01 of the Board of Trustees of the University of Puerto Rico. To expand our academics offerings and not limit them to the secondary level, the teacher preparation program decides to change its official name to "Curricular Sequence for Teacher Certification", change approved March 2, 2016 by the Academic Senate of the University of Puerto Rico at Mayaguez, Certification Num. 16-14

The goal of the Teacher Preparation Program of the Mayagüez Campus of the University of Puerto Rico is to prepare professional educators committed to new educational paradigms, leaders



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in education with an inquisitive attitude, creative and critical thinkers, with a mastery of pedagogical and conceptual content in their discipline. The program seeks to foster that the candidate develop cognitive, affective, psychomotor, research, technological and communication skills. The intention is that the candidate becomes a lifelong learner in order to be a competent, effective teacher.

### ***Teacher-Preparation Program***

This intensive training program is designed for students pursuing a bachelor's degree in the College of Arts and Sciences, College of Business Administration, and College of Engineering. In addition to education courses, the program includes observations and practice in the classroom under the direct supervision of experienced teachers, and university faculty.

The Education Program offers the sequence of courses required by the Department of Education of Puerto Rico to obtain Certification as Secondary and Elementary Level Teacher. In order to receive a teaching license, students must present evidence to the Department of Education at the conclusion of the Education Program. In addition, students must approve the required State Teaching Certification Test (PCMAS), offered by the College Board.

### **Teacher Preparation Program**

#### **Transition Point #1:**

Prospective candidates may enroll in the Teacher Preparation Program after completing a bachelor's program or while pursuing a bachelor's degree at UPR-Mayagüez.

To be admitted to the program applicants must have an overall grade point average of 3.0, a grade point average of 3.0 in the major, according to regulations of the Department of Education of Puerto Rico. They have to fill an admission document to the sequence at the Register Office and then make an interview at TPP with regards to their disposition towards teaching. The candidate could have credits on fundamental education before formal admission to the TPP. All the credits of Foundations courses must have a grading pass of B or more. Admitted students must completed a disposition interview.

#### **Transition Point #2: Enrollment in Theory and Methodology Course**

To enroll in the Theory and Methodology Course candidates must have completed five foundations of education courses EDFU 3011 (Human Growth and Development I), EDFU 3012 (Human Growth and Development II), EDFU 3017 (Evaluation of Students Learning), EDFU 3007 (Social Foundations of Education), and EDFU 4019 (Philosophical Foundations of Education) and also EDPE 3129 (Use of microcomputer in the classroom) with a grade point average of 3.0 or better. They also must have completed at least 18 credits in their major with grade point averages of 3.0 or better overall and in their major.

In some education courses including Methodology and Student's Teacher Courses the candidate have to satisfactorily develop an electronic portfolio with Teacher Candidate Work Sample (TCWS) that demonstrates the candidate's content knowledge, applied knowledge of human development and learning, sensibility to diversity, pedagogical content knowledge skills and reflective habits on the effectiveness of their practice. In the TCWS the candidate has to include artifacts such as lesson or unit plans, samples of assessment techniques including pre and post test, and classroom management techniques. They also have to prepare a reflection diary about the observation they do in schools.

#### **Transition Point #3: Entrance to Practicum**

To enroll in the Teaching Practice Course candidates must have completed the Theory and Methodology course with a grade of B or better. They have to score 80% or higher on the Educational Philosophy Essay Rubric and on the evaluation of the Electronic Portfolio with the Teacher Candidate Work Sample. They should also have at least 21 credits in their major with grade point averages of 3.0 or better overall and in their major.

#### **Transition Point #4: Program Completion**

Candidates fulfill the requirements for the Teacher Preparation Program when they complete 21 credits in core courses in the teaching specialty and the 36 credits.. The 36 credits include: 15 credits in foundation of education courses; 3 credits in The Use of Microcomputers in the Classroom; 3 credits in Nature and Needs of Exceptional Learners; 3 credits in the history of Puerto Rico; 3 credits in the history of the United States; 3 credits in theory and methodology; and 6 credits in student teaching. Candidates are

advised to take the PCMAS after completing their methodology course.

In the Student Teaching Course the candidate have to satisfactorily develop an electronic portfolio with Teacher Candidate Work Sample (TCWS) that demonstrates the candidate's content knowledge, applied knowledge of human development and learning, sensibility to diversity, pedagogical content knowledge skills and reflective habits on the effectiveness of their practice. In the TCWS the candidate has to include artifacts such as lesson or unit plans, exams with their analysis, and classroom management techniques. A systemic assessment process database that addresses the candidate's proficiencies is being designed by the unit.

### TEACHER'S CERTIFICATION

The following courses are available to UPRM students and in-service teachers.

#### *Courses in Education*

| Number    | Credits | Title                                  |
|-----------|---------|--|
| EDFU 3011 | 3       | Foundation of Human Development        |
| EDFU 3012 | 3       | Foundation of Educational Psychology   |
| EDFU 3007 | 3       | Social Foundations of Education        |
| EDFU 3017 | 3       | Evaluation of Learning                 |
| EDFU 4019 | 3       | Philosophical Foundations of Education |

#### *General Courses*

|                              |   |  |
|------------------------------|---|--|
| EDES 4006                    | 3 | Nature and Needs of Exceptional Learners   |
| EDPE 3129                    | 3 | The Use of Microcomputers in the Classroom |
| HIST 3241<br>or<br>HIST 3242 | 3 | History of Puerto Rico                     |
| HIST 3111<br>or<br>HIST 3112 | 3 | History of the United States of America    |

#### *Courses in Methodology*

Students select among these courses according to their professional major.

| Number    | Credits | Title  |
|-----------|---------|--|
| EDPE 4047 | 3       | Theory and Methodology in the Teaching of Computer Typing Skills   |
| EDPE 4059 | 3       | Theory and Methodology in the Teaching of Business Subjects and Computer Typing Skills in Secondary School |
| EDPE 4135 | 3       | Theory and Methodology in the Teaching of Science in Secondary School                                      |
| EDPE 4145 | 3       | Theory Methodology Teaching Mathematics Secondary School   |
| EDPE 4155 | 3       | Theory and Methodology in the Teaching of History and Social Studies in Secondary School                   |
| EDPE 4165 | 3       | Theory and Methodology in the Teaching of Art (K-12)   |
| EDPE 4185 | 3       | Theory and Methodology in the Teaching of Theatre (K-12)   |
| EDPE 4215 | 3       | Theory and Methodology in the Teaching of Physical Education in Secondary School                           |
| EDPE 4218 | 3       | Theory and Methodology in Teaching Elementary Physical Education   |
| EDPE 4235 | 3       | Theory and Methodology in the Teaching of Spanish in Secondary School                                      |
| EDPE 4245 | 3       | Theory and Methodology in the Teaching of English in Secondary School                                      |

#### *Courses in Practice Teaching (Laboratory Experiences)*

| Number    | Credits | Title  |
|-----------|---------|--|
| EDPE 4137 | 6       | Student Teaching of Biology in Secondary School        |
| EDPE 4138 | 6       | Student Teaching of Physics in Secondary School        |
| EDPE 4139 | 6       | Student Teaching of Chemistry in Secondary School      |
| EDPE 4146 | 6       | Student Teaching of Mathematics in Secondary School    |
| EDPE 4156 | 6       | Student Teaching of Social Studies in Secondary School |
| EDPE 4157 | 6       | Student Teaching of History in Secondary School        |
| EDPE 4166 | 6       | Practicum in Teaching of Art in K-12 School            |
| EDPE 4186 | 6       | Practicum Teaching of Theatre in K-12 School           |

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|           |   |  |
|-----------|---|--|
| EDPE 4187 | 6 | Student Teaching of Business Education in Secondary School |
| EDPE 4216 | 6 | Practicum in Teaching Physical Education                   |
| EDPE 4236 | 6 | Student Teaching of Spanish in Secondary School            |
| EDPE 4246 | 6 | Student Teaching of English in Secondary School            |

Students must complete three credits in History of Puerto Rico or History of the United States.

Total credits for certification: 36

#### *Other Courses*

|           |   |  |
|-----------|---|--|
| EDIN 4005 | 3 | Test and Measurements for Industrial Vocational Education        |
| EDIN 4029 | 3 | Shop Organization and Management                                 |
| EDPE 4218 | 3 | Theory and Methodology in Teaching Elementary Physical Education |
| EDFU 4006 | 3 | The Child and His Social Milieu                                  |
| EDFU 3055 | 3 | Legal Foundations of Education                                   |

#### **Technology Courses**

|           |   |   |
|-----------|---|---|
| TEED 5007 | 3 | Creating Online Courses   |
| TEED 5008 | 3 | Design and Creation of Educational Materials for Online Courses |
| TEED 5015 | 3 | Advanced Strategies for Online Courses                          |
| TEED 5016 | 3 | Learning Management System Online Courses Practicum             |

#### **Special Education Re- Certification Courses**

|           |   |   |
|-----------|---|---|
| EDES 3205 | 3 | Assistive Technology in Special Education.  |
| EDES 4048 | 3 | Behavior Modification Applied to a Classroom Setting.   |
| EDES 4077 | 3 | Communication Techniques for the Hearing Impaired.  |
| EDES 4096 | 3 | Methods in Teaching Reading and Writing in Special Education K-12                                 |
| EDES 4125 | 3 | Autism: Psychological & Neuro-Biochemical Aspects.  |
| EDES 4055 | 3 | Educational Strategies for the inclusion of students with special needs in the regular classroom. |

#### **FACULTY**

**CARMEN BELLIDO-RODRÍGUEZ**, *Professor*, Ph.D., 1997, University of Puerto Rico.

**JOSE R. FERRER LOPEZ**, *Associate Professor*, Ed.D., 2010, *Universidad del Turabo*.

**JANETTE FERRER MONTES**, *Associate Professor*, Ph.D., 2013, University of Wisconsin, Madison Campus.

**EFRAÍN GRACIA-PÉREZ**, *Professor*, M.A., 1972, Interamerican University of Puerto Rico; Juris Doctor, 1981, Catholic University of Puerto Rico.

**REBECA ORAMA-MELÉNDEZ**, *Professor*, Ed.D., 2005, University of Puerto Rico, Río Piedras.

**GRISEL RIVERA-VILLAFañE**, *Professor*, Ed.D., 2006, Interamerican University of Puerto Rico.

**ANTONIO SANTOS-CABRERA**, *Professor*, M.A.Ed., 1976, Interamerican University of Puerto Rico.

#### **COURSES OF INSTRUCTION**

##### **Special Education**

**EDES 3205. ASSISTIVE TECHNOLOGY IN SPECIAL EDUCATION.** Three credit hours. Three hours of lecture per week.

Analysis of the fundamental practices of assistive technology for the education of people with disabilities. Analysis of the integration of assistive technology in education and within the family environment, as well as in terms of service models and the process of evaluation and identification of students' needs. Field experience is required.

**EDES 4006. NATURE AND NEEDS OF EXCEPTIONAL LEARNERS.** Three credits. Three hours of lecture per week.

This course offers a overview of the psychological and educational needs of exceptional learners. It provides the experiences and knowledge necessary for the design and implementation of curricular programs, special teaching techniques, and strategies appropriate for exceptional learners. Laboratory and field experiences will be an integrate part of the course.

**EDES 4048. BEHAVIOR MODIFICATION APPLIED TO A CLASSROOM SETTING.** Three credit hours. Three hours of lecture per week. Prerequisite: EDES 4006.

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Analysis and management of the principles and techniques for altering, changing and modifying abnormal, inappropriate, and deviant behavior associated with the teaching-learning process.

**EDES 4055.** EDUCATIONAL STRATEGIES FOR THE INCLUSION OF STUDENTS WITH SPECIAL NEEDS IN THE REGULAR CLASSROOM. Three credit hours. Three hours of lecture per week. Prerequisite: EDES 4006.

Study in the practical aspect of the teaching-learning process for students with disabilities in the regular classroom. Description of the planning process while considering the individual differences of students. Preparation of materials adapted to a wide array of human capabilities, development of educational strategies directed towards properly managing the context of diversity, and perspectives of universal design for learning and differentiated instruction.

**EDES 4077.** COMMUNICATION TECHNIQUES FOR THE HEARING IMPAIRED. Three credit hours. Three hours of lecture per week.

Application of basic sign language including spelling and common signs, specifically for the puerto rican population. Evaluation of the historical aspects and rules to maintain effective communication with a deaf person.

**EDES 4096.** METHODS IN TEACHING READING AND WRITING IN SPECIAL EDUCATION K-12. Three credit hours. Three hours of lecture per week. Prerequisite: EDES 4006.

Application of practical and fundamental theories of how exceptional children and youngsters learn to read and write. The course uses the Spanish State Curriculum at the elementary, middle, and secondary levels. Design and application of appropriate methods and strategies used for special populations considering the goals and objectives included in the individualized education program (IEP), unit plans, materials, assistive technology, and assessment.

**EDES 4097.** LANGUAGE ART METHODS IN SPECIAL EDUCATION K-12. Three credit hours. Three hours of lecture per week. Prerequisite: EDES 4006.

Application of the language arts (listening, speaking, reading and writing) to special education. Examination of the methods and remedial strategies appropriate for exceptional student's that facilitate the opportunity to expand the student's ability to identify, solve and make assertive decisions.

**EDES 4125.** AUTISM: PSYCHOLOGICAL & NEURO-BIOCHEMICAL ASPECTS. Three credit hours. Three hours of lecture per week. Prerequisite: EDES 4006.

Analysis of autism from birth to adulthood. Explanation of the historical background of its studies and theoretical foundations included in state and federal laws and the public policy to protect the rights of this population. Evaluation of the characteristics and current definitions that correspond to established protocols in the area of mental health. Analysis of the possible causal factors of the condition, such as psychological, neurological, biochemical and exogenous, and the identification of the role of various health professionals in the diagnosis, epidemiology and treatment of autism. Analysis of the accommodations, technology support, and educational practices appropriate for this population.

### **Education Foundations**

**EDFU 3007.** SOCIAL FOUNDATIONS OF EDUCATION. Three credits. Three hours of lecture per week.

Analysis of the basic social science principles in terms of the educational process. Study and discussion of the social problems that have conditioned the development of education in Puerto Rico.

**EDFU 3011.** FOUNDATIONS OF HUMAN DEVELOPMENT. Three credit hours. Three hours of lecture per week.

Analysis of the fundamentals of cognitive, social, emotional, and physical development in the human life cycle, addressing particularly the period of adolescence. Classifies and analyzes the different paradigms associated with these areas of development from the holistic perspective and examines the implications of these in Puerto Rico.

**EDFU 3012.** FOUNDATIONS OF EDUCATIONAL PSYCHOLOGY. Three credit hours. Three hours of lectures per week. Prerequisites: EDFU 3001 or EDFU 3011.

An analysis of the psychological theories, research and innovations which explain the learning and thinking processes in the school context. The course examines the basic concepts of the behaviorist, cognitive, socio-cultural, and humanist theories related to school teaching, motivation, diversity and school life. An analysis of the application to educational practice in contemporary Puerto Rican

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society is a part of the course. Field experience is required in a school setting.

**EDFU 3017. EVALUATION OF LEARNING.** Three credit hours. Three hours of lecture per week. Prerequisites: ((EDFU 3001 or EDFU 3011) and (EDFU 3002 or EDFU 3012)) or authorization of the Director of the Department.

To create consciousness on the part of the student-teacher towards the philosophy of evaluation as a part of the educational process and to promote a knowledge of the quantitative and qualitative techniques of evaluation and their uses. The evaluation techniques will be analyzed and practice will be offered in the development of valid and reliable evaluation instruments to identify, stimulate, predict and guide the student's behavioral characteristics. This course also includes the organization, presentation and statistical analysis of the results as presented by the evaluation instruments and the interpretation of this data to make intelligent decisions in relation to teaching strategies.

**EDFU 3055. LEGAL FOUNDATIONS OF EDUCATION.** Three credit hours. One and a half hour of lecture and one and a half hour of discussion per week.

Legal aspects related with the over-all process of Education the teachers, the students and the community are examined and analyzed. Two analytical models or schemes will be used: the hierarchy of norms and the jurisprudence.

**EDFU 4006. THE CHILD AND HIS SOCIAL MILIEU.** Three credits. Three hours of lecture per week.

Study of the child from the social and cultural viewpoints; analysis of the social forces and their effects on human behavior; the socializing function of the more important agencies; and their contribution to the realization of educational objectives.

**EDFU 4019. PHILOSOPHICAL FOUNDATIONS OF EDUCATION.** Three credits. Three hours of lecture per week.

Study of philosophic theory and its relation to pedagogical practice. Presentation of major problems that have been caused by conflicting educational philosophies in terms of their historical development and their present day impact. The course emphasizes and clarifies the role of the teacher in regard to educational goals, curriculum programs, and evaluation. Basic philosophical problems such as the meaning of truth and

knowledge; the relation between knowledge and action; the nature of beauty, truth, happiness; and their educational implications are analyzed. The course also endeavors to promote an understanding of the way in which the development of the scientific method, the progress of democracy, changes in social and economic institutions, and the advance of human knowledge demand changes in philosophical attitudes as well as in all educational practice.

**EDIN 4005. TEST AND MEASUREMENTS FOR INDUSTRIAL VOCATIONAL EDUCATION.**

Three credit hours. Three hours of lecture per week.

A course designed to develop knowledge of the relationship between scientific evaluation and effective teaching in industrial vocational education. The essential principles of psychometry as applied to shop courses; the construction, administration, interpretation, and application of achievement, performance, and aptitude tests; the organization and presentation of evaluative data; and the conversion of raw scores to letter or standard grades as used in school system of Puerto Rico.

**EDIN 4029. SHOP ORGANIZATION AND MANAGEMENT.** Three credit hours. Three hours of lecture per week.

A course designed to offer an opportunity for the discussion of problems related to shop organization and management. Includes practices and procedures in the field of industrial education; types of shop organization, layouts and housing, light, ventilation, equipment, supplies, inventories and requisitions; community needs; records and reports, safety procedures; organization of activities, student control, and other shop administrative problems in Vocational Industrial Education.

**EDPE 3129. THE USE OF MICROCOMPUTERS IN THE CLASSROOM.** Three credits. Three hours of lecture per week.

Introductory courses on the role of microcomputers in the classroom. Special emphasis will be given to the use of Microcomputers in the school setting, resources that are available to the classroom teacher and how to integrate computers to teaching. Workshop experiences and special assignments will complement class discussions.

### **Educational Programs and Teaching**

All the THEORY AND METHODOLOGY TEACHING courses are based on a theoretical and practical approach. All aspects related to the teaching of that curricular area are studied: planning,

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innovative education and curriculum analysis; basic content in the area of specialization; preparation, adaptation and utilization of resources; methodology, teaching techniques and strategies; fundamentals of evaluation and measurement; educational administrative skills. These contents are integrated to the class on a practical basis. All students must complete at least 15 hours per semester of observation experiences and laboratory work, inside and outside of the classroom, in public or private schools. These experiences will enable students to develop critical, dynamic and creative attitudes towards the Puerto Rican educational problems.

Prerequisite: a Baccalaureate degree or 18 credits or more with 3.0 point average in the discipline of study, *in one of the following majors*: Biology, Chemistry, English, History, Social Studies, Mathematics, Office Administration, Marketing, Accounting, Physics, Physical Education, Arts, Spanish and Theater.

The student should have also approved 15 credits or more with 3.0 average in foundation of education courses: EDFU 3011, EDFU 3012, EDFU 3007, EDFU 3017, EDFU 4019. Authorization of the Director of the Department.

**EDPE 4047. THEORY AND METHODOLOGY IN THE TEACHING OF COMPUTER TYPING SKILLS.** Three credit hours. Three hours of lecture per week. Prerequisites: EDFU 3002 or EDFU 3012 or authorization of the Director of the Department.

This course will equip the student with the required competencies for directing the acquisition of occupational typing skill.

**EDPE 4059. THEORY AND METHODOLOGY IN THE TEACHING OF BUSINESS SUBJECTS AND COMPUTER TYPING SKILLS IN SECONDARY SCHOOL.** Three credit hours. Three hours of lecture and fifteen hours of laboratory experiences. Prerequisites: ((EDFU 3001 or EDFU 3011) and (EDFU 3002 or EDFU 3012)) and EDFU 3007 and EDFU 4019 and authorization of the Director of the Department. Corequisites: EDFU 3017 and EDPE 3129.

The course will prepare the students in the Methodology of Teaching Business Subjects and computer typing skills. It will reinforce the cognitive, affective and motor skills. Studies of theories, general procedures in teaching development, selecting and preparing teaching materials for business subjects and computer typing classes will be discussed. Various forms of evaluating student's progress will be integrated into

the necessary elements in the development of necessary skills in this process.

**EDPE 4135. THEORY AND METHODOLOGY IN THE TEACHING OF SCIENCE IN SECONDARY SCHOOL.** Three credit hours. Three hours of lecture per week.

Theoretical and practical approach to the teaching-learning process. All aspects related to the teaching of Science in Secondary School are Studied: Planning, Innovative Education and Curriculum Analysis; Basic Content in this area of Specialization, Preparation, Adaptation and Utilization of Resources; Methodology, Teaching Techniques and Strategies; Fundamentals of Measurement and Evaluation. These contents are integrated on a Practical Basis. All students must complete at least 15 hours of laboratory experiences in public or private schools. These experiences will enable students to develop critical, dynamic and creative attitudes toward Puerto Rican Educational problems.

**EDPE 4136. STUDENT TEACHING OF GENERAL SCIENCE IN SECONDARY SCHOOL.** Six credit hours. Six hours of lecture per week. Prerequisite: EDPE 4135.

The course requires that teacher candidates lead the process of learning and teaching in a public or private, that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A university professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends four hours daily to the school or the seminar at the university as schedule in the semester calendar.

**EDPE 4145. THEORY METHODOLOGY TEACHING MATHEMATICS SECONDARY SCHOOL.** Three credit hours. Three hours of lecture per week.

Theoretical and practical approach to the teaching-learning process. All aspects related to the teaching of Mathematics in Secondary School are Studied: Planning, Innovative Education and Curriculum Analysis; Basic Content in this area of Specialization, Preparation, Adaptation and Utilization of Resources; Methodology, Teaching Techniques and Strategies; Fundamentals of

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Measurement and Evaluation. These contents are integrated on a Practical Basis. All students must complete at least 15 hours of laboratory experiences in public or private schools. These experiences will enable students to develop critical, dynamic and creative attitudes toward Puerto Rican Educational problems.

**EDPE 4155. THEORY AND METHODOLOGY IN THE TEACHING OF HISTORY AND SOCIAL STUDIES IN SECONDARY SCHOOL.** Three credit hours. Three hours of lecture per week.

Theoretical and practical approach to the teaching-learning process. All aspects related to the teaching of History and Social Studies in secondary school are studied: planning, innovative education and curriculum analysis; basic content in this area of specialization; preparation, adaptation and utilization of resources; methodology, teaching techniques and strategies; fundamentals of measurement and evaluation. These contents are integrated on a practical basis. All students must complete at least 15 hours of laboratory experiences in public or private schools. These experiences will enable students to develop critical, dynamic and creative attitudes toward Puerto Rico educational problems.

**EDPE 4165. THEORY AND METHODOLOGY IN THE TEACHING OF ART (K-12).** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Theoretical and practical approach to the teaching-learning process. All aspects related to the teaching of Arts in K-12 School are Studied: Planning, Innovative Education and Curriculum Analysis; Basic Content in this area of Specialization, Preparation, Adaptation and Utilization of Resources; Methodology, Teaching Techniques and Strategies; Fundamentals of Measurement and Evaluation. These contents are integrated on a Practical Basis. All students must complete at least 15 hours of laboratory experiences in public or private schools. These experiences will enable students to develop critical, dynamic and creative attitudes toward Puerto Rico Educational problems.

**EDPE 4185. THEORY AND METHODOLOGY IN THE TEACHING OF THEATRE (K-12)** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Theoretical and practical approach to the teaching-learning process. All aspects related to the teaching of Theatre in K-12 School are Studied: Planning, Innovative Education and Curriculum Analysis;

Basic Content in this Area of Specialization, Preparation, Adaptation and Utilization of Resources; Methodology, Teaching Techniques and Strategies; Fundamentals of Measurement and Evaluation. These contents are integrated on a Practical Basis. All students must complete at least 15 hours of laboratory experiences in public or private schools. These experiences will enable students to develop critical, dynamic and creative attitudes toward Puerto Rican Educational problems.

**EDPE 4215. THEORY AND METHODOLOGY IN THE TEACHING OF PHYSICAL EDUCATION IN SECONDARY SCHOOL.** Three credit hours. Three hours of lecture and fifteen hours of laboratory experiences per week. Prerequisite: authorization of the Director of the Department and EDFI 4205. Corequisite: EDPE 3129.

Theoretical and practical approach to the appropriate methodology to the teaching-learning process of physical education in secondary school. Includes basic content and curriculum analysis, utilization of resources; planning, as well as teaching, measurement and evaluation techniques and strategies (all contents are integrated on a practical basis). All students must complete at least 15 hours of supervised laboratory experiences in secondary schools. This will enable students to develop critical, dynamic, and creative attitudes toward Puerto Rican educational problems.

**EDPE 4218. THEORY AND METHODOLOGY IN TEACHING ELEMENTARY PHYSICAL EDUCATION.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: EDFI 4179, EDFI 4205. Corequisite: EDFI 3106.

Study of the theoretical and practical approaches to the teaching-learning process in elementary school physical education. Development of the knowledge, materials, and skills required for planning, preparing, and providing instruction. Study of learning theories, teaching methods and techniques, curricular analysis, and evaluation and assessment methods in the classroom and outdoor settings. Thirty (30) hours of laboratory experience in public or private schools are required.

**EDPE 4235. METHODOLOGY TEACHING SPANISH SECOND LANGUAGE.** Three credit hours. Three hours of lecture per week.

Theoretical and practical approach to the teaching-learning process. All aspects related to the teaching of Spanish in Secondary School are Studied: Planning, Innovative Education and Curriculum Analysis; Basic Content in this Area of

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Specialization, Preparation, Adaptation and Utilization of Resources; Methodology, Teaching Techniques and Strategies; Fundamentals of Measurement and Evaluation. These contents are integrated on a Practical Basis. All students must complete at least 15 hours of laboratory experiences in public or private schools. These experiences will enable students to develop critical, dynamic and creative attitudes toward Puerto Rican Educational problems.

**EDPE 4245. THEORY AND METHODOLOGY IN THE TEACHING OF ENGLISH IN SECONDARY SCHOOL.** Three credit hours. Three hours of lecture and a minimum fifteen hours minimum laboratory experiences. Prerequisite: authorization of the Director of the Department. Corequisite: INGL 5010.

Theoretical and practical approach to the teaching-learning process. All aspects related to the teaching of English in secondary school are studied: planning, innovative education and curriculum analysis; basic content in this area of specialization; preparation, adaptation and utilization of resources; methodology, teaching techniques and strategies; fundamentals of measurement and evaluation. These contents are integrated on a practical basis. All students must complete at least 15 hours of laboratory experiences in public and private schools. These experiences will enable students to develop critical, dynamic and creative attitudes toward Puerto Rican educational problems.

**EDPE 4137. PRACTICUM IN TEACHING BIOLOGY IN SECONDARY SCHOOL.** Six credit hours. One hour of lecture per week and twenty hours of supervised practice per week.

The course requires that teacher candidates lead the process of learning and teaching in a public or private; that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A University professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends four hours daily to the school or the seminar at the University as scheduled in the semester calendar.

**EDPE 4138. PRACTICUM IN TEACHING OF GENERAL PHYSICS IN SECONDARY SCHOOL.** Six credit hours. One hour of lecture per week and twenty hours of supervised practice per week. Prerequisites: EDPE 4135 and authorization of the Director of the Department.

The course requires that teacher candidates lead the process of learning and teaching in a public or private; that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A University professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends four hours daily to the school or the seminar at the University as scheduled in the semester calendar.

**EDPE 4139. PRACTICUM TEACHING OF GENERAL CHEMISTRY SECONDARY SCHOOL.** Six credit hours. One hour of lecture per week and twenty hours of supervised practice per week. Prerequisites: EDPE 4135 and authorization of the Director of the Department.

The course requires that teacher candidates lead the process of learning and teaching in a public or private; that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A University professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends four hours daily to the school or the seminar at the University as scheduled in the semester calendar.

**EDPE 4146. STUDENT TEACHING OF MATHEMATICS IN SECONDARY SCHOOL.** Six credit hours. One hour of lecture per week and twenty hours of supervised practice per week. Prerequisites: EDPE 4145 and authorization of the Director of the Department.

The course requires that teacher candidates lead the process of learning and teaching in a public or private; that they participate in school activities and attend seminars offered at the University of Puerto



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Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A University professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends four hours daily to the school or the seminar at the University as scheduled in the semester calendar.

**EDPE 4156. STUDENT TEACHING OF SOCIAL STUDIES IN SECONDARY SCHOOL.** Six credit hours. One hour of lecture per week and twenty hours of supervised practice per week. Prerequisite: authorization of the Director of the Department.

The course requires that teacher candidates lead the process of learning and teaching in a public or private; that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A University professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends four hours daily to the school or the seminar at the University as scheduled in the semester calendar.

**EDPE 4157. PRACTICUM IN TEACHING GENERAL HISTORY IN SECONDARY SCHOOL.** Six credit hours. One hour of lecture per week and twenty hours of supervised practice per week. Prerequisite: authorization of the Director of the Department.

The course requires that teacher candidates lead the process of learning and teaching in a public or private; that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A University professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends four hours daily to the school or the seminar at the University as scheduled in the semester calendar.

**EDPE 4166. PRACTICUM IN TEACHING OF ART IN K-12 SCHOOL.** Six credit hours. One hour of lecture per week and twenty hours of supervised practice per week. Prerequisites: EDPE 4165 and authorization of the Director of the Department.

The course requires that teacher candidates lead the process of learning and teaching in a public or private; that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A University professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends four hours daily to the school or the seminar at the University as scheduled in the semester calendar.

**EDPE 4186. PRACTICUM TEACHING OF THEATER IN K-12 SCHOOL.** Six credit hours. One hour of lecture and twenty hours of supervised practice per week. Prerequisite: EDPE 4185.

The course requires that teacher candidates lead the process of learning and teaching in a public or private school; that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A University professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends 4 hours daily to the school or the seminar at the University as scheduled in the semester calendar.

**EDPE 4187. PRACTICUM IN TEACHING OF BUSINESS EDUCATION IN SECONDARY SCHOOL.** Six credit hours. One hour of lecture per week and twenty hours of supervised practice per week. Prerequisite: authorization of the Director of the Department.

The course requires that teacher candidates lead the process of learning and teaching in a public or private; that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and

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attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A University professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends four hours daily to the school or the seminar at the University as scheduled in the semester calendar.

**EDPE 4216. PRACTICUM IN TEACHING PHYSICAL EDUCATION.** Six credit hours. Three hours of seminar and twenty hours of supervised practice per week. Prerequisites: EDPE 4215 and authorization of the Director of the Department.

The course requires that teacher candidates lead the process of learning and teaching in a public or private school; that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A university professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends four hours daily to the school and three hours to the seminar at the university as schedule in the semester calendar.

**EDPE 4236. PRACTICAL IN TEACHING OF SPANISH IN SECONDARY SCHOOL.** Six credit hours. One hour of lecture per week and twenty hours of supervised practice per week. Prerequisites: EDPE 4235 and authorization of the Director of the Department.

The course requires that teacher candidates lead the process of learning and teaching in a public or private; that they participate in school activities and attend seminars offered at the University of Puerto Rico. Through these experiences teacher candidates are equipped with theories, practical techniques and methods to develop their knowledge, skills and attitudes that contribute to improvements in practicum. In addition, we discuss and analyze current topics in the field of study or situations that arise during their practicum. A University professor, a cooperating teacher and the school principal supervise the teacher candidate. The teacher candidate attends fours hours daily to the school or the seminar at the University as scheduled in the semester calendar.

**EDPE 4246. STUDENT TEACHING OF ENGLISH IN SECONDARY SCHOOL.** Six credit hours. One hour of lecture per week and twenty hours of supervised practice per week.

Prerequisites: EDPE 4245 and authorization of the Director of the Department.

The student will be assigned to a public (or private) secondary school for three hours daily, five days a week. Four days will be devoted to teaching English and participating in other activities that form part of the work of the teacher. One day weekly will be spent in a seminar with the college supervisor to analyze and discuss the problems students are facing in their student teaching. In this laboratory student will be helped in their learning by the cooperating teacher, the school principal and the college supervisor.

**TEED 5007. CREATING ONLINE COURSES.** Three credit hours. Three hours of lecture, discussion and laboratory per week. Prerequisite: EDPE 3129 or authorization of the Director of the Department.

Creation, development and management of an online course taking into account the latest neuroscience findings of how the brain learns. The effect of emotions, course design, organization, aesthetics, communication and evaluation in learning are discussed.

**TEED 5008. DESIGN AND CREATION OF EDUCATIONAL MATERIALS FOR ONLINE COURSES.** Three credit hours. Three hours of lecture, discussion and laboratory per week. Prerequisite: EDPE 3129.

The steps in designing and creating educational materials for online courses are described and explained. The ideal characteristics, from a pedagogical point of view, are described for each of these materials and their effect on learning, according to empirical evidence. Tools and applications available to facilitate the creation of these digital materials are presented and discussed. Various of these digital materials (e.g. podcasts, infographs, voice-overs, videos, screencasts) will be planned and created as practice.

**TEED 5015. ADVANCED STRATEGIES FOR ONLINE COURSES.** Three credit hours. Three hours of lecture, discussion, and laboratory per week. Prerequisites: TEED 5007- Creating Online Courses or authorization of the Director of the Department.

Analysis and application of advanced strategies to facilitate online teaching and learning.

**TEED 5016. LEARNING MANAGEMENT SYSTEM ONLINE COURSES PRACTICUM.** Three credit hours. Three hours of lecture,

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discussion, and laboratory per week. Prerequisites: EDPE 3129- The Use of Microcomputers in the Classroom or authorization of the Director of the Department.

In this course students will create the elements of an online course within a Learning Management System (LMS). They will add lessons with educational content in various formats, learning activities as well as assessment and evaluation activities using various tools available from the LMS.

## OFFICE OF GRADUATE STUDIES

The Office of Graduate Studies (<http://grad.uprm.edu>) is a unit of the Office of the Dean of Academic Affairs. The UPRM Graduate Catalogue is available at <http://www.uprm.edu/catalog>.

**Office:** Celis Building, 1<sup>st</sup> floor, 111  
**Phone:** 787-265-3809; 787-832-4040, ext. 3809, 3598, 3442  
**Website:** <http://grad.uprm.edu>  
**Email:** [egraduados.uprm@upr.edu](mailto:egraduados.uprm@upr.edu)

## OFFICE OF IMMIGRATION AFFAIRS

The *Office of Immigration Affairs* is currently under the Deanship of Academic Affairs, its principal mission is to provide assistance and guidance to all international students and scholars who study and work at the UPRM. Since 2013 the office is focused solely on matters related to our international students and scholars. The Principal Designated School Official (PDSO) or Designated School Official (DSO) prepares Form I-20 for students who are admitted to the UPRM. We work closely with the Admissions Office, the Graduate School and the Registrar's Office, making sure that all requirements for the preparation of Form I-20 are met. This office issues Form I-20 to students admitted to the UPRM, in order for them to be able to get the entry visa into United States territory at the US Embassy in their country of origin. We also prepare and submit H1B visa petitions on behalf of scholars that are being hired by academic departments, in coordination with such departments.

Our office also plays an important role in guidance and advising not only for our international students and scholars, but also for all administrators and faculty working with them. Our vision is to facilitate study and work at the UPRM for foreign nationals following all federal regulations and requirements established by *Student and Exchange Visitor's Program (SEVP)* and *United States Citizenship and Immigration Services (USCIS)*, as well as other federal agencies under the *Department of Homeland Security (DHS)*.

Every fall and spring session starts off with an orientation for all newly admitted undergraduate and graduate students. During this orientation we emphasize the importance of maintaining status while in F1 visa classification, and we go over regulations regarding international students as contemplated in the *Code of Federal Regulations: 8 CFR 214.2(f)*.

The *Office of Immigration Affairs* is continually collaborating with all academic departments and UPRM dependencies (Human Resources Office and others) giving guidance and advice on all matters relating to international students and scholars. Our PDSO is continuously keeping up to date as an active member of NAFSA (The Association of International Educators).

### Contacts:

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**Office:** Celis Building 207  
**Phone:** (787) 832-4040 Ext. 2415 / 5757  
**Fax:** (787) 265-5418

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## GENERAL LIBRARY

### Vision

To distinguish itself as a facilitator of teaching, learning, and research. To promote lifelong learning and ethical values in the academic community. To be recognized as a leader in service, resources, information literacy skills, innovative technology, and access to the Campus intellectual output.

### Mission

The General Library supports the institutional mission of excellence. The library guarantees access to information and resources needed for teaching, research, and creative endeavors. It is a pioneer in offering formal courses, incorporating information literacy skills in the curriculum, and establishing the liaison program with the university faculty.

### LIBRARY SYSTEM

The General Library serves the local campus community as well as the residents of Mayagüez and nearby towns. It fully supports UPRM's educational and research mission and objectives by providing adequate library and information resources, facilities and services. It consists of a main library and a special departmental collection.

The main library has an area of approximately 124,335 square feet, with a seating capacity of 973, nine individual study rooms, eight study rooms for group discussions and collaborative work, a computer lab with 75 workstations, and two library instruction classrooms. There is also a large conference room as well as smaller meeting rooms.

In order to fulfill its mission, the Library is divided into key areas: Collections and Departments

- Álvarez Nazario Collection
- Audiovisual Collection
- Center for Technological Assistance (CAT)
- Circulation/Reserve Collection
- Graduate Research and Innovation Center (GRIC)
- Electronic Resources Center
- Interlibrary Loan Department

- Marine Sciences Collection
- Patent and Trademark Resources Center
- Puerto Rican Collection (Manuel María Sama y Auger)
- Reference/Documents Collection
- Research and Information Literacy Center (CEDIBI)
- Technical Process Department
- Systems Department

The library provides a wide range of services directly to the public. Among these are assisting users in finding information, facilitating access to information and teaching skills necessary for their academic research and life-long learning. This all Collections and Departments manages the circulation of materials, course reserves, user accounts, reference and audiovisual services, information literacy program, the promotion of library services and outreach efforts to campus community. Other services include library instruction modules, faculty liaison and collaboration program and orientations of the library. In September 1, 2016 the Graduate Research and Innovation Center (GRIC) was inaugurated in the General Library. GRIC is a creative space for collaboration and innovation, where UPRM's graduate students, faculty and researchers can gather together to develop projects and receive specialized research services in scholarly communication, research methodology and data management.

The Library holdings include: 742,201 volumes; 280,682 book volumes; 117,907 journals; 157,817 electronics journals; 8,910 electronic books; 69,698 microfiches; 386 microcards; 2,491 microfilms; 177,643 government documents; 3,545 films; 4,892 maps; 10,300 sound recordings; 442 musical scores; 508 sound magnetic tapes; 2,852 videocassettes; 3,562 CD/DVD; 4,901 theses; and access to millions of U.S. patents and trademarks.

The Library is a selective depository for the publications of the U.S. Government and one of the coordinating agencies of the Puerto Rico Census Data Center under the State Planning Board. It serves as depository for the publications of the U.S. Bureau of the Census, and holds membership in the Patent and Trademark Resource Centers Program of the U.S. Patent and Trademark Office since 1995. It's one of the centers serving Puerto Rico, the Caribbean Basing and Latin America.

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Other library services include books, documents and journal loans, interlibrary loans, traditional and virtual reference, printing and photocopying. Additionally, virtual reference, digital reserve, electronic resources, online databases, catalog and institutional repository are accessed through our webpage.

The Library offers tours of its facilities, and provides information literacy workshops, library instruction sessions and credit courses. Faculty librarians teach the following credit courses: AGRO 4019—Seminar in Agronomy and Soils (Agronomy and Soils Department), BIOL 3055—Bibliography and Library Research in the Biological Sciences (Biology Department), CISO 3145—Bibliography and Library Research in the Social Sciences (Social Sciences Department), CIAG 3025—Library Resources in Agricultural Science. An interdisciplinary three-credit course is offered for those students wanting to learn about Research Methods in Libraries: INTD 3355.

The Library keeps its academic community informed through various social media platforms, media display within the library and institutional email. Further information about library services, facilities, resources and collections are available at: [www.upr.edu/biblioteca-rum](http://www.upr.edu/biblioteca-rum). You can also find us in Facebook (BibliotecaUPRM), Twitter ([bibliotecauprm](https://twitter.com/bibliotecauprm)) and Pinterest (General Library-UPRM).

Phone: 787-265-3810; 787-832-4040 exts. 3810, 2151, 2155

Website: [www.upr.edu/biblioteca-rum](http://www.upr.edu/biblioteca-rum)

Email: [library@uprm.edu](mailto:library@uprm.edu)

#### GENERAL LIBRARY FACULTY

**JACQUELINA E. ÁLVAREZ**, Librarian III, M.L.I.S., 1997, University of Wisconsin, Madison.

**MARÍA DEL C. AQUINO-RUIZ**, Librarian IV, M.L.S., 1991, University of Puerto Rico, Río Piedras Campus.

**HILDA TERESA AYALA-GONZÁLEZ**, Librarian I, M.A.S., 2016, University of British Columbia, Vancouver, Canadá, M.I.S., 2011, University of Puerto Rico, Río Piedras Campus.

**MARÍA VIRGEN BERRÍOS-ALEJANDRO**, Librarian IV, M.L.S., 1989, University of Puerto Rico, Río Piedras Campus.

**CYNDIA CARABALLO-RIVERA**, Librarian III M.L.S., 1997, Interamerican University, San Germán, Puerto Rico.

**LUIS O. CASIANO-TORRES**, Librarian IV, M.L.S., 1989, University of Puerto Rico, Río Piedras Campus.

**JORGE L. FRONTERA-RODRÍGUEZ**, Librarian IV, M.S.L.S., 1988, Catholic University of America at Washington, D.C.

**ILEANA GUILFUCCI-GONZÁLEZ**, Librarian IV, M.L.I.S., 1992, Interamerican University, San Germán, Puerto Rico.

**GLADYS E. LÓPEZ-SOTO**, Librarian IV, M.L.S., 2002, University of Puerto Rico, Río Piedras Campus.

**LOURDES RIVERA-CRUZ**, Librarian IV, M.L.S., 1990, University of Puerto Rico, Río Piedras Campus.

**GRISELL RODRÍGUEZ-VELÁZQUEZ**, Librarian IV, M.L.I.S., 1996, University of Wisconsin at Milwaukee.

**EDITH M. TORRES-GRACIA**, Librarian IV, M.B.A., 1988, Interamerican University, San Germán; M.L.I.S., 1992, Long Island University, CW, Post Campus, Brookville, New York.

**ELSIE TORRES-NEGRÓN**, Librarian IV, M.L.S., 1986, University of Puerto Rico, Río Piedras Campus.

**ANIDZA VALENTÍN-RODRÍGUEZ**, Librarian II, Director, D.B.A., 2013, Turabo University, M.I.S., 2014, University of Puerto Rico, Río Piedras Campus, M.B.A. Management Information Systems, 2007, Interamerican University, San Germán, Puerto Rico

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## REGISTRAR'S OFFICE

### Vision

To be a leader and model of the Registrar's Offices processes, implementing innovative processes and advanced technology that allow us to provide our students with high quality services, reliable and accessible, placing the student at the center and rationale of university life.

### Mission

Protect the information and manage the processes that allow students to advance in their academic program, and ensure that the active and inactive students and university officials have access to accurate, timely and relevant information related to academic performance. To achieve this consistently the Office of the Registrar should ensure:

- Maintenance and confidentiality of student records, according to applicable regulations
- Easy access to services by students
- Efficient enrollment and graduation processes

### Confidentiality and Privacy of Academic Records

The University of Puerto Rico, Mayagüez Campus, fully complies with the provisions of the Buckley Amendment (Family Educational Rights and Privacy Act of 1974, as amended). This Act protects the privacy of students' educational records and establishes the students' right to examine their own files. It also provides guidelines for correcting the accuracy of the information contained in those files through informal and formal hearings. In relation to alleged violations of the Act by the institution, students have the right to file complaints written complaints to: The Family Educational Rights and Privacy Act Office, U. S. Department of Health and Human Services, 200 Independence Ave. S.W., Washington, D.C. 20201.

Copies and questions related to the institutional policy established by the University in compliance with the Act may be obtained in the Office of the Registrar.

## Veteran Services Office

The Veteran Services Office attends to veterans, dependents of veterans, servicemen, and servicewomen in matters pertaining to the Veterans Administration such as: educational benefits, registration, and studies at the university. All beneficiaries must comply with the norms established by this office. (See [Veteran addendum](#))

### Academic Progress (applicable to veterans and/or beneficiaries)

Veterans and/or beneficiaries should complete their studies during the regular time allotted (100%) as stated in the program curricula. If they exceed the time allotted they lose eligibility for the benefits of Veterans Programs. This norm is not applicable to federal aids such as Pell Grant or others where eligibility is established by the institution and/or the entity/agency granting the scholarship if the recipients maintain the correspondent requisites. Also, students must maintain the minimum average required (general and major average) as established for each program in order to graduate.

### Repetition of courses (applicable to veterans and/or beneficiaries)

The Veterans Administration (VA) only approves payment for the repetition of a failing grade ("F"). The VA does not approve payment for repeated courses with passing grades, unless they are repeated in order to comply with the requirements of the program of study.

**Office:** Celis Building, 2<sup>nd</sup> floor, 203

**Phone:** 787-265-3813; 787-832-4040, ext. 3404, 3420, 3254

**Website:** [www.uprm.edu/registrar](http://www.uprm.edu/registrar)

**Email:** [registro@uprm.edu](mailto:registro@uprm.edu)

## OFFICE OF THE DEAN OF STUDENTS

The Office of the Dean of Students assures and maintains an optimal learning environment by providing a variety of services and activities as support systems for academic programs. Students are urged to take full advantage of these services and are encouraged to participate in extra-curricular activities which are designed to enrich their personal development and academic growth. The office is located in the Dean of Students building in room DE-1. For more information contact Dr. Jonathan Muñoz Barreto at [decano.estudiantes@uprm.edu](mailto:decano.estudiantes@uprm.edu) or 787-265-3862.

## DEPARTMENT OF ATHLETIC ACTIVITIES

### Athletics

UPRM is a member of the Puerto Rico Inter-University Athletic League (LAIPR) and fully participates in a variety of intercollegiate sports. It is also an active member of the National Collegiate Athletic Association (NCAA) Division II. The program offers 15 men's and 14 women's sports for students who demonstrate superior athletic abilities. Men's sports include baseball, basketball, beach volleyball, cross country, judo, soccer, swimming, table tennis, taekwondo, tennis, track and field, volleyball, weightlifting, wrestling and cheerleading. Women's sports include weightlifting, basketball, beach volleyball, soccer, cross country, judo, softball, swimming, taekwondo, table tennis, tennis, track and field, volleyball and cheerleading. The NCAA sponsors six men's and six women's sports (volleyball, basketball, track and field, cross country, swimming and tennis). Exhibition sports include a co-ed dance team.

The Intramural Program provides activities and competitions that take place mostly on campus grounds. Students, faculty and staff participate in a wide variety of competitions including 3 on 3 basketball, indoor soccer, softball, 5 on 5 basketball, volleyball, employee softball tournament and other recreational activities sponsored by students in their free time.

Athletics facilities include an old gymnasium, a coliseum, a world class natatorium with an

Olympic size swimming pool, a diving pool and a 25 meter warm up pool, a tennis complex with 8 lighted courts that includes a grand stand court, 3 indoor racket ball courts, synthetic 400 meters running track, weightlifting gymnasium, training and conditioning exercise room, old athletic field for soccer practice and recreational activities, lighted softball field, and fitness trail.

The mascot is an English male bulldog name Tarzan and the female, Jane. The athletic nickname is Colegio and the moto is: Antes, Ahora y Siempre COLEGIO.

**Office:** Rafael A. Mangual Coliseum,  
2<sup>nd</sup> floor, #209

**Phone:** 787-265-3866; 787-832-4040, ext. 2565,  
3866, 3679, 3540, 3534, 3527, 3549

**Website:** [www.uprm.edu/actividadesatleticas](http://www.uprm.edu/actividadesatleticas)

**Email:** [ray.quinones@upr.edu](mailto:ray.quinones@upr.edu)

## BAND AND ORCHESTRA

### Vision

To become a service unit that supports the transformation of society by strengthening the institutional environment.

### Mission

To train students in the pro-active participation in the fine arts through musical performance, so as to contribute to the emotional, cultural and educational development to complement their comprehensive training, educational and ethical.

Students with musical talent may join different music groups such as the marching band, chamber choir "Chorium", Coral Universitaria, strings orchestra, and Latin American group "Alma Latina", Vocal ensemble "RUMVoz". Students interested in participating in any of these groups are required to perform in an audition.

Groups are required to rehearse twice or more weekly to develop interpretive skills and maintain an ample musical and artistic program. The ensembles present a variety of concerts and performances as representatives of the university also international performances, festivals and competitions. For more information contact: BAND AND ORCHESTRA DEPARTMENT at (787) 265-3895; 787-832-4040 exts. 3415, 3895.

### Website:

<http://www.uprm.edu/cms/index.php/page/380>



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## DEPARTMENT OF COUNSELING AND PSYCHOLOGICAL SERVICES

The Department is fully accredited by the International Association of Counseling Services (IACS). Counseling and Psychological Services are offered to the students so that they may achieve better self-understanding and make adequate adjustment to the university environment. Programs and services are offered to diminish the negative impact of everyday stress and to help students cope with academic and environmental demands.

The Department of Counseling and Psychological Services provide personal counseling, career and life planning, testing, and psychological services.

Psychologists provide individual therapy, crisis intervention, workshops and lectures on personal, emotional, and social growth topics. Also, some of these areas are supported with a Clinical Social Worker.

Professional Counselors assist students with personal, educational, and career development issues and concerns. They also teach a freshman orientation course, known as:

**UNIV 3005. INTRODUCTION TO THE UNIVERSITY WAY OF LIFE.** Zero credit hour. One hour of lecture per week.

Course directed towards a better understanding of the fundamental aspects that affect student life and adequate adjustments to the campus environment. Designed to enhance the academic and social integration in order to help students during their college years. Includes topics such as: study and communication skills, career planning, personal development, computer literacy, academic regulations and institutional resources.

**Freshman Orientation Days** are offered a week prior to the registration period for the first semester. It is a campus wide activity in which new students receive information about facilities, academic programs, services, and student organizations. It offers freshmen the opportunity to meet faculty, staff, and other students. Members of the **Peer Counseling Program** work intensely during this week and throughout the year in coordination with the Department of Counseling and Psychological Services assisting Professional Counselors with campus tours, group guidance, open house, and career days.

## COUNSELING AND PSYCHOLOGICAL FACULTY

### PROFESSIONAL COUNSELORS:

**MARÍA E. ALMODÓVAR-ALMODÓVAR**, *Associate Professor, (Counselor III and Acting Associate Dean of Students)*, Ed.D. 2010, Interamerican University of Puerto Rico-Metropolitan Campus.

**LISANDRA COLÓN-RIVERA**, *Professor, (Counselor IV)*, M.A.M.C.R., 1994, University of Puerto Rico at Río Piedras.

**MAYRA L. GONZÁLEZ-ORNES**, *Assistant Professor, (Counselor II)*, Ed.D. 2016, Interamerican University of Puerto Rico - Metropolitan Campus.

**AGNES D. IRIZARRY-IRIZARRY**, *Professor (Counselor IV)*, M.A.E., 1978, Interamerican University of Puerto Rico at San Germán Campus.

**MAGALY MERCADO-NAZARIO**, *Assistant Professor, (Counselor II)*, Ed.D. 2012, Interamerican University of Puerto Rico-Metropolitan Campus.

**CAROLYN MERCADO ROSADO**, *Professor (Counselor IV)*, Ed.D. 2016, Interamerican University of Puerto Rico-Metropolitan Campus.

**GLORIA MUÑIZ-CRUZ**, *Professor (Counselor IV)*, M.S., 1979, University of Bridgeport.

**NELSON PAGÁN-SUÁREZ**, *Associate Professor (Counselor III)*, Ed.D. 2014, Interamerican University of Puerto Rico – Metropolitan Campus.

**MADELINE J. RODRÍGUEZ-VARGAS**, *Associate Professor (Counselor III and Acting Director)*, Ed.D. 2013, Interamerican University of Puerto Rico - Metropolitan Campus.

### PSYCHOLOGISTS:

**ZAIDA M. CALDERÓN-FONTANES**, *Professor (Psychologist IV)*, M.S., 1988, Louisiana State University at Natchitoches.

**SHEILA Y. MAESTRE-BONET**, *Professor (Psychologist IV)*, Psy.D., 2005, Ponce School of Medicine.

**SCOTT TSAI-ROQUE**, *Professor, (Psychologist IV)*, Ph.D., 2006, University of Puerto Rico, Río Piedras.

**EMIR S. RIVERA-CATILLO**, *Associate Professor, (Psychologist III)*, Psy.D., 2008, Ponce School of Medicine.

**Office:** Students Center 501, Stéfani 225, ADMI 120

**Phone** [787-832-4040](tel:787-832-4040) exts. 2040, 3372, 3864

**Website:** <http://www.uprm.edu/DCSP>



## FINANCIAL AID DEPARTMENT

The Department of Financial Aid administers financial aid programs to assist students with educational expenses. Each year approximately 70% of the student body qualifies for financial assistance. This assistance is provided through federal, state, institutional, and private sources. These programs include grants and scholarships which do not have to be repaid, part-time employment for students who wish to work, and loans that require repayment.

The philosophy followed in rendering financial assistance is based on the principle that parents are the ones who are primarily responsible for providing financial means to educate their children. Students are also considered responsible in helping finance their college education through self-help which includes resources from assets, earnings from work, and loans to be repaid from future earnings.

The established requirements for financial assistance are:

- US citizenship or eligible non-citizen
- Be working toward a degree or a teaching certificate program
- Be registered with the selective service system
- Be making satisfactory academic progress for Title IV Program
- Have financial need.

Financial need is determined by the difference between the cost of education and the amount of aid that parents and student can contribute and the economical resources and aids that the students receives from the institution. The amount that a student may receive is determined according to student's financial need and fund availability. In order to be considered for all financial aid programs, students must complete and submit once every academic year the Application for Federal Student Aid and all other required documents.

## Financial Aid Programs

### Grants and Scholarships

The ***Federal Pell Grant Program*** provides grants to undergraduate students who are enrolled in a degree-granting program and who do not hold a previous baccalaureate degree unless enrolled in a teaching certificate program.

- Pell Grants are the foundation of federal student financial aid, to which aid from other federal and nonfederal sources might be added.
- Pell Grants are generally awarded only to undergraduate students-those who haven't earned a bachelor's or graduate degree.
- The duration of a student's eligibility to receive a Federal Pell Grant is 12 semesters (or its equivalent)
- In some limited cases, however, you might receive a Pell Grant if you're enrolled in a post baccalaureate teacher certificate program.

Amounts can change yearly. The maximum Pell Grant award for the 2019 -2020 award year is \$6,195, and the corresponding maximum Pell Grant eligible expected family contribution (EFC) is 5576.

The ***Federal Supplemental Education Opportunity Grant (FSEOG)*** provides assistance to undergraduates who demonstrate considerable need and are eligible for the Federal Pell Grant.

- FSEOGs are awarded to undergraduate students with exceptional financial need-those with the lowest Expected Family Contribution\*(EFC) numbers.
- Federal Pell Grant recipients receive priority for FSEOG awards.

The ***Legislative Scholarship Program*** receives funds assigned by the Puerto Rico Legislature to assist students with need and who also meet specific academic criteria.

***Private scholarships and grants*** are received by the University for student assistance which are administered according to criteria and guidelines specified by each donor.

## Federal Work-Study Program

The *Federal Work-Study Program* provides on campus employment opportunities for undergraduate and graduate students with financial need.

## Loans

Based on their determined financial need, the *Direct Loan* allows undergraduate students to borrow low-interest federally subsidized funds. Students can also obtain unsubsidized loans regardless of need. Repayment begins six months after the student graduates or ceases to be enrolled.

The regulations create and define the terms “Maximum Eligibility Period”, “Subsidized Usage Period”, and “Remaining Eligibility Period”. Maximum Eligibility Period is a period of time equal to 150% of the published length of the academic program in which the borrower is enrolled. Subsidized Usage Period is generally, the period of time for which the first-time borrower received a Direct Subsidized Loan. Remaining Eligibility Period is the difference between the borrower’s Maximum Eligibility Period and the sum of the borrower’s Subsidized Usage Periods. All of these periods are measured in full or partial academic years.

The *Geer Loan Program* is funded through a private trust donation to the Mayaguez Campus. It provides 5 percent interest loans for up to a maximum yearly amount of \$ 1,000 based on financial need. Repayment begins 90 days after the loan proceeds are disbursed.

**Office:** Financial Aid, Deanship of Students Building

**Phone:** 787-265-3863; 787-4040 ext. 3440, 3863

**Fax:** 787-265-1920

**Website:** <http://www.uprm.edu/financialaid>

**Email:** [aeconomica@uprm.edu](mailto:aeconomica@uprm.edu)

## HEALTH SERVICES DEPARTMENT

The Health Services Department offers primary health care, and emergency aid services, for all students. Among the services provided are medical consultation, emergency and short-stay recuperation care, ambulance services, clinical laboratory tests, psychology service, addiction counseling, health education, and promotion program, stress management and a family planning program. The University of Puerto Rico also offers a university health insurance plan throughout a private provider for students who are not covered by a private or government health insurance.

These services are classified in three areas: physical, emotional and social health. A preventive medicine with emphasis on primary and secondary prevention and therapeutic medicine. Preventive medicine pursues the prevention, detection, and screening. The therapeutic medicine covers control of medical conditions for students that may need immediate attention, observation or special and emergency care. Services are offered during regular working hours, except ambulance transportation service, which is coordinated on a twenty-four hour daily by Security Department University through the municipal or state emergency services.

All students entering the University for the first time are required to complete and submit a medical history exam that includes and required complete physical examination, laboratory tests and other important documents. Evidence of immunizations is also required. Failure to comply will result in a medical hold on registration.

Medical consultation and emergency services are offered by general physicians and professional nurses. These services are offered from 8:00am to 4:30pm, Monday to Friday. A clinical laboratory complements these services during regular working hours.

Psychological services are also part of the services offered. This includes psychotherapy, crisis intervention, group therapy and consultation to other health departmental professionals. Workshops on various mental health topics are also available.

The Stress Management Center offers services to all the university community by previous appointment. This center specialized in teaching

techniques for stress management which are music therapy, visualization and direct relaxation. The psychologist coordinates this service. The Center is a practice center for psychology students from the Psychology Department.

Through a Health Promotion and Prevention Program, individual and group orientations are offered covering various health topics. Some of the areas covered are: nutrition, sexual health, eating disorders, sexually transmitted diseases including AIDS, alcohol and other drug abuse prevention, counseling on addiction and other topics. Secondary prevention for chronic illness such as heart diseases, diabetes, and asthma, as well as other health related areas with emphasis in the promotion of healthy lifestyles and health maintenance are also part of the program. A resource library with books and printed educational and informational material is available to the community.

The University, through a private health insurance company, offers the students an insurance health plan in order to provide more comprehensive health services. The plan is required, unless the student provides evidence of other health insurance coverage. The university plan offers medical specialists services, X-rays and laboratory tests, emergency room care, hospitalization, surgical procedures, maternity services including prenatal and postnatal care within others. There are options on pharmacy, dental and major medical services. Some services require eligibility time.

A Title X Family Planning Program (PREVEN) offers comprehensive sexual and reproductive health to all members of the university community. This program offers evaluation and medical consultation by a gynecologist specialist physician, as well as sexual health education, guidance in reference to abstinence, natural family planning, referrals, PAP smears tests and others tests for sexually transmitted diseases such as Chlamydia and HIV, as well as education and availability of contraceptive methods supply.

A Traffic Safety Project (FIESTA) sponsored by the Puerto Rico Traffic Safety Commission offers educational and promotional activities establishing traffic safety as part of a healthy way of life among all members of the community.

The Health Services Department considers social health as a very important component of the integral university health services. Some of the

actual health issues such as alcohol and other substance abuse are related to social health. This motivated the development of the project “Café Colegial La Cueva del Tarzan”; a pro-active socialization prevention project that offer social alternatives. This environmental project is developed and run by students where a positive, creative and entertain environment free of alcohol is present.

A Smoke Cessation Program is available to student and university staff.

The department also sponsors three student organizations that advocate healthy lifestyles among the student community.

**Phone:** (787) 832-4040 Exts. 3405, 3408, 3416

**Website:** <http://www.uprm.edu/medical>

**Email:** [servmed@uprm.edu](mailto:servmed@uprm.edu)

## PLACEMENT DEPARTMENT

### Vision

Serve as liaison between students and businesses while providing the best and most effective service for both part.

### Mission

Provide students the necessary tools that will help them achieve an effective job search, while helping businesses recruit the best talent by working with their employment needs so the students can be placed effectively in a summer, full time, temporary or part time employment.

The Placement Department's main objective is to assist students in obtaining permanent, summer, or temporary employment. Services provided include arrangement of on-campus interviews with prospective employers, coordination of employer presentations, and job referrals. The Department offers seminars and workshops to facilitate job search, résumé preparation, and interviewing skills.

Twice a year, the Placement Department organizes and hosts a **Job Fair** with the participation of private and government agencies from Puerto Rico and the United States.

Annually, the department prepares a study with each graduating class that reflects the number of students that find job placement in and outside of the island, continue their graduate studies in Puerto Rico or the United States or continue to seek employment. Students are advised to initiate their job search as early as their freshmen year, since this will increase their chances of obtaining summer or co-op experience.

**Office:** Student Center Bldg., 5th Floor Room 508

**Phone:** (787) 265-3898; (787) 832-4040 Exts. 2070, 3858, 3691 Fax: (787) 834-5115

**Website:** <http://www.uprm.edu/placement>

**Email:** [placement@uprm.edu](mailto:placement@uprm.edu)

## QUALITY OF LIFE OFFICE

The Quality of Life Office offers a wide variety of services in order to promote a safe campus environment and achieve the educational objectives of this institution. This office encourages a safe and secure environment through various activities each semester. It sponsors peer education and support student groups.

Proactive prevention programs are offered in order to prevent campus crime, violence, sexual assault, and the use and abuse of alcohol and other drugs, which may affect the quality of life on campus. Further information about the office, its services, and activities may be obtained by calling 787-832-4040, Extensions 3894, 3107, 5467 or at [calidaddevida@uprm.edu](mailto:calidaddevida@uprm.edu) <http://www.uprm.edu/calidaddevida>.

### Mission

Our mission is to raise community awareness about total welfare, alcohol abuse and prevention, drugs, smoking, crime alert, prevention of sexual harassment and sexual assault, violence, aggression and safety and adjacent areas. We seek to contribute to the integral development of our students by offering alternatives to develop healthy lifestyles in the university community. Coordinate activities directed to meet, the regulations established by the Department of Education and the University of Puerto Rico.

### Vision

To be the leading office in prevention and safety and to promote healthy lifestyles, responding to the needs of the university community. To promote a culture of tolerance and diversity, with the determination of improving the Institutional Climate of our campus.

## CAMPUS SAFETY AND SECURITY

Emergency Numbers: Security Office (787) 265-1782, Office of the Dean of Students (787) 265-3862, Quality of Life Office (787) 265-5467, Health Services (787) 265-3865, Counseling and Guidance (787) 265-3864.

At UPRM, the safety and well being of our students, faculty, and staff is an important priority.

UPRM's urban campus and its environs are safe and have a relatively low crime rate.

The University is required by federal law to publish an annual security report containing information with respect to campus security policies and statistics on the incidence of certain crimes on and around our campus.

### FEDERAL CAMPUS SEX PREVENTION LAW

The Department of Superior Education of the United States of America established an order that any educational institution that receives federal funds must have open access to the university community of the sex offender's register.

That database contains public record information of offenders classified as sexual predators and sex aggressors under the law of Puerto Rico known as Registration of Convicted Persons of Sexual Crimes and Abuses Against Children Law (Law No. 266 of September 9, 2004).

This information would be available on the website Quality of Life Office, <http://www.uprm.edu/cvida/ofensores.php>, and on the website of the Information System of Criminal Justice, <http://prcjisweb.gobierno.pr/CjisServices/Forms/Registries/Registry266TermsConditions.aspx>.

## Statistics of Campus Crime Report:

### ON-CAMPUS CRIME REPORT-2013-2015 REQUIRED BY THE PUBLIC LAW 101-542 (STUDENT RIGHT TO KNOW AND CAMPUS SECURITY ACT)

| CATEGORIES*   | In Campus |      |      | Students Residence |      |      |
|---|-----------|------|------|--------------------|------|------|
|   | 2016      | 2017 | 2018 | 2016               | 2017 | 2018 |
| Murder/Negligent Manslaughter                               | 0         | 0    | 0    | 0                  | 0    | 0    |
| Non-Negligent Manslaughter                                  | 0         | 0    | 0    | 0                  | 0    | 0    |
| Forcible Sex Offenses (Including forcible rape)             | 0         | 0    | 0    | 0                  | 0    | 0    |
| Non-forcible Sex Offenses                                   | 0         | 0    | 0    | 0                  | 0    | 0    |
| Robbery   | 0         | 0    | 0    | 0                  | 0    | 0    |
| Aggravated Assault  | 0         | 0    | 0    | 0                  | 0    | 0    |
| Burglary  | 0         | 0    | 1    | 0                  | 0    | 0    |
| Motor Vehicle Theft   | 0         | 0    | 0    | 0                  | 0    | 0    |
| Arson   | 0         | 0    | 0    | 0                  | 0    | 0    |
| Property Damage   | 0         | 6    | 17   | 0                  | 0    | 0    |
| Illegally Appropriated by Force                             | 21        | 13   | 19   | 0                  | 0    | 0    |
| *Hate Crimes  | 0         | 0    | 0    | 0                  | 0    | 0    |
| Disciplinary Actions/Judicial Referrals and/or Arrests for: |           |      |      |                    |      |      |
| Liquor Law Violations                                       | 0         | 0    | 0    | 0                  | 0    | 0    |
| Drug Law Violations   | 0         | 0    | 0    | 0                  | 0    | 0    |
| Illegal Weapon Possession                                   | 0         | 0    | 0    | 0                  | 0    | 0    |

**ON-CAMPUS CRIME REPORT-2013-2015  
REQUIRED BY THE PUBLIC LAW 101-542  
(STUDENT RIGHT TO KNOW AND  
CAMPUS SECURITY ACT)**

| CATEGORIES*   | Non-Campus<br>Residence |      |      | Public<br>Properties |      |      |
|---|-------------------------|------|------|----------------------|------|------|
|   | 2016                    | 2017 | 2018 | 2016                 | 2017 | 2018 |
| Murder/<br>Negligent<br>Manslaughter  | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Non-Negligent<br>Manslaughter   | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Forcible Sex<br>Offenses<br>(Including<br>forcible rape)                    | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Non-forcible<br>Sex Offenses  | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Robbery   | 2                       | 0    | 0    | 2                    | 0    | 0    |
| Aggravated<br>Assault   | 2                       | 0    | 0    | 2                    | 3    | 3    |
| Burglary  | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Motor Vehicle<br>Theft  | 2                       | 0    | 0    | 2                    | 0    | 0    |
| Arson   | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Property<br>Damage  | 0                       | 0    | 2    | 0                    | 11   | 11   |
| Illegally<br>Appropriated<br>by Force                                       | 4                       | 6    | 6    | 4                    | 20   | 20   |
| *Hate Crimes  | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Disciplinary<br>Actions/<br>Judicial<br>Referrals<br>and/or Arrests<br>for: |                         |      |      |                      |      |      |
| Liquor Law<br>Violations  | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Drug Law<br>Violations  | 1                       | 0    | 0    | 0                    | 0    | 0    |
| Illegal<br>Weapon<br>Possession   | 0                       | 0    | 0    | 0                    | 0    | 0    |
|   |                         |      |      |                      |      |      |

**ON-CAMPUS CRIME REPORT-2013-2015  
REQUIRED BY THE PUBLIC LAW 101-542  
(STUDENT RIGHT TO KNOW AND  
CAMPUS SECURITY ACT)**

| CATEGORIES*  | Total |      |      |
|--|-------|------|------|
|  | 2016  | 2017 | 2018 |
| Murder/Negligent<br>Manslaughter                               | 0     | 0    | 0    |
| Non-Negligent<br>Manslaughter                                  | 0     | 0    | 0    |
| Forcible Sex Offenses<br>(Including forcible rape)             | 0     | 0    | 0    |
| Non-forcible Sex Offenses                                      | 0     | 0    | 0    |
| Robbery  | 2     | 0    | 2    |
| Aggravated Assault   | 0     | 3    | 2    |
| Burglary   | 0     | 0    | 1    |
| Motor Vehicle Theft  | 0     | 0    | 0    |
| Arson  | 0     | 0    | 0    |
| Property Damage  | 1     | 17   | 32   |
| Illegally Appropriated by<br>Force                             | 36    | 39   | 33   |
| *Hate Crimes   | 0     | 0    | 0    |
| Disciplinary Actions/Judicial<br>Referrals and/or Arrests for: |       |      |      |
| Liquor Law Violations  | 0     | 0    | 0    |
| Drug Law Violations  | 0     | 0    | 0    |
| Illegal Weapon Possession                                      | 0     | 0    | 0    |

**STATE POLICE CRIME REPORT OF  
CAMPUS ADJACENT AREAS  
REQUIRED BY THE PUBLIC LAW 101-542  
(STUDENT RIGHT TO KNOW AND  
CAMPUS SECURITY ACT)**

| CATEGORIES*   | In Campus |      |      | Students<br>Residence |      |      |
|---|-----------|------|------|-----------------------|------|------|
|   | 2016      | 2017 | 2018 | 2016                  | 2017 | 2018 |
| Murder/<br>Negligent<br>Manslaughter                                    | 0         | 0    | 0    | 0                     | 0    | 0    |
| Non-Negligent<br>Manslaughter   | 0         | 0    | 0    | 0                     | 0    | 0    |
| Forcible Sex<br>Offenses<br>(Including<br>forcible rape)                | 0         | 0    | 0    | 0                     | 0    | 0    |
| Non-forcible<br>Sex Offenses  | 0         | 0    | 0    | 0                     | 0    | 0    |
| Robbery   | 1         | 0    | 0    | 7                     | 0    | 0    |
| Aggravated<br>Assault   | 0         | 0    | 1    | 0                     | 0    | 0    |
| Burglary  | 2         | 0    | 0    | 0                     | 0    | 0    |
| Motor Vehicle<br>Theft  | 1         | 0    | 0    | 0                     | 0    | 0    |
| Arson   | 0         | 0    | 0    | 0                     | 0    | 0    |
| Property<br>Damage  | 10        | 6    | 5    | 11                    | 0    | 0    |
| Illegally<br>Appropriated<br>by Force                                   | 12        | 14   | 5    | 10                    | 0    | 0    |
| *Hate Crimes  | 0         | 0    | 0    | 0                     | 0    | 0    |
| Disciplinary<br>Actions/Judicial<br>Referrals<br>and/or Arrests<br>for: | 1         | 0    | 0    | 0                     | 0    | 0    |
| Liquor Law<br>Violations  | 0         | 0    | 0    | 0                     | 0    | 0    |
| Drug Law<br>Violations  | 0         | 0    | 0    | 0                     | 0    | 0    |
| Illegal<br>Weapon<br>Possession   | 0         | 0    | 0    | 0                     | 0    | 0    |

**STATE POLICE CRIME REPORT OF  
CAMPUS ADJACENT AREAS  
REQUIRED BY THE PUBLIC LAW 101-542  
(STUDENT RIGHT TO KNOW AND  
CAMPUS SECURITY ACT)**

| CATEGORIES  | Non-Campus<br>Residence |      |      | Public<br>Properties |      |      |
|---|-------------------------|------|------|----------------------|------|------|
|   | 2016                    | 2017 | 2018 | 2016                 | 2017 | 2018 |
| Murder/<br>Negligent<br>Manslaughter  | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Non-<br>Negligent<br>Manslaughter   | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Forcible Sex<br>Offenses<br>(Including<br>forcible rape)                    | 0                       | 1    | 1    | 0                    | 0    | 0    |
| Non-forcible<br>Sex Offenses  | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Robbery   | 0                       | 8    | 5    | 0                    | 0    | 0    |
| Aggravated<br>Assault   | 1                       | 5    | 5    | 0                    | 0    | 0    |
| Burglary  | 3                       | 0    | 5    | 0                    | 0    | 0    |
| Motor Vehicle<br>Theft  | 0                       | 11   | 10   | 0                    | 0    | 0    |
| Arson   | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Property<br>Damage  | 0                       | 44   | 33   | 0                    | 0    | 0    |
| Illegally<br>Appropriated<br>by Force                                       | 5                       | 63   | 39   | 4                    | 0    | 0    |
| *Hate Crimes  | 0                       | 1    | 1    | 0                    | 0    | 0    |
| Disciplinary<br>Actions/<br>Judicial<br>Referrals<br>and/or<br>Arrests for: | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Liquor Law<br>Violations  | 0                       | 0    | 0    | 0                    | 0    | 0    |
| Drug Law<br>Violations  | 0                       | 1    | 1    | 0                    | 0    | 0    |
| Illegal<br>Weapon<br>Possession   | 0                       | 0    | 7    | 0                    | 0    | 0    |

**STATE POLICE CRIME REPORT OF  
CAMPUS ADJACENT AREAS  
REQUIRED BY THE PUBLIC LAW 101-542  
(STUDENT RIGHT TO KNOW AND  
CAMPUS SECURITY ACT)**

| CATEGORIES*   | Total |      |      |
|---|-------|------|------|
|   | 2016  | 2017 | 2018 |
| Murder/Negligent Manslaughter                               | 0     | 0    | 0    |
| Non-Negligent Manslaughter                                  | 0     | 0    | 0    |
| Forcible Sex Offenses (Including forcible rape)             | 0     | 1    | 1    |
| Non-forcible Sex Offenses                                   | 0     | 0    | 0    |
| Robbery   | 8     | 8    | 5    |
| Aggravated Assault  | 1     | 5    | 6    |
| Burglary  | 5     | 0    | 5    |
| Motor Vehicle Theft   | 1     | 11   | 10   |
| Arson   | 0     | 0    | 0    |
| Property Damage   | 21    | 50   | 38   |
| Illegally Appropriated by Force                             | 31    | 77   | 44   |
| *Hate Crimes  | 0     | 1    | 0    |
| Disciplinary Actions/Judicial Referrals and/or Arrests for: | 1     | 0    | 0    |
| Liquor Law Violations                                       | 0     | 0    | 0    |
| Drug Law Violations   | 0     | 1    | 1    |
| Illegal Weapon Possession                                   | 0     | 0    | 7    |

**ADYACENT AREAS:**

Parking Satellites Area  
(Palacio de Recreación y Deportes and Juan Rivero Zoo)  
Pedro Albizu Campos Avenue  
Barrio Dulces Labios  
Barrio Paris  
Bosque Street, West Side  
Dr. Basora Street, West Side  
Martínez Nadal Street  
Mayagüez Town Center  
Méndez Vigo Street (Darlington Building)  
Morell Campos Street, West Side  
Los Próceres Park  
Urb. Ensanche Ramírez  
Urb. La Riviera  
Urb. Mayagüez Terrace  
Road 108, 2 km.

\*Subcategories under hate crimes:

Theft

Aggression

Intimidation

Vandalism, property damage

Domestic violence

Gender violence

Stalking



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## SOCIAL AND CULTURAL ACTIVITIES

The Social and Cultural Department offers diverse social and cultural activities such as theatrical and musical plays, concerts, sport events, and art exhibitions. The department is responsible for all UPRM student organizations accreditation and work with the approval of all their campus events and fundraising initiatives. Although most activities are on campus, university-sponsored activities are also offered at municipal government facilities such as the Yagüez Theater, the Cultural Center, and the Municipal Coliseum.

The department also has a leading role on Institutional events like Christmas Concert, Graduation, Freshmen Welcome and other events from the Dean of Students and the Chancellor's Office.

### Vision

To complement the formal education through social and cultural activities that give students the interpersonal, leadership, communication and social skills needed to give society active, creative, social and self-confident individuals.

### Mission

To present and promote an agenda of extracurricular activities for the UPRM community through artistic, social and cultural events that contributes to an integral student education, promoting also arts and culture development.

## STUDENT ORGANIZATIONS AND CLUBS

The UPRM has over 300 recognized student organizations and clubs which respond to student's social needs and interests. These organizations include chapters of national organizations, local clubs and groups of interest which give them an opportunity to enrich their cultural wealth and educative experiences. They also help their professional network to grow, and to develop leadership, interpersonal skills and sensibility through community service events.

**Office:** Students Center Building, 3<sup>rd</sup> floor, 306

**Phone:** 787-832-4040 exts. 3366, 3370

**Website:** <http://www.uprm.edu/actividadessociales>

**Email:** [actividadessociales@uprm.edu](mailto:actividadessociales@uprm.edu)

## STUDENT GOVERNANCE

The General Student Council, is composed of representatives from each academic faculty elected by the student body. Additional information regarding the student council and its functions may be obtained at the General Student Council Office located on the 1<sup>st</sup> floor of the Student Center or at (787) 832-4040 ext. 3409.

## STUDENT CENTER

The Student Center is the university's community center and it is open to all students, faculty, staff, alumni, and visitors every day.

### Mission

To provide students with a comfortable facility that meets recreational, entertaining, dining, and social needs in a safe environment.

There is always something going on in the UPRM Student Center. It is a focal point for cultural, social, and recreational activities while providing study areas for students. The 3<sup>rd</sup> Floor is being use for academic purposes as Colloquiums, Symposiums, Research Poster Exhibitions, Music, Theater and Performances, Movies and Graduated School Fairs.

Service Departments from the Dean of Students Office are located in the Center like Placement, Social and Cultural Activities, and the Student Exchange Program-International Services, Student Government and Professional Counseling and Psychological Services. It also houses a Computer Center with free printing services for students, a relaxation room and a breastfeeding room. Other offices located in Center include the Students Affairs Council Office, Book Store, and the "Café Colegial", an alcohol free club and cafeteria managed by UPRM students. A food court, a game room, a branch of a local bank Banco Popular de Puerto Rico and a branch of the First Credit and Savings Coop of Puerto Rico, are also in the building and free wireless connection to UPRM network and the WWW is available.

Students, faculty and administrators also hold meetings, conferences and special events at the Student Center. The facility has the *Tarzan Room* to accommodate 125 sitting people with audio/visual equipment. Also the 3<sup>rd</sup> floor is available with a stage and audio for events like these.

Services are available from:

Monday to Thursday: 7:00 am to 12:00 midnight

Friday: 7:00 am to 6:00pm

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Sunday and holidays: Available by reservation  
\*Check dates for availability

**Administrator's Office:** Students Center Building,  
4<sup>th</sup> floor, 411  
**Phone:** 787-832-4040 exts. 2711, 3366, 3370

## STUDENT EXCHANGE PROGRAMS AND INTERNATIONAL STUDENT SERVICES

### Mission

Our mission is to offer our students the opportunity to expand their educational and cultural horizons through their participation in the student exchange programs. To provide information to international students who visit our campus, and familiarize them with our college community and with the Puerto Rican culture.

The Mayagüez Campus is an active member of the National Student Exchange Consortium and the International Student Exchange Program. Also, we have Agreements with universities in: Europe, Latin America, Dominican Republic and U.S.A.

Exchange programs offer excellent opportunities to explore academic, social, and cultural settings.

**The National Student Exchange** offers students the opportunity to attend and study at another college or university in the United States and its territories.

**UNIV 4000. EXCHANGE PROGRAM.** Three to eighteen credit hours.

UPRM students participating in the Exchange Program must register in this course as a placeholder for administration purposes.

[www.nse.org](http://www.nse.org)

**The International Student Exchange Program** offers students the opportunity to study, experience and learn from exposure to different regional, cultural, and ethnic perspectives and to broaden their educational background. A qualified, full-time undergraduate student may participate in the exchange program for an entire academic year and live in one of 50 countries.

[www.isep.org](http://www.isep.org)

The Exchange Program office provides orientation services to students from other countries as they become acquainted with registration procedures, educational facilities, and student services.

Information is offered in areas of immigration, financial assistance, foreign embassies located in Puerto Rico, programs sponsored by international agencies, and housing. The office works closely with the academic community, the administration, and the local community.

**Office:** Students Center Building, 5th floor, 510  
**Phone:** 787-832-4040 exts. 3896, 2270  
**Website:** <http://uprm.edu/intercambio>

## OTHER SERVICES

### Alumni

The UPRM Alumni Office is engaged in activities designed to strengthen relationships between UPRM and its graduates.

#### Vision

Be a life liaison between the University of Puerto Rico at Mayagüez (UPRM), it's current and future alumni, encouraging their collaboration and support to achieve institutional goals for the benefit of future generations.

#### Mission

To establish, strengthen and maintain the relationship between the University of Puerto Rico at Mayagüez and it's alumni so they can contribute to institutional goals and support the University. This is addressed by:

- Promoting communication and active alumni participation in campus events
- Recognizing and reporting alumni contributions to our society
- Promoting UPRM love and pride

This office tracks UPRM alumni, run fundraising campaigns, and organize events for the UPRM alumni community.

**Office:** Students Center Building, 3<sup>rd</sup> floor 306  
**Phone:** 787-832-4040 ext. 3366, 3370, 5062  
**Website:** <http://www.uprm.edu/egresados/>  
**Email:** [egresados@uprm.edu](mailto:egresados@uprm.edu)

### Bookstore

UPRM Bookstore is located at the Campus Student Center on the first floor and provides ongoing service Mondays through Fridays from 7:00 AM to 4:00 PM. Recent restructuring of services that were traditionally offered, allow us to provide our campus community bookstore supplies, textbooks, office and

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school supplies, university logo souvenirs and personal care supplies. Additional information available at <http://www.uprm.edu/decadmi/libreria/librecolegial.php>. Please contact us at [edgardo.perez8@upr.edu](mailto:edgardo.perez8@upr.edu), or call 787-265-3885, 787-832-4040 Exts. 2294 or 3885, 787-834-8290 (fax).

## Campus Dorms

An in-Campus accommodation for our athletes is provided through the University Enterprises Department. UPRM Athletes residence is located at Building A and provides our students with the following services and amenities: laundromat, vending machines, common-use kitchen and study area.

**Phone:** 787-265-3891

**Website:** <http://hotelcolegial.com/>

**Email:** [margarita.quintana@upr.edu](mailto:margarita.quintana@upr.edu)

## Dining

Food service is provided in our Cafeteria which is conveniently located in the Student Center. Ongoing service is provided in specific time slots separately at our main dining room and snack bar. Mondays through Thursdays from 6:30 AM to 8:00 PM, our main dining room will serve breakfast, lunch and dinner. Food service on Fridays will run up to 3:00 PM. Snack bar service will be available Mondays through Fridays from 7:00 AM until 3:00 PM.

**Phone:** 787-832-4040 ext. 2991

## Information Technology Center

As one of the units of the Chancellor's Office, the Information Technology Center, also known as the Campus Computer Center, serve the academic and administrative community by providing support to their technological needs. The CTI facilities are located on the ground floor of the Luis de Celis Building. Our servers are located in an adequate space and we are continually working to provide the best infrastructure to maintain our computer services running in a 7/24 basis.

The institutional network **RUMNET** (Recinto Universitario de Mayagüez Network) is the most valuable resource supported by the Center. With a strong fiber optic infrastructure interconnecting over 40 buildings throughout the campus, it is part of the Internet 2 project. The Center also supports the most widely deployed wireless network for academic

purposes in Puerto Rico, covering the most part of the campus. The university community can access information resources, including Internet access wirelessly from almost anywhere, anytime.

Computing services for the academic users, are offered through the User Support Unit. Consulting and training services in academic and administrative tools like WordPress, CMS and the Portal, preparation of online user guides and manuals, academic support to the learning management system (LMS) Moodle and administration of institutional software licensing agreements, are some of the services provided.

The Analyst/Programming and Systems Units, ensure the flow of information needed for the day to day tasks of the academic and administrative community. Also, the Technical Services Unit provide network infrastructure, computer equipment maintenance and repair services, in coordination with other technical personnel around the campus.

The University covers the operational expenses of the computer network to provide Internet access through the wireless system inside the campus.

Additionally to the services provided from the CTI, several academic departments operate their own computer laboratories, some with specialized hardware or software, so their use is restricted to students who are enroll in certain courses or engaged in research. Most departmental laboratories are open to the general campus population.

**Phone:** 787-834-3718; 787-832-4040 ext. 2009, 2051, 2059, 2132, 3331,

**Website:** <https://www.uprm.edu/cti/>

## Press and Publications

The Press Office is the link between the university community as well as local and international media. Press releases and articles regularly published in daily and weekly newspapers and internal publications such as *Cartelera Semanal*, *La Gaceta Colegial*, and the UPRM web page ([www.uprm.edu](http://www.uprm.edu)), keep the general public informed of UPRM's main events. The Press Office produces *Foro Colegial*, an interview format program with host from Mayagüez Campus, which is broadcasted weekly on Radio Universidad WRTU FM. The Press Office also manages the content of the institution official social networks pages. Radio and TV announcements are also prepared by the Press Office.

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## ***TUITION, FEES AND EXPENSES***

The following fees, prescribed by the university are tentative for new students and transfers for 2019-2020 and are subject to change at the discretion of the Governing Board. University charges such as tuition and fees are due and payable in full by the date announced before the beginning of each term.

### **Tuition Fees**

#### **Cost per credit Undergraduate**

For **U.S.A. citizen's residents of Puerto Rico:**

\$124.00 per credit for regular students enrolled in four or five-year undergraduate programs plus applicable regular or special fees.

For **U.S.A. citizen's non residents of Puerto Rico:**

\$186.00 per credit for regular students enrolled in four or five-year undergraduate programs plus applicable regular or special fees.

For **foreign students:**

\$248.00 per credit for regular students enrolled in four or five-year undergraduate programs plus applicable regular or special fees.

#### **Visiting students:**

\$33.00 per undergraduate course plus \$13.00 maintenance fee and \$25.00 technology fee for each academic session.

### **Regular Fees**

|   |         |
|---|---------|
| Application for admission .....   | \$30.00 |
| Maintenance fee   |         |
| Graduation fee.....   | \$80.00 |
| Application for transfer to a<br>different program.....                     | \$20.00 |
| Application for readmission.....  | \$35.00 |
| Late registration fee.....  | \$20.00 |
| Academic transcript of credits (per<br>copy).....                           | \$ 5.00 |
| Duplicate of admission letter,<br>class ticket or schedule card (per copy). | \$ 5.00 |
| Identification card.....  | \$10.00 |
| Repetition courses.....   | \$10.00 |
| Partial withdrawal.....   | \$15.00 |

|  |         |
|--|---------|
| Total withdrawal.....                                    | \$20.00 |
| Letter of recommendation of the<br>Dean of Students..... | \$ 5.00 |

Students applying for admission, readmission, or transfer after the corresponding due date will pay one-and-a-half times the regular fee. Late applications are accepted only after complete justification is presented.

### **Special Fees**

|   |          |
|---|----------|
| Laboratory fees per laboratory course ... | \$100.00 |
| Maintenance fee                           |          |
| (per registration period) .....           | \$ 75.00 |
| Technology fee                            |          |
| (per registration period).....            | \$ 25.00 |

### **Annual Medical Insurance**

Basic \$1,112.00

Basic including pharmacy and dental charges \$1,430.00

Basic including pharmacy, dental and mayor medical charges \$1,486.00

Basic including pharmacy and major medical charges \$1,168.00

### **Regulations**

**Date for Payment of Fees:** All general student fees for each semester are paid in advance on the corresponding registration day.

**Deferred Payment of Fees:** As a general rule, no deferred payment of fees is granted. However, in very exceptional cases, the Dean of Students is authorized to grant an extension of time which cannot exceed 10 days before the end of the course. In those exceptional cases, a student must apply for deferred payment of fees in ample time prior to the registration date so that the merits of the application may be evaluated. On registration day, those students to whom deferred payment of fees is granted must pay 100% of Special Fees plus the corresponding percent of Tuition Fees. The balance must be paid at least 10 days before the last day of classes of the semester. Students who fail to pay accordingly must pay a late fee of \$3.00 per credit.

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Students who fail to settle their accounts with the university 30 days before the last day of classes every semester or the specified date for each Summer Session will not receive credit for their work. The Registrar will not release any transcript of record or other official documents until all outstanding fees and charges have been paid. All fees must be paid for the exact amount using U. S. currency, certified check or postal money order to the University of Puerto Rico.

### ***Honor Registration Exemption***

Honor registration is granted only to undergraduate students registered in a full-time program (12 credit hours or more), and it is only effective during the academic year and the following summer session for which it is granted.

### **Honor Registration Requirements**

1. Students who have completed their previous two semesters with full academic programs, a minimum 3.5 GPA and who rank at the top 4% of their class.
2. Students who are readmitted after having interrupted their studies for one or more semesters, who have a minimum 3.5 GPA or higher and who have completed a minimum 12 credit- hours in each of their last two semesters at the institution.

### **Reimbursements**

Students who withdraw from UPRM within the first two weeks of any semester or the first week of a summer session are entitled to a 50% refund of tuition fees, excluding special fees. The application for reimbursement must be approved by the corresponding Dean and the Registrar and filed in the Treasurer's Office within five days following the date of approval. No refunds are allowed after deadline.

Visitors and students forced to withdraw for disciplinary reasons are not entitled to a refund. Medical services, maintenance, laboratory, late registration, and transfer and readmission fees are non-refundable.

### **Return of University Property**

Before leaving the University, a student is expected to return in good condition all ROTC and AFROTC property and any other UPRM property used during the year. The ROTC and AFROTC property custodians will send written notices to all students who do not comply with this policy. If property is not returned within 30 days after notification, the individual's name will be forwarded to the Registrar. The value of any property which has been lost, damaged, or not returned will be deducted from the total deposit.

Unclaimed fees and deposits will be retained by the university by the end of the second semester of the academic year. Fines will be assessed on any overdue books and library materials. Failure to comply with these regulations will result in the student's inclusion on the Finance Department Debtors' List.

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## ACADEMIC STANDARDS

### Freshmen Admission

**Academic Requirements:** Candidates for admission to the first-year class at the University of Puerto Rico, Mayagüez Campus, must file an online application for admission at <https://admisiones.upr.edu/ac/admissions/students/index.php>. Applicants must have a high school diploma or its equivalent from an educational institution duly accredited.

**Entrance Examination:** Prospective applicants for admission to the freshman class must take the University Admissions Tests (PAA in Spanish) administered by the College Entrance Examination Board (CEEB). Application forms may be obtained at the high schools or by subscribing to the follow web page: [latam.collegeboard.org](http://latam.collegeboard.org).

Application form for the English version of the test are available from the Scholastic Aptitude Test (SAT and Subject Tests in English Literature, Spanish Reading and Math level I or II). The online application may be obtained through the web page [collegereadiness.collegeboard.org/sat](http://collegereadiness.collegeboard.org/sat).

Candidates, who take tests after February of their last year in high school, will submit their scores during the reconsideration process.

**Application Procedure:** First-year applicants are only considered for admission in August (first semester) or January (second semester). The following official documents must be sent to the Admissions Office:

- (a) Official high school academic transcript, including grades for the first semester of their senior year.
- (b) Official report of test scores obtained on the college entrance examination (PAA or SAT).
- (c) If school and/or College Board provide GPA and/or score test electronically, **physical documents are not needed.**

**Selection of Candidates:** Admission to UPRM is based on an admission index formula. The General Admission Index is based on the Admission Test of the College Entrance Examination or SAT. It is calculated as follows: 50% of the score is based on high school academic index, 25% on the mathematical score and 25% on

the verbal score on the Admission Test of the College Entrance Examination. These raw scores are converted to a scale figure in order to obtain the General Admission Index (IGS). Admission is granted to students whose index strictly complies with the minimum value established by the UPRM Administrative. Admission index varies according to program demands and admission limitations.

**Non-resident Applicants:** Admission may be granted to students from other countries. Candidates must submit evidence of their ability to undertake university work. Applicants from countries where the College Board offers an entrance examination are required to present these results in order to be eligible for admission.

**Advanced Placement:** Advanced placement is granted to students who approve the College Board Advanced Placement tests with scores of 4 or 5 in the English, Spanish, Mathematics section (Level II), Calculus AB or Calculus BC. Students who meet these criteria, receive credits for the first-level course, which appear on the student record as approved courses (P). Students are then placed in the next level course as specified by their curricula. These credits qualify as graduation requirements.

**Placement in First Level Courses:** Students who do not qualify for advanced placement (in a second level course) must take the first level course in Spanish, Mathematics, and/or English, following criteria defined by their respective academic departments, which may include, but are not limited, to College Board Achievement test scores. Placement is compulsory.

**Pre-calculus:** In accordance with regulations approved by the Academic Senate and recommendations from the Department of Mathematical Sciences:

- Students who score 604 or less on the PAA, on the mathematics part of the Achievement test of the College Entrance Examination Board, must take and approve a diagnostic exam, prepared by the Department of Mathematical Sciences or register in the required remedial course.
- Students who score less than 50% on the diagnostic exam, must prepare to repeat the diagnostic exam with a passing grade or approve the remedial course. Once those requirements are met, the student will be allowed to register in the pre-calculus course.

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## Re-admission

Students who have voluntarily interrupted their studies or students who have had at least one year of academic suspension must apply for readmission if they wish to continue studying at UPRM. Applications must be filed at the Office of the Registrar as determined on the Academic Calendar (See [Academic Calendar](#)):

The Registrar will process each application with the respective college Dean or with the Dean of Academic Affairs, as the case may be, and will notify the applicant of the decision. There is a non refundable fee established by the institution (<http://www.uprm.edu/registraduria/servicios/>). UPRM reserves the right to grant re-admission according to space availability in specific colleges, departments, or programs, especially if a student has exceeded the number of years required for degree completion.

## Transfers

### Transfers from Outside the University of Puerto Rico System

Any student, who has approved courses taken at any college-level accredited institution outside the University of Puerto Rico shall be considered a transfer student applicant.

#### *Eligibility Criteria:*

Candidates for admission, with advanced standing by transfer from accredited colleges or universities, must fulfill the following requirements:

- (a) Be free of any disciplinary process pending for resolution at the previous institution.
- (b) The student must have completed at least 48 credit hours.
- (c) The student must comply with specific departmental requirements, including required GPA.

#### *Application Deadlines:*

The Institution approves yearly an Academic Calendar. Please see the current calendar for the deadlines.

([http://www.uprm.edu/p/decasac/calendario\\_academico](http://www.uprm.edu/p/decasac/calendario_academico))

**Application Procedure:** Applications must be accompanied by the following documents:

- (a) Two official transcripts of all courses previously taken at any post-secondary level institution.
- (b) A copy of the catalogue or announcements of the institutions attended, describing the courses taken. This applies only to institutions outside the University of Puerto Rico.
- (c) Pay the corresponding fee.

All documents should be mailed to:

UPR Mayagüez Campus  
ADMISSIONS OFFICE  
Call Box 9000  
Mayagüez PR 00681-9000

#### *Transfer Credits:*

UPRM reserves the right to accept as transfer credit those courses taken at other institutions of higher education. Only those courses with a grade of C or better, will be evaluated for credit transfer. The maximum number of transferable credits is half of the total required for the degree.

#### *Selection of Candidates:*

Applicants for a program will be evaluated by the department, according to the minimum requirements established for that program. If a program does not have sufficient space to accommodate all qualified candidates, it will be filled with the best qualified applicants.

#### **Internal Transfers**

Undergraduate students of the Mayagüez Campus may apply for transfer from one program to another within campus. Transfer applicants must meet the following requirements:

1. File an application in the Office of the Registrar or online according to academic calendar.
2. Submit to the Office of the Registrar at UPRM a Transcript of Conduct certified by the Dean of Students of the unit of the University of Puerto Rico of origin within the transfer dates established for the application.
3. Comply with specific departmental requirements.
4. Pay the corresponding fee.
5. The student cannot have transferred more than three times.



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## External Transfers

Students from other units of the University of Puerto Rico may also apply for transfer. Applicants must meet the following requirements:

1. Apply for transfer to the unit concerned through the Office of the Registrar according to the Academic Calendar.
2. Submit to the Office of the Registrar at UPRM a Transcript of Conduct certified by the Dean of Students of the unit of the University of Puerto Rico of origin within the transfer dates established for the application.
3. Meet any academic requirements specified by the program of interest.
5. Pay the corresponding fee.

The Mayagüez Campus reserves the right to grant transfers according to the available capacity of each college, department, or program.

## Language of Instruction

Spanish is the language of instruction in most courses at UPRM, but students are required to have a working knowledge of the English language. The individual professor decides the language used in class lectures and in student evaluation activities.

## Registration

Registration procedures are published by the Office of the Registrar prior to each enrollment period. Students are required to register according to the published schedule. New students are required to turn in their Admission Certificates in order to receive registration materials. They are also required to comply with the Health Services Department requirements prior to registration. Failure to comply with these procedures will result in the cancellation of enrollment authorizations.

Registration is neither complete nor valid until a student has paid all tuition and related fees to the Bursar's Office. Students must attend the courses in which they are registered. Failure to do so will result in a failing grade in the course. Students are also held responsible for the fulfillment of all academic obligations as specified in their academic programs.

## Classification of Students

Students at the Mayagüez Campus are classified in one of the following categories:

- (a) **regular students:** those who have fulfilled UPRM entrance requirements, who are candidates for a degree, and/or carry an academic course load of at least 12 credit-hours.
- (b) **part-time students:** those who have fulfilled all UPRM entrance requirements, who are candidates for a degree, and carry an academic course load of less than 12 credit-hours.
- (c) **auditing students:** those who, regardless of whether or not they fulfill admission requirements, do not intend to earn a degree. They attend classes with the permission of the head of the department, the professor of the course, and the Registrar. These students will neither take exams, receive grades nor credit for work done in a course.
- (d) **transient students:** those who, regardless of whether or not they fulfill requirements for admission to UPRM, have been authorized by other institutions to attend classes at this campus. These students are not interested in earning credits towards a degree from this campus. Being accepted as a transient student does not guarantee that courses requested by the student will be offered.
- (e) **professional development students:** those who have a degree and do not want to obtain another degree, but wish to take courses for personal enrichment.
- (f) **special students:** faculty members in active duty of the UPR system who wish to take courses at the UPR campuses. Certification number 108 (2005-2006) of the Board of Trustees <http://www.certificaciones.upr.edu>, establishes the regulations for the authorization of studies for the faculty members of the UPR system in active duty.

## Maximum Academic Load

The maximum academic load is 18 credit hours per semester, except in cases where the curriculum requires a higher number of credits. Students with a minimum 3.00 GPA may carry a maximum 21 credit-hour load. During the last two semesters, students may carry a maximum 21 credit-hour load per semester pending recommendation of the Director of the Department and approval of the Dean of the Faculty.



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## Summer Session Programs

Students attending summer sessions are normally allowed to register for a maximum of seven credit-hours, but candidates for graduation in summer or next semester and honor students may be permitted to carry a maximum of 10 credit-hours subject approval by the corresponding dean. The same rule applies for students authorized to take summer courses for credit in other colleges or universities. Class programs for such students must have the approval of the Director of the Department and the Dean of their respective College. Courses taken at institutions outside the University of Puerto Rico system will not be accepted unless they are approved with C (2.0) or higher grade, and are recognized with a "P" in the academic record.

## Withdrawal

### *Partial Withdrawal*

A student may withdraw from a course before the deadline established in the university academic calendar. Partial withdrawal will not be permitted after the established deadline. After the student completes the established procedure and submits the completed official request to the Office of the Registrar, the Registrar will post a "W" (withdrawal) for the particular course or courses on the student's permanent record. Certification 11-34 of the Academic Senate <http://www.uprm.edu/senadojunta/docs/certsenado/11-34.pdf> establishes the maximum of withdrawals permitted by program of studies.

### *Complete Withdrawal*

A student may completely withdraw from UPRM at any time up to the last day of classes by completing and submitting a total withdrawal form at the Registrar's Office. After the student submits the official request, the official date of withdrawal is posted in the academic record and a grade of "W" is placed for each course the student is enrolled in at the time of the withdrawal.

## Curricular Sequences and Minor Concentrations

The University of Puerto Rico has a policy [Cert. 69 (2013-2014) Governing Board] for the creation of Minor Concentrations. The Academic Senate of the University of Puerto Rico in Mayagüez, established by Certification 15-07, the policy for the creation of curricular sequences. The main

objective of these certifications are to complement, enrich, expand, and diversify the academic preparation that a bachelor degree offers; and to promote the formation of a more versatile student, capable of performing effectively on different scenarios. Minor Concentration and Curricular Sequences consists of a series of courses which provide students with a reasonable knowledge and skills in a selected area.

Applications for Minor Concentrations and Curricular Sequences are available at the Office of the Registrar for the cost of \$1.35. Applications must be filed by February 15 for the first semester and the summer session and by September 15 for the second semester.

The University of Puerto Rico at Mayagüez offers the following **Minor Concentrations**:

### **College of Arts and Sciences**

- Art
- Comparative Literature
- Economics
- Linguistics
- Practice and Professional Ethics
- Writing and Communication in English

### **College of Business Administration**

- Accounting
- Business Administration
- Business Development
- Computerized Information Systems
- Finance
- Human Resources Management
- Marketing
- Office Assistant
- Operations Management
- Project Management for students of Business Administration
- Project Management for students of Arts and Sciences, Agricultural Sciences, and Engineering

### **College of Engineering**

- Aerospace Sciences and Engineering
- Integrated Construction Engineering and Architecture Practice
- Management of Service Processes
- Pharmaceutical Engineering

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The University of Puerto Rico at Mayagüez offers the following **Curricular Sequences**:

**College of Agricultural Sciences**

- Plant Biosafety
- Food Science and Technology

**College of Arts and Sciences**

- Adapted Physical Education
- Applied Mathematics for Science and Engineering
- Art
- Astronomy and Astrophysics
- Atmospheric Sciences and Meteorology
- Film Studies
- Comparative Literature
- Computational Linguistics
- Elementary Physical Education
- French Literature and Culture and Francophone
- Human Welfare
- International Relations
- Italian
- Linguistics
- Literary and Cultural Studies of Women and Gender
- Music
- Pure Mathematics
- Physics
- Statistics and Probability

**Graduate Curricular Sequence:**

- Teaching English to Speakers of Other Languages

**College of Engineering**

- Materials Science and Engineering

**Academic Affairs**

- Teacher-Preparation Program in Secondary Education

For additional information, please contact the College that offers the Minor Concentration or Curricular Sequence.

## Course Coding System

Courses are designated by a four-letter alphabetical code based on the Spanish titled of the academic discipline represented.

***Academic Discipline Codes***

|      |   |
|------|---|
| ADMI | BUSINESS ADMINISTRATION                                   |
| ADOF | OFFICE ADMINISTRATION                                     |
| AGRO | AGRONOMY  |
| ALEM | GERMAN  |
| ANTR | ANTHROPOLOGY  |
| ARTE | ART   |
| ASTR | ASTRONOMY   |
| BIND | INDUSTRIAL BIOTECHNOLOGY                                  |
| BIOL | BIOLOGY   |
| BOTA | BOTANY  |
| CFIT | PLANT SCIENCE   |
| CHIN | CHINESSE  |
| CIAN | ANIMAL SCIENCE  |
| CIBI | BIOLOGICAL SCIENCES                                       |
| CIFI | PHYSICAL SCIENCES   |
| CIIC | COMPUTER AND INFORMATION SCIENCES AND ENGINEERING         |
| CIMA | MARINE SCIENCES   |
| CIMI | MILITARY SCIENCES   |
| CINE | CINEMA  |
| CIPO | POLITICAL SCIENCES  |
| CISO | SOCIAL SCIENCES   |
| CMOB | MARINE SCIENCES BIOLOGICAL OCEANOGRAPHY                   |
| CMOF | MARINE SCIENCES PHYSICAL OCEANOGRAPHY                     |
| COMP | COMPUTER SCIENCE  |
| CONT | ACCOUNTING  |
| DESC | DIVISION OF CONTINUING EDUCATION AND PROFESSIONAL STUDIES |
| ECAG | AGRICULTURAL ECONOMICS                                    |
| ECON | ECONOMY   |
| EDAG | AGRICULTURAL EDUCATION                                    |
| EDES | SPECIAL EDUCATION   |
| EDFI | PHYSICAL EDUCATION  |
| EDFU | EDUCATION FOUNDATIONS                                     |
| EDMA | MATHEMATICS EDUCATION                                     |
| EDPE | EDUCATIONAL PROGRAMS AND TEACHING                         |
| ENFE | NURSING   |
| ESAE | AEROSPACE STUDIES   |
| ESMA | MATHEMATICAL STATISTICS                                   |
| ESOR | ORGANIZATIONAL STUDIES                                    |
| ESPA | SPANISH   |
| ESTA | STATISTICS  |
| EXAG | AGRICULTURAL EXTENSION                                    |
| FILO | PHILOSOPHY  |
| FINA | FINANCE   |
| FISI | PHYSICS   |
| FRAN | FRENCH  |
| GEOG | GEOGRAPHY   |
| GEOL | GEOLOGY   |

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|      |  |
|------|--|
| GERE | MANAGEMENT                             |
| GERH | HUMAN RESOURCES MANAGEMENT             |
| GRIE | GREEK                                  |
| HIST | HISTORY                                |
| HORT | HORTICULTURE                           |
| HUMA | HUMANITIES                             |
| ICOM | COMPUTER ENGINEERING                   |
| INAG | AGRICULTURAL ENGINEERING               |
| INCI | CIVIL ENGINEERING                      |
| INEL | ELECTRICAL ENGINEERING                 |
| INGE | GENERAL ENGINEERING                    |
| INGL | ENGLISH                                |
| ININ | INDUSTRIAL ENGINEERING                 |
| INME | MECHANICAL ENGINEERING                 |
| INPE | ANIMAL SCIENCE                         |
| INQU | CHEMICAL ENGINEERING                   |
| INSO | SOFTWARE ENGINEERING                   |
| INTD | INTERDISCIPLINARY                      |
| ITAL | ITALIAN                                |
| JAPO | JAPANESE                               |
| LATI | LATIN                                  |
| LING | LINGUISTIC                             |
| LITE | LITERATURE                             |
| MATE | MATHEMATICS                            |
| MERC | MARKETING                              |
| METE | METEOROLOGY                            |
| MUSI | MUSIC                                  |
| PROC | CROP PROTECTION                        |
| PSIC | PSYCHOLOGY                             |
| QUIM | CHEMISTRY                              |
| RECR | RECREATION                             |
| RUSO | RUSSIAN                                |
| SAGA | AGRICULTURAL AND ENVIRONMENTAL SYSTEMS |
| SICI | COMPUTERIZED INFORMATION SYSTEMS       |
| SOCI | SOCIOLOGY                              |
| TEAT | THEATER                                |
| TEED | TECHNOLOGICAL EDUCATION                |
| TMAG | MECHANICAL AGRICULTURAL TECHNOLOGY     |
| UNIV | UNIVERSITY COURSES                     |
| ZOOL | ZOOLOGY                                |

The first digit of the four-digit numbers which follow the alphabetical code indicates course level according to the following guide:

- 0- Remedial courses.
- 1- First-level courses corresponding to a technical two-year associate degree program.
- 2- Second-level courses corresponding to a technical, two-year associate degree program.
- 3- First-level courses of undergraduate programs. Usually, courses offered during the first two years of a program which leads to a bachelor's degree.
- 4- Second-level courses of undergraduate programs. Usually, courses offered in the third and fourth year of a program which leading to a bachelor's degree.

- 5- Advanced undergraduate courses that may be taken for graduate credit.
- 6- Graduate courses.
- 7- Doctoral courses.

## GRADES

**Units of instruction: One-credit hour** comprises one hour of lecture-discussion or two to four hours of laboratory practice, language drill, or any other work of a similar nature each week during the semester. **One hour of academic work** is equivalent to a fifty-minute class period. **A semester** comprises a minimum of fifteen weeks of instruction not include final examinations. For each credit registered, it is recommended that students dedicate two hours of outside class time.

At UPRM grades are awarded as follows:

- A - excellent 4.0
- B - good 3.0
- C - satisfactory 2.0
- D - passing but deficient 1.0
- F - failure 0
- P - passing
- NP- not passing
- S- satisfactory
- NS- not satisfactory
- W - authorized withdrawal

In the case of thesis or research in progress, the grades S (Satisfactory), NS (Not Satisfactory) will be used, but as the grade P and NP (Not Passing), they will not be considered in computing the grade point average of a student. The same rule may apply for some seminars.

The minimum grade for passing any graduate and major course in the Colleges of Business Administration, and Engineering and in the major courses in the Departments of Agronomy and Soil, Animal Sciences, Geology, Hispanic Studies, Nursing, Mathematics, and Physical Education is C. The minimum grade for passing other undergraduate courses is D.

**Grade point average (GPA):** This is the official measurement of the merit awarded to student work. It is computed by dividing the total number of honor points acquired by the total number of units of credit in which the student has received final grades. Honor points are assigned for each grade as follows: A= 4, B= 3, C= 2, D= 1, F= 0. Grades received in courses marked "W," "S," "NS," "P" or "NP" is not calculated in the student's GPA.

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GPA is computed after considering all courses completed. To determine academic progress, grades received in courses taken during summer sessions are considered in the computation of the GPA for the following academic year.

For information on the GPA for graduate students please refer to Certification 09-09 (**Academic Senate at UPRM**).

**Provisional grades:** A provisional grade or "Incomplete" (I) may be given to a student when, for justifiable reasons acceptable to the instructor, he or she has been unable to complete the academic requirements of a given course. The provisional grade will be computed on the basis of assigning a grade of F to the incomplete work. If the student has made up the deficiency before the end of the following semester, the instructor will notify the Registrar of the final grade. Provisional grades that have not been changed become final at the end of the following semester. The academic calendar specifies applicable deadlines.

**Repetition of courses:**

- (1) Courses in which students obtain a grade of D, or F, or are not approved may be repeated without restrictions.
- (2) If requested by a student and, after analyzing the specific academic circumstances, the Dean of the College may authorize, in exceptional cases, the repetition of a course in which a student has obtained a grade of C. The Registrar has to be notified in writing of the authorization.
- (3) If a student repeats a course, only the higher grade will be counted in the computation of the GPA, but all grades will appear on the official transcript.

**Graduation index:** This is computed with honor points as defined above including only courses which meet degree requirements and have been approved with a final passing grade.

**Evaluation of Student's Academic Course Work**

Grading criteria will be based on academic progress utilizing the existing diverse forms of evaluation according to the nature and content of the course curriculum. The forms and elements to be taken into consideration in the evaluation of the student's academic progress in a course will be

justified by the professor. Nevertheless, at the beginning of each semester, the professor needs to inform students of the evaluation procedure and the relative value of daily class participation, laboratory work, tests, and other aspects of a course.

Professors must offer students at least one evaluation of their academic work before the official partial withdrawal date. Examinations and all work handed in by the student, up to two weeks before the scheduled withdrawal date will be graded and returned to the student before the last day for partial withdrawal.

Professors will allow students an opportunity to discuss grades or doubts regarding course work.

A student should discuss such matters with the professor within a ten-day period after an exam or partial work is graded.

**Class Attendance and Examinations**

**Class attendance:** Class attendance is compulsory. UPRM reserves the right to address individual absenteeism cases at any time. Professors are expected to record students' absences. Frequent absences will affect adversely a student's final grade, and may even result in the total loss of credits. Arranging to make up missed work after a legitimate class absence is the student's responsibility.

**Final examinations:** A final examination at the end of the semester must occur in all courses in accordance with the academic calendar. The professor will choose the method or instrument deemed most appropriate for an evaluation that would provide enough objective evidence for the grade awarded. The method and weight of the final examination must be indicated in the course syllabus.

If necessary, final examinations scheduled by special arrangement must be given during the examination period prescribed in the Academic Calendar including Saturdays and Sundays. Change in the date assigned for a final exam may only be effected with the written authorization of the respective Dean and the Registrar.

**Absence from examinations:** Students are required to attend all examinations. Students who are absent from an examination for a justifiable reason acceptable to the professor, will be given a

make-up exam. If the exam is not taken, or not duly justified the student will receive an F on the missed examination.

**Review period:** A review period will be scheduled for each semester between the end of the semester and the beginning of final examinations. During this period, students will be free of any academic obligations so that they may devote this time to study for their final examinations.

## Retention Standards

At the end of the second semester the Registrar Office will analyze the student's records to certify the regular or part-time student's academic progress; notifications are posted to the student Portal accounts.

### Satisfactory Academic Progress

1. [Certification number 18-105 of the Academic Senate](#) at UPRM establishes that a regular student will be considered as having satisfactory academic progress and "in good standing" if the following conditions are met at the end of the academic year:

- a. Comply with all the established university regulations without being under probationary status.
- b. Attains the minimum GPA allowed according to the number of years completed at UPRM:

| Completed year of study | Minimum GPA required |
|-------------------------|----------------------|
| First                   | 1.70                 |
| Second                  | 1.90                 |
| Third                   | 1.95                 |
| Fourth and Fifth        | 2.00                 |

- c. Approve a percentage of the total credits required according to the students study program.

### Probations

Students who do not comply with the following criteria will be dismissed from the University of Puerto Rico, Mayagüez for a year, unless eligible to continue studying under a probationary status.

Students who, at the end of an academic year, do not show satisfactory academic progress may continue studying under probationary status if they satisfy the following conditions:

1. Eligibility for regular students: regular students who completed their second year of study, may continue studying under probationary status if they satisfy the following conditions:

- Attains the minimum GPA allowed according to the number of years completed:

| Completed year of study | Minimum GPA required |
|-------------------------|----------------------|
| First                   | 1.50                 |
| Second                  | 1.70                 |
| Third                   | 1.75                 |
| Fourth and Fifth        | 1.80                 |

- Approve during the last two semesters at least twelve credits.
- After a year on probation, student's must comply with the following conditions: (1) the minimum GPA, (2) attain the minimum number of credit hours required for good standing and (3) satisfactorily complete more than half the credit hours registered during the academic year. Students who comply with only two of the three condition will be placed on probation for another year.
- Students under probation will carry a course load no more than 15 credits per semester.

### Dismissal

1. Students who do not comply with the requirements stated above will be dismissed from the University of Puerto Rico, Mayagüez Campus. Students must apply for readmission after at least one year of academic suspension within the time period established in the academic calendar.
2. Re-admitted students will be placed on academic probation and will be subjected to the established norms.

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3. The first readmission for a dismissed student with an academic suspension will be processed by the Registrar Office.
  4. Students with an academic suspension for a second time who wish to continue studying, must file an application for readmission. This application will be evaluated by the Scholastic Achievement Committee with no commitment from the Institution and equally with the rest of the applications which have been submitted.

### **Dismissed Students Reconsiderations**

#### **1. Scholastic Achievement Committee**

- a. The Scholastic Achievement Committee will be constituted by the Dean of the corresponding faculty, the Dean of Students and the Dean of Academic Affairs or representative, who will be the president of the committee.
- b. The Scholastic Achievement Committee will consider the applications for dismissed students who they believe have an extraordinary circumstance which led them not to obtain a satisfactory academic progress.

#### **2. Process for dismissed students reconsideration**

- a. Dismissed students who believe they have an extraordinary circumstance which led them not to obtain a satisfactory academic progress may apply for reconsideration to the Scholastic Achievement Committee.
- b. Within the extraordinary circumstances for reconsideration are: severe or prolonged illness of the student, death or prolonged illness of the father, mother, siblings or spouse.
- c. Students must file the following documents at the Registrar's Office:
  - Application for Reconsideration which is available at the Registrar's Office.
  - Proof of Payment of the application for reconsideration for dismissed students. This payment is non-refundable.

- A letter addressed to the Scholastic Achievement Committee stating the circumstances which made the student fail and how they worked out the situation which allows them to now continue their academic work.
- Evidence which supports the extraordinary circumstance or situation.

3. Applications must be filed at the Registrar Office by the last working day of the month of June. After this date no application will be considered.

4. The applications will be evaluated by the Scholastic Achievement Committee. The Registrar Office will inform the student, in writing, the Committee's final decision.

### **Graduation Requirements**

The University of Puerto Rico, Mayagüez Campus, reserves the right to make changes in the different curriculum and degree requirements whenever, in its judgment, these are considered beneficial to the institution. As a rule, a student is entitled to graduate under the officially established requirements at the time of his or her entrance to the institution and should consult with the academic department to obtain a copy of the specific requirements upon enrollment. Both a student who fails to fulfill the graduation requirements within the time period specified in the corresponding curriculum and a student who re-registers after a period of absence from the university are governed by the requirements specific to their graduating class.

To receive a degree, a student must satisfy the following requirements:

- (a) Comply with the specific departmental requirements.
- (b) Students who complete their program with a 3.30–3.49 GPA will graduate with honors (Cum Laude). Those who complete the program with a 3.50–3.94 GPA will graduate with high honors (Magna Cum Laude), and students who completed their programs with a 3.95–4.00 GPA will graduate with maximum honors (Summa Cum Laude).
- (c) Students must have approved the program courses with a minimum of 2.00 GPA.

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- (d) Satisfy the following time-limit requirements for degree-completion:

| Normal Time<br>Required for<br>Completion of<br>Programs | Maximum<br>Time<br>Allowed |
|--|----------------------------|
| 4 years  | 8 years                    |
| 5 years  | 10 years                   |

After this period, the University reserves the right to require that a student repeat all courses which, in the opinion of the respective Dean, needs to be reviewed. In all such cases, the student must obtain the Dean's written authorization in duplicate form as well as a list of the courses to be repeated. Copies of this authorization must be submitted to the director of the respective department and to the registrar.

- (e) Students must have approved the last 28 credit hours of their program of study at the University of Puerto Rico, Mayagüez. Courses taken in any of the University of Puerto Rico campuses or with a sponsor of the UPR Student Exchange Program will be considered as courses taken at the University of Puerto Rico at Mayagüez (Cert. 115-1996-1997, Junta de Síndicos).

- (f) Students must not be under any disciplinary sanction or have a pending resolution of a disciplinary action at any or the disciplinary forums as defined in the Student Manual's (Reglamento General de Estudiantes de la Universidad de Puerto Rico, Reglamento General de Estudiantes de la Universidad de Puerto Rico en Mayagüez).

- (g) Satisfy all financial obligations to the University.

- (h) File an application for the degree, in the Registrar's Office no later than the date specified in the Academic Calendar approved by the Administrative Board.

- (i) Receive faculty recommendation for the degree.

UPRM celebrates commencement exercises once during the academic year at the end of the second semester. Students who meet their course requirements for the degree at the end of the summer session or at the end of the first semester may apply at the Registrar's Office for a certificate indicating that they have completed their studies, but will receive their degree at commencement.

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## **COLLEGE OF AGRICULTURAL SCIENCES**

### **Vision**

The College of Agricultural Sciences will be at vanguard of formal and non-formal education; as well as in research, striving for innovation in sustainable tropical agriculture systems and in the human and environmental sciences that benefit individuals, communities and society in general.

### **Mission**

Contribute to the development, through education, research and extension, of new technologies to innovate in agricultural products for humans and animals through an economically viable, sustainable, and globalized agriculture that will contribute to improvement of the quality of life in our society.

### **Organizational Structure**

The College of Agricultural Sciences is the unit within the Mayagüez Campus where formal education, research, and extension in agricultural sciences are integrated. These three functions are mutually complementary and exist under a central scheme of a three-dimensional organization which includes the Faculty of Agricultural Sciences, the Agricultural Experiment Station, and the Agricultural Extension Service.

University teaching in the field of agriculture began formally in Puerto Rico in 1911 with the establishment of the College of Agriculture at Mayagüez.

The Agricultural Experiment Station of the University of Puerto Rico (AES) was originally established in 1910 as a private entity of the Sugar Producers' Association of Puerto Rico. In 1914, it was transferred to the Government of Puerto Rico. With the Jones Act of 1917, the Agency became part of the Department of Agriculture and Labor, and it was given the name "Insular Experiment Station." In 1933, and in accordance with Joint Resolution No. 3 of the Legislature of Puerto Rico, the Experiment Station was transferred to the University of Puerto Rico.

The Smith-Lever Act of 1914 created the Cooperative Extension Service. In Puerto Rico, the establishment of the Agricultural Extension Service in 1934, was made possible by an understanding between the United States Department of Agriculture and the University of Puerto Rico.

The College of Agricultural Sciences was created in accordance with Public Law No. 1, known as the University Law, which was approved on January 20, 1966, and Certification No. 13 of the Council of Higher Education, dated September 11, 1968. The College integrated within Mayagüez Campus formal teaching, research, and extension in agricultural sciences. A management team, composed of the Dean and Director of the College of Agricultural Sciences, the Associate Dean of the College of Agricultural Sciences, the Associate Dean and Deputy Director of the Agricultural Extension Service, and the Associate Dean and Deputy Director of the Agricultural Experiment Station, the Director of Budget and Planning, and the Director of the Office of International Programs, directs the plans and programs of the College, in accordance with Certification No. 174 of September 24, 1980, issued by the Council of Higher Education.

The Office of International Programs adds a dimension of hemispheric cooperation to the College of Agricultural Sciences. Through this office, the College coordinates short course offerings to international participants and trainees; facilitates short term technical assistance to institutions in developing nations; sponsors international graduate student programs; and provides logistic support for faculty exchange and internship programs in tropical agriculture.

The Mayagüez Campus is one of two Land-Grant universities in the tropics, and the only one where Spanish is the native language (although the English language is also used extensively). The campus provides a unique setting, and, to some extent, it is in a privileged position to serve as an international center for studies, training, and research in the fields of agricultural sciences.

Besides the library, laboratories, and farm facilities for research at the Mayagüez Campus and La Montaña in Aguadilla, facilities are also available at the Río Piedras Research Center (AES) and at six substations located in different geographic regions of Puerto Rico. The USDA Tropical Agriculture Research Station (TARS), adjacent to the Mayagüez Campus, offers technical assistance and makes available to graduate students its library and other physical facilities for research.



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## Areas of Study

The College of Agricultural Sciences is responsible for higher learning in the agricultural sciences; its basic function is performed at three different levels. The main emphasis is placed on the bachelor programs, but it includes a non-degree program in Pre-Veterinary and graduate studies at the Masters degree level.

At the undergraduate level, the College of Agricultural Sciences offers programs leading to a Bachelor in Agricultural Sciences. Students are trained in all areas related to the science and art of modern agriculture, as well as in the ability to express themselves both orally and in writing. In addition, the student is provided with opportunities for the development of an analytical, critical, and reflective mind.

To accomplish these aims, the College of Agricultural Sciences offers eleven programs leading to the Bachelor's degree:

- Agribusiness
- Agricultural Economics
- Agronomy
- Soils
- Animal Science
- Crop Protection
- Agricultural Extension
- General Agricultural Sciences
- Horticulture
- Agricultural and Environmental Systems
- Agricultural Education

In addition, the College offers a non-degree program of study in Pre-Veterinary Studies for those students pursuing Veterinary Medicine and the Department of Agricultural Education offers the alternative to complete the requirements for a certificate for Teacher in Vocational Agriculture.

The College follows an interdisciplinary approach in its programs of study, which, in addition to the various specialties in the agricultural sciences, encompass teaching in natural sciences, social sciences, humanities, and languages. The goal of formal teaching is to prepare scientists, agronomists, and entrepreneurs for the development and progress of Puerto Rico's agriculture and to provide them with the knowledge and competence in their fields of specialization, as well as with indispensable background in socio-humanistic disciplines and the positive attitudes necessary to serve the Island. In order to keep up with the new challenges that confront our society, our programs include disciplines like natural resource conservation and sustainability to

achieve the goal of a sustainable agricultural business in harmony with the environment.

The first year of study is almost the same for all programs in the College of Agricultural Sciences, with the exception of the Pre-Veterinary Program. Beginning in sophomore year, students take the required courses and the professional electives pertaining to a particular field of specialization. All programs require students to enroll at the end of the third year of study in a summer practicum under the supervision of a professor of the department.

At the graduate level, the College of Agriculture offers study programs leading to the Master of Science degree in Animal Science, Agricultural Economics, Agricultural Education, Agricultural Extension, Agronomy, Soils, Crop Protection, Food Science and Technology, and Horticulture. For more information, refer to the Graduate Studies Catalogue of the Mayagüez Campus.

## Cooperative Education Program

The Coop Program offers all qualified students majoring in Agricultural Economics, Agribusiness, Agronomy, Soil, Animal Science, Crop Protection, Horticulture, Mechanical-Agricultural Technology and General Agricultural Sciences Program an opportunity to enhance their academic preparation, acquire valuable work experience, and explore career options. Through this program, students alternate terms of full-time study with terms of full-time paid employment. Work experiences are supervised jointly by a mentor in the cooperating institution (private business or government agency) and a faculty member. A fundamental purpose of cooperative education is on the job training.

## Student Eligibility

To be eligible for the Coop program, students must meet the following minimum requirements:

- To have a 2.50 GPA
- To have completed 2 years of study, and
- To register in professional courses which are considered as pre-requisites by some employers

## Employment Participation

The coop organization is committed, through a written agreement, to provide the student with a learning experience in the workplace and to evaluate the student's work experience. Since during work-

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experience periods students are considered employees of the hiring organization, the following norms are applicable:

- Student is considered an employee of the hiring organization and subject to policies and laws that relate to other employees.
- Student receives compensation in the form of wages for work performed.
- Student is under the supervision of the employer and performs work assigned.
- Employers make hiring decisions.

### **The Plan**

- Work periods are integrated within the curriculum. They do not occur before the initial school term or after the final school term has been completed.
- A student must be registered in the cooperative education course assigned and will receive six credit-hours in free electives for a minimum of two work experiences; one must take place during a regular semester.

## **Agricultural Experiment Station**

The role of the Agricultural Experiment Station (AES) is to provide the scientific and technological base necessary for the development of the agricultural and rural sectors of Puerto Rico. As part of its functions, the Agricultural Experiment Station also conducts agro-industrial research related to the preservation, processing and added-value of agricultural products. The research program has incorporated urban horticulture and the assessment of quality and use of agricultural and industrial by-products. This program is in accordance with the appropriate environmental and governmental policies. In each field, activities are developed in both basic and applied research.

The Station has central offices and research activities at the two main research centers at Mayagüez and Río Piedras. In addition to the main Research Centers, the Agricultural Experiment Station has six substations with a total area of more than 2,000 acres of land distributed in different geographical and ecological zones of Puerto Rico. The Substations at Adjuntas and Corozal are located in the central, humid mountainous region. Those at Lajas and Juana Díaz are in the dry, flat coastal southern region. The Substation at Isabela is in the sub-humid northern region and the Gurabo Substation is in the east central region. This wide distribution allows for the evaluation of different crops

and animal production systems in the ecological zones where they best adapt.

## **Agricultural Extension Service**

The Agricultural Extension Service's basic aim is to educate on recommended practices to maintain a prosperous agriculture, improve the quality of family life, and provide adequate orientation and guidance for youth and for the development of community resources.

The Agricultural Extension Service is the informal education branch of the College of Agricultural Sciences and offers its services through four main programs:

- Educational Programs in Agriculture, Marketing and Natural Resources
- Family and Consumer Sciences
- Youth and 4-H Clubs
- Community Resources Development.

The administrative unit of the Agricultural Extension Service has two main offices located at Mayagüez and Río Piedras, and five regional offices located in San Juan, Arecibo, Mayagüez, Ponce and Caguas. In addition, 55 local offices fulfill educational functions by serving the 78 municipalities of Puerto Rico. In each of the areas served by the Agricultural Extension Service, a citizens' committee collaborates with professional personnel in the preparation and development of annual work plans for the agency which responds to Puerto Rico's needs.

## **International Programs in Agriculture**

The Office of International Programs in Agriculture administers a number of training and research programs in tropical agriculture, mainly through the use of external funds provided to the University by international agencies in the field of agriculture.

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## Courses of Instruction

**CIAG 3025. LIBRARY RESOURCES IN AGRICULTURAL SCIENCES.** One credit hour. One hour of lecture per week.

Discussion of available library resources in agricultural sciences, their use, how to discriminate between different sources of information and how to utilize the information for writing papers and preparing oral presentations. Study and discussion of research publications in agricultural sciences.

**CIAG 4999. UNDERGRADUATE RESEARCH.** One to three credit hours. Three hours of research per week per credit. Prerequisite: authorization of the Director of the Department.

Exposition to research careers in agricultural sciences. Use of the scientific method in the completion of a research project in the student's area of study under the guidance of a faculty member of the College of Agricultural Sciences. Experience in the creation of a research project from its conception to the presentation of its work in several scientific forums. Oral and written presentations at the end of the course. Presentation of a scientific poster.

**CITA 3015. INTRODUCTION TO FOOD SCIENCE.** Three credit hours. Three hours of lecture per week.

Introduction to composition concepts and the functionality of the major food components. It will show the physical and chemical properties of food, processing methods as well as basic concepts in microbiology, food handling and safety, and sensory analysis.

**CITA 4055. SEMINAR.** One credit hour. One hour of seminar per week. Prerequisites: CITA 4997-Food Science Practicum or CITA 4999-Undergraduate Research or authorization of the Director of the Department.

Discussion of problems, experiences, research, and recent findings in food science and technology.

**CITA 4305. NUTRITION AND FOOD TECHNOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: (QUIM 3002 or ((QUIM 3132 and QUIM 3134) or QUIM 3042)) and (BIOL 3022 or BIOL 3052 or BIOL 4015 or CIBI 3002).

Study of the basic concepts of nutrition, nutritional components of food and the function of nutrients in the human body. Analysis of the effect of technology in the nutritional value of food. Introduction of the role of biotechnology in the production, selection, new product development and food consumption.

**CITA 4995. SUPERVISED PROFESSIONAL OCCUPATIONAL EXPERIENCE FOR COOP PLAN STUDENTS.** Three to six credit hours. Thirty hours of supervised practice per week. Prerequisite: authorization of the Director of the Department.

Practicum in Food Science and Technology in cooperation with the private sector or government jointly supervised by the academic program, the coop program coordinator, and an official from the cooperating entity.

**CITA 4997. FOOD SCIENCE PRACTICUM.** Three credit hours. Thirty hours of supervised practice per week. Prerequisite: Minimum of 12 credits in applicable courses of the curricular sequence or authorization of the Program Coordinator.

Practical professional experience in food science and technology. Student supervision carried out in collaboration between the program and the public or private entity hosting the student.

**CITA 4999. UNDERGRADUATE RESEARCH.** One to three credit hours. One to three hours of research per week. Prerequisite: authorization of the Director of the Department.

Use of the scientific method for the completion of a research project in the student's area of study under the guidance of a faculty member of the Food Science and Technology Program.

## Advanced Undergraduate Courses

**CITA 5005. QUALITY CONTROL IN THE FOOD INDUSTRY.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3172 or authorization of the Director of the Department.

Study of quality control tools and the processes of continuous improvement applied to the food industry.

**CITA 5006. QUALITY AND SAFETY MANAGEMENT IN FOOD PROCESSING.** Three credit hours. Two hours of lecture and three hours of laboratory per week.

Safety and quality principles of the management of a food processing plant in Puerto Rico.

**CITA 5007. FOOD INDUSTRY LAWS AND REGULATIONS.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Identify key topics and core concepts so that food scientists recognize the laws and regulations that govern the production and handling of foods in the United States and around the world.

**CITA 5995.** SPECIAL PROBLEMS IN FOOD SCIENCE AND TECHNOLOGY. One to three credit hours. One hour of lecture per week per credit.

Study and research of a specific problem in the area of Food Science and Technology selected by the student and the professor.

**CITA 5996.** SPECIAL PROBLEMS IN FOOD SCIENCE AND TECHNOLOGY II. One to three credit hours. One hour of lecture per week per credit.

Study and research of a specific problem in the area of Food Science and Technology selected by the student and the professor.

## GENERAL PROGRAM IN AGRICULTURAL SCIENCES

(Interdepartmental Program)

The great diversity of crop and animal enterprises which characterizes the Island's agriculture requires well prepared individuals to identify and solve the multiple varied problems which commonly affect agricultural enterprises, rural life, economic and social development.

The curriculum of the General Program in Agricultural Sciences is primarily designed to prepare students for employment as agronomists and professional agriculturists. Graduates from this program may occupy positions, which require broad knowledge and skills in agricultural sciences.

The General Program in Agricultural Sciences offers greater opportunities for studying the technical aspects of agriculture. A student of this program chooses professional electives in any of the other programs in agricultural sciences. A three-credit summer practicum is required as part of the curriculum.

### Vision

The General Program in Agricultural Sciences is a holistic approach to all the disciplines in the Faculty of Agricultural Sciences, providing diverse experiences

to individuals seeking a professional career in Agriculture.

### Mission

To provide high quality interdisciplinary education for undergraduate students pursuing a degree in Agricultural Sciences. For those students who have not decided on a major at the time of application, the program provides the opportunity to be in contact with diverse disciplines in Agriculture while continuing their studies.

Definition of General Education for the General Program in Agricultural Sciences:

A series of courses and formal experiences to broaden the student's intellectual perspective beyond the focus of a major and to set them on the path to becoming educated members of society. To foster appreciation for the many perspectives and the diverse voices that may be heard in a democratic society.

It encourages students to consider the relationships between disciplines, providing fundamental knowledge for advanced courses.

The General Program in Agricultural Sciences Student Learning Outcomes:

1. Communicate effectively in written and oral forms in Spanish and English.
2. Identify and solve problems, think critically and synthesize information.
3. Demonstrate leadership and capacity to face today's challenges.
4. Utilize computers and informatics technology as work tools.
5. Apply values and ethical principles.
6. Capacity to engage in life-long learning.
7. Develop an interdisciplinary and global vision for its discipline and environmental issues.

General Education Requirements for the General Program in Agricultural Sciences

| Subject Area | Total Number of Required Credits | Accepted Courses   |
|--------------|----------------------------------|--|
| Spanish      | 6                                | ESPA 3101, ESPA 3102   |
| English      | 12                               | INGL 3101, INGL 3102, INGL 3201, (INGL 3202 or INGL 3209 or INGL 3289) or advanced |

|                                 |    |   |
|---------------------------------|----|---|
| Humanities                      | 6  | ALEM, ARTE, CHIN, FILO, FRAN, GRIE, HUMA, ITAL, JAPO, LATI, LITE, MUSI, RUSO, or TEAT   |
| Social Sciences                 | 6  | ECON 3021, ANTR, CIPO, CISO, ECAG 3005, ECAG 3015, ECAG 4006, ECAG 4027, ECON 3022, ECON 3091, ECON 3092, ECON 4037, ECON 4056, GEOG, HIST, PSIC, or SOCI |
| Mathematics                     | 6  | MATE 3171 and MATE 3172   |
| Sciences (Biological /Physical) | 34 | QUIM 3131-3133, QUIM 3132-3134, QUIM 3061 or QUIM 3461-3462, QUIM 3062 or QUIM 3463-3464, BIOL 3051, BIOL 3052, BIOL 3770, BIOL 3300 and FISI 3091-3092   |
| Physical Education              | 2  | EDFI or RECR  |
| General Education Curriculum    | 72 |   |

### Articulated Transfer Programs

In accordance with the Institutional Policy of the University of Puerto Rico on transfer programs and student movement between units of the University of Puerto Rico (Certification 115 of the Board of Trustees 1996-1997), the Mayagüez Campus (UPRM) has two agreements for Articulated Transfer Programs within the University of Puerto Rico at the Utuado and Cayey Campuses. The Articulated Transfer Programs offers the students the opportunity to take the first two (2) years in general studies leading to the Bachelor of Science Degree in Agricultural Sciences of the General Program in Agricultural Sciences enabling their transfer to the UPRM to complete the degree.

## PROGRAM OF STUDY

### GENERAL PROGRAM IN AGRICULTURAL SCIENCES CURRICULUM (Interdepartmental Program)

#### FIRST YEAR

##### First Semester

| Number     | Credits | Course                             |
|------------|---------|------------------------------------|
| *INGL 3--- | 3       | First year course in English       |
| *ESPA 3101 | 3       | Basic course in Spanish I          |
| *MATE 3171 | 3       | Pre-Calculus I                     |
| BIOL 3051  | 4       | General Biology I                  |
| CFIT 3005  | 4       | Fundamentals of Crop Production    |
| EDFI ----  | 1       | Basic course in Physical Education |
|            | 18      |                                    |

##### Second Semester

| Number         | Credits | Course  |
|----------------|---------|---|
| *INGL 3---     | 3       | First year course in English                  |
| *ESPA 3102     | 3       | Basic course in Spanish II                    |
| *MATE 3172     | 3       | Pre-Calculus II                               |
| BIOL 3052      | 4       | General Biology II                            |
| CIAN 3011      | 3       | Fundamentals of Animal Science                |
| CIAN 3012      | 1       | Laboratory of Practices<br>In Animal Science  |
| CIAG 3025 ---- | 1       | Library Resources in Agricultural<br>Sciences |
|                | 18      |   |

#### SECOND YEAR

##### First Semester

| Number       | Credits | Course                                     |
|--------------|---------|--|
| INGL 3---    | 3       | Second year course in English              |
| BIOL 3300    | 3       | Genetics                                   |
| QUIM 3131    | 3       | General Chemistry I                        |
| QUIM 3133    | 1       | General Chemistry Lab I                    |
| ECON 3021 or | 3       | Principles of Economics:<br>Microeconomics |
| ECAG 3005    |         | Principles of Agricultural Economic        |
| EDAG 3005    | 1       | Agricultural Orientation                   |
| EDFI ----    | 1       | Basic course in Physical<br>Education      |
| ELECTIVES    | 3       | **Electives                                |
|              | 18      |  |

##### Second Semester

| Number     | Credits | Course                         |
|------------|---------|--------------------------------|
| *INGL 3--- | 3       | Second year course in English  |
| FISI 3091  | 3       | Elements of Physics            |
| FISI 3092  | 1       | Elements of Physics Laboratory |
| QUIM 3132  | 3       | General Chemistry II           |

|           |          |                          |
|-----------|----------|--------------------------|
| QUIM 3134 | 1        | General Chemistry Lab II |
| PROC 4006 | 3        | Tropical Phytopathology  |
| ELECTIVES | <u>3</u> | **Electives              |
|           | 17       |                          |

### THIRD YEAR

#### First Semester

| Number        | Credits  | Course   |
|---------------|----------|--|
| QUIM 3061, or | 4        | Fundamentals of Organic Chemistry and Biochemistry I |
| QUIM 3461     |          | Organic Chemistry I                                  |
| QUIM 3462     |          | Organic Chemistry Laboratory I                       |
| AGRO 3011     | 2        | Fundamentals of Soil Sciences                        |
| AGRO 3013     | 1        | Soil Sciences Laboratory                             |
| HORT 4009     | 3        | Horticultural Crops                                  |
| PROC 4008, or |          | Agricultural Entomology, or                          |
| PROC 4017, or | 3        | Weed Control, or                                     |
| PROC 4018     |          | Introduction to Agronomy                             |
| ELECTIVES     | <u>4</u> | **Electives  |
|               | 17       |  |

#### Second Semester

| Number        | Credits  | Course  |
|---------------|----------|---|
| SAGA 4015     | 3        | Agricultural Machinery I                              |
| BIOL 3770     | 3        | General Microbiology                                  |
| QUIM 3062, or | 4        | Fundamentals of Organic Chemistry and Biochemistry II |
| QUIM 3463     |          | Organic Chemistry II                                  |
| QUIM 3464     |          | Organic Chemistry Laboratory II                       |
| CIAN 4010     | 4        | Animal Feeding and Nutrition                          |
| ELECTIVES     | <u>3</u> | **Electives   |
|               | 17       |   |

### SUMMER SESSION

| Number | Credits | Course           |
|--------|---------|------------------|
| ****   | 3       | Summer Practicum |

### FOURTH YEAR

#### First Semester

| Number    | Credits  | Course                                      |
|-----------|----------|---|
| HUMA ---- | 3        | ***Elective course in Humanities            |
| CFIT 4005 | 3        | Physiological Principles of Crop Production |
| ECAG 4019 | 3        | Introduction to Farm Management             |
| CIAN 4005 | 3        | Veterinary Physiology                       |
| ELECTIVES | <u>3</u> | **Electives                                 |
|           | 15       |   |

### Second Semester

| Number    | Credits  | Course                                |
|-----------|----------|---------------------------------------|
| HUMA ---- | 3        | ***Elective course in Humanities      |
| CISO ---- | 3        | ***Elective course in Social Sciences |
| *****     | 1        | Seminar                               |
| ELECTIVES | <u>2</u> | **Electives                           |
|           | 16       |                                       |

### Total credits required for program: 139

\* Refer to the Academic Regulations section for information on Advanced Placement.

\*\* Minimum requirements of electives. The General Program in Agricultural Sciences requires a minimum of 25 credits in elective courses. At least 13 of these credits should be professional electives chosen from among the course offerings of the Faculty of Agricultural Sciences, with the approval of the Dean of the Faculty. The twelve remaining courses correspond to free electives.

\*\*\* Elective courses in the Social Sciences and Humanities will be chosen from among the offerings of the corresponding department with the approval of the Dean of Agricultural Sciences.

\*\*\*\* Students may enroll in a Summer Practicum of any Department of the Faculty of Agricultural Sciences in which they fulfill the requirements.

\*\*\*\*\* Students should enroll in a seminar in which they fulfill the requirements of the academic program.

^ Only for students who are in the Basic English Sequence; choose from the following courses: INGL 3202, INGL 3209 or INGL 3289.

### COURSES OF INSTRUCTION

#### Undergraduate Courses

**CIAG 4995. AGRICULTURAL SCIENCES INTERNSHIP.** One to six credit hours. Prerequisite: authorization of the Director of the Department.

Work experience in Agricultural Sciences supervised and evaluated by a faculty member in coordination with a government agency, academic or research institution, private enterprise or foundation, based on the student's academic background and work requirements.

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## DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

### Mission

The mission of the Department of Agricultural Economics and Rural Sociology is to develop professionals by means of a formal education, research, and extension service in the fields of agricultural economics and agribusiness. Contribute, through education, research and dissemination, to the development of agro-industries and economically viable and competitive agriculture. This includes the stages of production, processing and marketing of food, as well as the conservation of the environment, contributing to a better quality of life.

### Vision

The vision of the Department of Agricultural Economics and Rural Sociology is to be a leader in agricultural and agri-business education and research in Puerto Rico through an interdisciplinary team. Maintain close collaboration with the public and private sectors, projecting them towards other tropical regions of the world, particularly towards the Caribbean Basin.

The general undergraduate program education from our department offers a Bachelor of Agricultural Sciences (B.A.S.) degree with options in Agricultural Economics or Agribusiness. The Agricultural Economics option prepares students in understanding and solving problems in production, marketing, financing, distribution of food products and resource management. Meanwhile, the Agribusiness option prepares students for careers in agribusiness and general business, which provide goods and services for the production, processing and marketing of foods and fibers.

### Student Learning Outcomes

The general education student learning outcomes from our department are the following:

- Students learn how to integrate business management, economics, and marketing principles with technical knowledge in

Agricultural Sciences to develop necessary decision-making skills.

- Develops student's decision-making skills applicable to daily events in the private sector, the government and at the local and global economy levels.
- Agribusiness students should develop skills and knowledge in order to solve problems within and among related industries.
- Applying economic concepts and problem-solving techniques to economic and business decisions.
- The development of entrepreneurial skills.

The local chapter of the American Agricultural Economics Student Association is an affiliate of the American Agricultural Economics Association.

### PROGRAM OF STUDY

#### AGRICULTURAL ECONOMICS CURRICULUM

##### Summary of Credits in Program

|                           |           |
|---------------------------|-----------|
| General education courses | 60        |
| Faculty requirements      | 27        |
| Departmental requirements | 43        |
| Free electives            | <u>12</u> |
| Total                     | 142       |

##### FIRST YEAR

###### First Semester

| Number     | Course                             | Credits  |
|------------|------------------------------------|----------|
| *INGL 3--- | First year course in English       | 3        |
| *ESPA 3101 | Basic course in Spanish I          | 3        |
| *MATE 3171 | Pre-Calculus I                     | 3        |
| QUIM 3131  | General Chemistry I                | 3        |
| QUIM 3133  | General Chemistry Lab. I           | 1        |
| CFIT 3005  | Fundamentals of Crop Production    | 4        |
| EDFI ----  | Basic course in Physical Education | <u>1</u> |
|            |                                    | 18       |

###### Second Semester

| Number     | Course                       | Credits |
|------------|------------------------------|---------|
| *INGL 3--- | First year course in English | 3       |
| *ESPA 3102 | Basic course in Spanish II   | 3       |
| *MATE 3172 | Pre-Calculus II              | 3       |
| QUIM 3132  | General Chemistry II         | 3       |

|           |  |                |
|-----------|--|----------------|
| QUIM 3134 | General Chemistry Lab. II                    | 1              |
| CIAN 3011 | Fundamentals of Animal Science               | 3              |
| CIAN 3012 | Laboratory Of Practices<br>In Animal Science | 1              |
| EDFI ---- | Basic course in Physical<br>Education        | $\frac{1}{18}$ |

## SECOND YEAR

### First Semester

| Number    | Course   | Credits        |
|-----------|--|----------------|
| INGL 3--- | Second year course in English                    | 3              |
| BIOL 3051 | General Biology I                                | 4              |
| ECON 3021 | Principles of Economics:<br>Microeconomics       | 3              |
| EDAG 3005 | Agricultural Orientation                         | 1              |
| MATE 3049 | Mathematical Analysis for<br>Management Sciences | 3              |
| ELECTIVES | **Electives                                      | $\frac{3}{17}$ |

### Second Semester

| Number     | Course  | Credits        |
|------------|---|----------------|
| ^INGL 3--- | Second year course in English                   | 3              |
| FISI 3091  | Elements of Physics                             | 3              |
| FISI 3092  | Elements of Physics<br>Laboratory               | 1              |
| ECON 3022  | Principles of Economy:<br>Macroeconomics        | 3              |
| ECAG 3005  | Principles of Agricultural<br>Economic Analysis | 3              |
| BIOL 3052  | General Biology II                              | $\frac{4}{17}$ |

## THIRD YEAR

### First Semester

| Number    | Course                                   | Credits        |
|-----------|--|----------------|
| ECON 3091 | Micro-economic Theory                    | 3              |
| ECAG 4007 | Marketing of Agricultural<br>Products    | 3              |
| AGRO 3011 | Fundamentals of Soil Sciences<br>and     | 2              |
| AGRO 3013 | Soil Sciences Laboratory                 | 1              |
| ESMA 3101 | Applied Statistics I                     | 3              |
| ELECTIVES | **Electives                              | 3              |
| CISO ---- | ***Elective course in Social<br>Sciences | $\frac{3}{18}$ |

### Second Semester

| Number    | Course                | Credits |
|-----------|-----------------------|---------|
| ECON 3092 | Macro-economic Theory | 3       |
| ECAG 4028 | Agricultural Finance  | 3       |

|           |  |                |
|-----------|--|----------------|
| SAGA 4015 | Agricultural Machinery I                       | 3              |
| CFIT 4005 | Physiological Principles in<br>Crop Production | 3              |
| ESMA 3102 | Applied Statistics II                          | 3              |
| CISO ---- | ***Elective course in Social<br>Sciences       | $\frac{3}{18}$ |

## SUMMER SESSION

| Number    | Course                           | Credits |
|-----------|----------------------------------|---------|
| ECAG 4005 | Agricultural Economics Practicum | 3       |

## FOURTH YEAR

### First Semester

| Number    | Course                           | Credits         |
|-----------|----------------------------------|-----------------|
| HUMA ---- | ***Elective course in Humanities | 3               |
| ECAG 4025 | Seminar                          | 1               |
| ELECTIVES | **Electives                      | $\frac{12}{16}$ |

### Second Semester

|           |                                  |                 |
|-----------|----------------------------------|-----------------|
| HUMA ---- | ***Elective course in Humanities | 3               |
| ECAG 4019 | Farm Management and Accounting   | 3               |
| ELECTIVES | **Electives                      | $\frac{11}{17}$ |

## Total credits required for program: 142

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*Minimum requirements in electives. The Department of Agricultural Economics requires a minimum of 29 credits in elective courses. At least 12 should be in professional electives chosen from among Department offerings or from related areas. Also, 5 elective credits should be taken from offerings of other departments in the Faculty of Agricultural Sciences. In both cases, courses must be selected with the authorization of the Director of Agricultural Economics. The remaining 12 credits are free electives.

\*\*\*The elective courses in Social Sciences and Humanities will be selected with the authorization of the Director of the Department of Agricultural Economics and Rural Sociology.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.



## AGRIBUSINESS CURRICULUM

### Summary of Credits in Program

|                           |            |
|---------------------------|------------|
| General education courses | 60         |
| Faculty requirements      | 27         |
| Departmental requirements | 42         |
| Free electives            | <u>12</u>  |
| <b>Total</b>              | <b>141</b> |

### FIRST YEAR

#### First Semester

| Number     | Course                             | Credits  |
|------------|------------------------------------|----------|
| *INGL 3--- | First year course in English       | 3        |
| *ESPA 3101 | Basic course in Spanish I          | 3        |
| *MATE 3171 | Pre-Calculus I                     | 3        |
| QUIM 3131  | General Chemistry I                | 3        |
| QUIM 3133  | General Chemistry Laboratory I     |          |
| CFIT 3005  | Fundamentals of Crop Production    | 4        |
| EDFI ----  | Basic course in Physical Education | <u>1</u> |
|            |                                    | 18       |

#### Second Semester

| Number     | Course                                    | Credits  |
|------------|---|----------|
| *INGL 3--- | First year course in English              | 3        |
| *ESPA 3102 | Basic course in Spanish II                | 3        |
| *MATE 3172 | Pre-Calculus II                           | 3        |
| QUIM 3132  | General Chemistry II                      | 3        |
| QUIM 3134  | General Chemistry Lab. II                 | 1        |
| CIAN 3011  | Fundamentals of Animal Science            | 3        |
| CIAN 3012  | Laboratory Of Practices in Animal Science | 1        |
| EDFI ----  | Basic course in Physical Education        | <u>1</u> |
|            |   | 18       |

### SECOND YEAR

#### First Semester

| Number    | Course  | Credits  |
|-----------|---|----------|
| INGL 3--- | Second year course in English                 | 3        |
| BIOL 3051 | General Biology I                             | 4        |
| CONT 3011 | Financial Accounting Principles I             | 3        |
| ECON 3021 | Principles of Economics: Microeconomics       | 3        |
| EDAG 3005 | Agricultural Orientation                      | 1        |
| MATE 3049 | Mathematical Analysis for Management Sciences | <u>3</u> |
|           |   | 17       |

### Second Semester

| Number      | Course                                | Credits  |
|-------------|---------------------------------------|----------|
| ^ INGL 3--- | Second year course in English         | 3        |
| FISI 3091   | Elements of Physics                   | 3        |
| FISI 3092   | Laboratory for Elements of Physics    | 1        |
| ECON 3022   | Principles of Economy: Macroeconomics | 3        |
| BIOL 3052   | General Biology II                    | 4        |
| CONT 3012   | Financial Accounting Principles II    | <u>3</u> |
|             |                                       | 17       |

### THIRD YEAR

#### First Semester

| Number                    | Course                             | Credits  |
|---------------------------|------------------------------------|----------|
| +Course in Social Science |                                    | 3        |
| ECAG 4007                 | Marketing of Agricultural Products | 3        |
| AGRO 3011                 | Fundamentals of Soil Sciences and  | 2        |
| AGRO 3013                 | Soil Sciences Laboratory           | 1        |
| ESMA 3101                 | Applied Statistics I               | 3        |
| ELECTIVES****             | Electives in Agricultural Sciences | 3        |
| ELECTIVES**               | Professional Electives             | <u>3</u> |
|                           |                                    | 18       |

#### Second Semester

| Number                    | Course                                      | Credits  |
|---------------------------|---|----------|
| +Course in Social Science |   | 3        |
| ECAG 4028                 | Agricultural Finance                        | 3        |
| SAGA 4015                 | Agricultural Machinery I                    | 3        |
| CFIT 4005                 | Physiological Principles of Crop Production | 3        |
| ELECTIVES                 | Free Electives                              | 3        |
| ELECTIVES**               | Professional Electives                      | <u>3</u> |
|                           |   | 18       |

### SUMMER SESSION

| Number    | Course                           | Credits  |
|-----------|----------------------------------|----------|
| ECAG 4005 | Agricultural Economics Practicum | <u>3</u> |
|           |                                  | 3        |

### FOURTH YEAR

#### First Semester

| Number    | Course                           | Credits |
|-----------|----------------------------------|---------|
| ELECTIVES | ***Elective course in Humanities | 3       |
| ECAG 4025 | Seminar                          | 1       |

|           |  |                |
|-----------|--|----------------|
| ADMI 3009 | Introduction to Business,<br>Management, and Ethics  | 4              |
| ADMI 4001 | Introduction to Law                                  | 3              |
| ELECTIVES | Free Electives                                       | 3              |
| ELECTIVES | **Professional Electives in<br>Business Adm. Faculty | <u>3</u><br>17 |

## Second Semester

| Number        | Course                                | Credits        |
|---------------|---------------------------------------|----------------|
| ECAG 4019     | Farm Management and<br>Accounting     | 3              |
| ELECTIVES**** | Electives in Agricultural<br>Sciences | 3              |
| ELECTIVE***   | Elective course in Humanities         | 3              |
| ELECTIVE      | Free Electives                        | <u>6</u><br>15 |

## Total credits required for program: 141

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*Minimum required credits in electives. A minimum of 9 credits as professional electives, to be taken from among the offerings of the Department of Agricultural Economics and Rural Sociology, the Department of Economics of the College of Arts and Sciences and the College of Business Administration. At least 3 credits must be taken in this last College.

\*\*\*A minimum of 6 credits as electives in Humanities must be taken from among the offerings of the Department of Humanities with the authorization of the Director of the Department of Agricultural Economics and Rural Sociology.

\*\*\*\*A minimum of 6 credits must be taken as electives in agricultural sciences from among the offerings of the different departments of the Faculty of Agricultural Sciences, except the Agricultural Economics and Rural Sociology and Agricultural Education Departments.

+ Choose from the following courses at 3000 level or higher: ANTR XXXX, GEOG XXXX, HIST XXXX, CIPO XXXX, PSIC XXXX, CISO XXXX, SOCI XXXX.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## DEPARTMENTAL FACULTY

**CARMEN I. ÁLAMO-GONZÁLEZ**, *Professor Ad Honorem* (Agricultural and Applied Economics), Ph.D., 2012, Texas Tech University, Lubbock, TX.

**VIVIAN CARRO-FIGUEROA**, *Professor* (Rural Sociology), M.A., 1976, University of London.

**MYRNA COMAS-PAGÁN**, *Professor* (International Business), Ph.D., 2009, University of Puerto Rico, Río Piedras Campus.

**MILDRED CORTÉS-PÉREZ**, *Professor* (Economics), M.A., 1995, University of Puerto Rico, Río Piedras Campus.

**FLOR M. DELGADO-PHILIPPI**, *Associate Professor*, M.B.A., 1983, Louisiana State University.

**GLADYS M. GONZÁLEZ-MARTÍNEZ**, *Professor*, (Natural Resources Economics), Ph.D., 1984, University of Missouri, Columbia.

**JULIO C. HERNÁNDEZ-CORREA**, *Assistant Professor*, (Applied Economics), Ph.D., 2010, Western Michigan University, Kalamazoo.

**ALWIN J. JIMÉNEZ-MALDONADO**, *Professor*, (Agricultural Economics), Ph.D., 2011, Pennsylvania State University, University Park, PA.

**JORGE A. GONZÁLEZ-SOTO**, *Professor Ad Honorem*, (Agribusiness and Marketing), Ph.D., 1986, University of Missouri, Columbia; J.D., 1995, Pontifical Catholic University of Puerto Rico.

**ALEXANDRA GREGORY-CRESPO**, *Professor*, (Agricultural Economics), Ph.D., 2008, Kansas State University.

**LUIS R. MEJÍA-MAYMÍ**, *Assistant Extension Specialist* (Agricultural Economics) M.S., 1986, University of Puerto Rico, Mayagüez Campus.

**GERMÁN RAMOS-CARTAGENA**, *Associate Professor* (Sustainable Community Development), Ed.D., 2008, University of Puerto Rico.

**ROBINSON RODRÍGUEZ-PÉREZ**, *Professor*, (Rural Sociology), Ph.D., 2005, State University of New York at Binghamton.

**HÉCTOR S. TAVÁREZ-VARGAS**, *Assistant Professor*, (Environmental Sciences, Economics), Ph.D., 2016, University of Idaho, Moscow.

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## COURSES OF INSTRUCTION

### DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

#### Undergraduate Courses

**ECAG 3005.** PRINCIPLES OF AGRICULTURAL ECONOMIC ANALYSIS. Three credit hours. Three hours of lecture per week.

Introduction to the field of agricultural economics, with emphasis on the aspects of production. Includes study of the use of economic principles in agricultural production and of supply and demand, and elementary notions of policy making.

**ECAG 3007.** INTRODUCTION TO THE USE OF COMPUTERS IN THE AGRICULTURAL SCIENCES. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Introduction to computer use, basic concepts of word processor, spreadsheet, and presentation software. Student will use these tools to: create, manage and summarize data bases, create graphs, and write scientific reports with applications to agricultural sciences and agribusiness.

**ECAG 3015.** AGRICULTURAL LAW. Three credit hours. Three hours of lecture per week.

Analysis of different aspects of law relevant in the agribusiness decision-making process.

**ECAG 4005.** AGRICULTURAL ECONOMICS PRACTICUM. Three credit hours. A minimum of thirty hours per week during six consecutive weeks. Prerequisite: A minimum of twelve credits in Agricultural Economics and authorization of the Director of the Department.

Practical work experience in Agricultural Economics or Agribusiness. It will be under the supervision of the Department in collaboration with public or private entities.

**ECAG 4006.** INTRODUCTION TO CONSUMER ECONOMICS. Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021 or ECAG 3005.

An examination of topics that illustrate the ways in which consumers make decisions. Emphasis is given to the use of economic principles with respect to use of credit, and the purchase of food, housing, medical plans, education, automobiles, insurance, recreation, and other consumption items.

**ECAG 4007.** MARKETING OF AGRICULTURAL PRODUCTS. Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021 or ECAG 3005.

A general comprehensive study of agricultural products marketing institutions, functions and problems, with emphasis on the Puerto Rican situation. Includes study of supply and demand, market structures, prices, and marketing costs at the various levels of the distribution process.

**ECAG 4009.** COOPERATIVE ENTERPRISES. Three credit hours. Three hours of lecture per week.

Study of economic and social principles of cooperativism and their implication for development. Discussion of the functioning of different types of cooperatives, including legal aspects.

**ECAG 4015.** INTRODUCTION TO RESOURCE ECONOMICS. Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021 or ECAG 3005.

Introduction to the application of economic and political science concepts to problems in the use of natural resources including water, land, forest, and marine resources. Emphasis is given to concepts of regional growth, to the impact of urban development, and the process of public decision-making in the area of natural resources.

**ECAG 4017.** SPECIAL PROBLEMS IN AGRICULTURAL ECONOMICS. One to three credit hours. One to three work periods per week. Prerequisite: authorization of the Director of the Department.

Problems in any of the various phases of agricultural economics will be assigned or may be selected, subject to the approval of the professor in charge.

**ECAG 4019.** FARM MANAGEMENT AND ACCOUNTING. Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: ECON 3021 or ECAG 3005.

Use of economic principles and farm records in the organization and management of a farm business. Includes methods of keeping and analyzing farm records, farm inventory, income and net worth statements, receipts and expenses records, production records, income tax returns; use of economic principles and of records in budgeting; and analysis of aspects of the problems of risk and uncertainty in agriculture. Emphasis is placed on decision-making.

**ECAG 4025. SEMINAR.** One credit hour. One meeting per week. Prerequisites: authorization of the Director of the Department and twelve credits in Agricultural Economics.

Reports and discussions of problems, observation and recent research. Written and oral reports are required.

**ECAG 4026. INTRODUCTION TO RURAL SOCIOLOGY.** Three credit hours. Three hours of lecture per week.

Scientific study of rural society, its population, structure and social processes. Emphasis is given to the rural area of Puerto Rico.

**ECAG 4027. PRINCIPLES OF COMMUNITY ORGANIZATION.** Three credit hours. Three hours of lecture per week.

Study of the community structure and the processes relevant to its social and economic developments.

**ECAG 4028. AGRICULTURAL FINANCE.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021 or ECAG 3005.

Study of the methods and problems in financing the farm business, with emphasis on the aspects of credit. Includes study and analysis of credit requirements, institutions, types and effects.

**ECAG 4029. AGRIBUSINESS MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: ECAG 4019.

Managerial concepts. Application of economic principles. Analytical techniques and decision making procedures in agribusiness. Planning, organization, financial analysis and control; human relations. Case studies, discussion, and work problems involving actual managerial situations.

**ECAG 4035. FARM APPRAISAL.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021 or ECAG 3005.

Application of the process of farm appraisal based on economic, environmental, and market conditions. Study of appraisal concepts relevant to the preparation of a farm value report.

**ECAG 4991. AGRICULTURAL ECONOMIC INTERNSHIP.** One to six credit hours. Prerequisite: authorization of the Director of the Department.

Work experience in Agricultural Economics supervised and evaluated by a departmental member in coordination with a government agency, academic

or research institution, private enterprise or foundation, in accordance with the student's academic background and work requirements.

**ECAG 4993. SELECTED TOPICS I.** One to three credit hours. One to three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Selected topics in Agricultural Economics, Agribusiness, Rural Sociology and other related areas.

**ECAG 4994. SELECTED TOPICS II.** One to three credit hours. One to three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Selected topics in Agricultural Economics, Agribusiness, Rural Sociology and other related areas of interest.

**ECAG 4997. SUPERVISED PROFESSIONAL OCCUPATIONAL EXPERIENCE FOR COOP STUDENTS.** Three to six credit hours. A minimum of two practice periods is required, one of them in a semester. Prerequisites: authorization of the Director of the Department and to be a Coop program student.

Practical experience in agricultural economics and agribusiness management in cooperation with the private sector or government. To be jointly supervised by the academic department, the Coop program coordinator, and an official from the cooperating entity. A written report will be required upon completion of each work period.

### **Advanced Undergraduate and Graduate Courses**

**ECAG 5006. FEASIBILITY STUDIES OF AGRICULTURAL ENTERPRISES.** Three credit hours. Three hours of lecture per week. Prerequisites: ECAG 4019 or authorization of the Director of the Department.

Use and application of feasibility studies for the establishment and development of agricultural enterprises, considering sustainability of the resources.

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## DEPARTMENT OF AGRICULTURAL EDUCATION

### Mission

Contribute to the establishment of a high level of quality of life of the Puerto Rican society. Commitment to the preparation of educators, journalists and leaders to play different positions in the institution of education. Development of individuals and strengthen families so that these members develop self-confidence and increase the administrative and decision-making skills. Develop knowledge and technologist to facilitate individual, family and community development, social integration and economic development °.

### Vision

Being recognized locally, nationally, and internationally for driving research and disseminate information of good quality, to develop curricula and academic programs dynamic and relevant to education, both formal and non-formal; fully prepare educators for agriculture, natural resources, environmental management, individual development, family and community.

### General Education

The Agricultural Education Department offers a program leading to the degree of Bachelor of Agricultural Sciences with majors in Agricultural Education or Extension Education. Graduates from this department may qualify to teach vocational agriculture upon completion of the program of study which includes supervised teaching and other courses required for certification to teach in the school system of Puerto Rico. Graduates in Extension Education may qualify to enter extension and other related educational and public service jobs.

### Learning outcomes

Develop teaching methodology, strategies and techniques to achieve an effective formal and no-formal teaching - learning process. Apply educational, psychology and sociology concepts. Develop effective teaching plans for pedagogical and andragogical educational programs activities. Integrate technology into the curriculum of formal, and no-formal settings.

Develop instructional materials that consider student diversity. Develop, administrate and lead youth organizations. Demonstrate and apply sustainable agricultural practices to effectively educate the learning community. Develop educational programs that address community needs and ethical standards in a global context.

Courses that fulfill the general education requirements

Some areas represented in Agricultural Education courses are:

Teaching Methods  
Curriculum Development  
Organization and Educational Administration  
evaluation

- Educational Technology
- Youth Organizations
- International Agriculture
- Adult Education

Some areas represented in Agricultural Extension courses are:

- Extension Philosophy
- Organization Communities
- Extension Methods and Techniques
- Program Evaluation
- Oral and Written Communication
- Program Development
- Leadership and Group Dynamics
- Organization Communities

## PROGRAM OF STUDY

### AGRICULTURAL EDUCATION CURRICULUM

#### Summary of Credits in Program

|                           |            |
|---------------------------|------------|
| General education courses | 60         |
| Faculty requirements      | 33         |
| Departmental requirements | 19         |
| Professional electives    | 18         |
| Free electives            | <u>12</u>  |
| <b>Total</b>              | <b>142</b> |

#### FIRST YEAR

##### First Semester

| Number     | Course                       | Credits |
|------------|------------------------------|---------|
| *INGL 3--- | First year course in English | 3       |
| *ESPA 3101 | Basic course in Spanish I    | 3       |

|            |   |          |
|------------|---|----------|
| *MATE 3171 | Pre-Calculus I                            | 3        |
| QUIM 3131  | General Chemistry I                       | 3        |
| QUIM 3133  | General Chemistry Laboratory I            | 1        |
| CIAN 3011  | Fundamentals of Animal Science            | 3        |
| CIAN 3012  | Laboratory Of Practices in Animal Science | 1        |
| EDFI 3---  | Basic course in Physical Education        | <u>1</u> |
|            |   | 18       |

## Second Semester

| Number     | Course                             | Credits  |
|------------|------------------------------------|----------|
| *INGL 3--- | First year course in English       | 3        |
| *ESPA 3102 | Basic course in Spanish II         | 3        |
| *MATE 3172 | Pre-Calculus II                    | 3        |
| QUIM 3132  | General Chemistry II               | 3        |
| QUIM 3134  | General Chemistry Lab. II          | 1        |
| CFIT 3005  | Fundamentals of Crop Production    | 4        |
| EDFI 3---  | Basic course in Physical Education | <u>1</u> |
|            |                                    | 18       |

## SECOND YEAR

### First Semester

| Number     | Course                                  | Credits  |
|------------|---|----------|
| INGL 3---  | Second year course in English           | 3        |
| BIOL 3051  | General Biology I                       | 4        |
| ECON 3021  | Principles of Economics: Microeconomics | 3        |
| EDAG 3005  | Agricultural Orientation                | 1        |
| **ELECTIVE | Electives                               | 4        |
| ***HUMA    | Elective course in Humanities           | <u>3</u> |
|            |   | 18       |

### Second Semester

| Number      | Course                            | Credits  |
|-------------|-----------------------------------|----------|
| ^ INGL 3--- | Second year course in English     | 3        |
| BIOL 3052   | General Biology II                | 4        |
| FISI 3091   | Elements of Physics               | 3        |
| FISI 3092   | Elements of Physics Laboratory    | 1        |
| AGRO 3011   | Fundamentals of Soil Sciences and | 2        |
| AGRO 3013   | Soil Sciences Laboratory          | 1        |
| ***HUMA---- | Elective course in Humanities     | <u>3</u> |
|             |                                   | 17       |

## THIRD YEAR

### First Semester

| Number    | Course                                       | Credits |
|-----------|--|---------|
| SAGA 4015 | Agricultural Machinery I                     | 3       |
| PROC 4006 | Tropical Phytopathology                      | 3       |
| CIAN 4005 | Veterinary Physiology                        | 3       |
| ECAG 4019 | Introduction to Farm Business Administration | 3       |

|             |  |          |
|-------------|--|----------|
| EDAG 4005   | Methods in Teaching Vocational Agriculture | 3        |
| ***CISO---- | Elective course in Social Sciences         | <u>3</u> |
|             |  | 18       |

## Second Semester

| Number      | Course  | Credits  |
|-------------|---|----------|
| CFIT 4005   | Physiological Principles of Crop Production               | 3        |
| EDAG 4006   | Curriculum Development                                    | 3        |
| EDAG 4007   | Organization and Administration in Vocational Agriculture | 3        |
| ***CISO---- | Elective course in Social Sciences                        | 3        |
| **ELECTIVES | Professional Electives                                    | <u>6</u> |
|             |   | 18       |

## FOURTH YEAR

### First Semester

| Number      | Course                 | Credits   |
|-------------|------------------------|-----------|
| CIAN 4036   | Farm Animal Diseases   | 3         |
| EDAG 4018   | Teaching Practice I    | 3         |
| **ELECTIVES | Professional Electives | <u>11</u> |
|             |                        | 17        |

### Second Semester

| Number      | Course                          | Credits  |
|-------------|---------------------------------|----------|
| PROC 4008   | Agricultural Entomology         | 3        |
| EDAG 4015   | Youth Organization and Programs | 3        |
| EDAG 4017   | Agricultural Education Seminar  | 1        |
| EDAG 4019   | Teaching Practice II            | 3        |
| **ELECTIVES | Electives                       | <u>8</u> |
|             |                                 | 18       |

## Total credits required for program: 142

- \* Refer to the Academic Regulations section for information on Advanced Placement.
- \*\* Minimum requirements in electives: The Agricultural Education Program requires a minimum of 17 of these credits to be selected from the courses offered by the Agricultural Sciences Faculty or by the Division of Continuing Education and Professional Studies and the remaining 12 credits are free electives.
- \*\*\* The electives in Social Sciences and Humanities require authorization of the Director of the Agricultural Education Department.
- ^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## AGRICULTURAL EXTENSION CURRICULUM

### Summary of Credits in Program

|                           |            |
|---------------------------|------------|
| General education courses | 60         |
| Faculty requirements      | 51         |
| Departmental requirements | 13         |
| Professional electives    | 6          |
| Free electives            | <u>12</u>  |
| <b>Total</b>              | <b>142</b> |

### FIRST YEAR

#### First Semester

| Number     | Course                                       | Credits  |
|------------|--|----------|
| *INGL 3--- | First year course in English                 | 3        |
| *ESPA 3101 | Basic course in Spanish I                    | 3        |
| *MATE 3171 | Pre-Calculus I                               | 3        |
| QUIM 3131  | General Chemistry I                          | 3        |
| QUIM 3133  | General Chemistry Laboratory I               | 1        |
| CIAN 3011  | Fundamentals of Animal Science               | 3        |
| CIAN 3012  | Laboratory Of Practices<br>in Animal Science | 1        |
| EDFI ----  | Basic course in Physical Education           | <u>1</u> |
|            |  | 18       |

#### Second Semester

| Number     | Course                                | Credits  |
|------------|---------------------------------------|----------|
| *INGL 3--- | First year course in English          | 3        |
| *ESPA 3102 | Basic course in Spanish II            | 3        |
| *MATE 3172 | Pre-Calculus II                       | 3        |
| QUIM 3132  | General Chemistry II                  | 3        |
| QUIM 3134  | General Chemistry Lab. II             | 1        |
| CFIT 3005  | Fundamentals of Crop Production       | 4        |
| EDFI 3---  | Basic course in Physical<br>Education | <u>1</u> |
|            |                                       | 18       |

### SECOND YEAR

#### First Semester

| Number       | Course                                     | Credits  |
|--------------|--|----------|
| INGL 3---    | Second year course in<br>English           | 3        |
| BIOL 3051    | General Biology I                          | 4        |
| ECON 3021    | Principles of Economics:<br>Microeconomics | 3        |
| AGRO 3011    | Fundamentals of Soil Sciences<br>and       | 2        |
| AGRO 3013    | Soil Sciences Laboratory                   | 1        |
| EDAG 3005    | Agricultural Orientation                   | 1        |
| ***CISO ---- | Elective course in Social<br>Sciences      | <u>3</u> |
|              |  | 17       |

### Second Semester

| Number       | Course                             | Credits  |
|--------------|------------------------------------|----------|
| ^INGL 3---   | Second year course in English      | 3        |
| FISI 3091    | Elements of Physics                | 3        |
| FISI 3092    | Elements of Physics Laboratory     | 1        |
| BIOL 3052    | General Biology II                 | 4        |
| HORT 3005    | Plant Propagation                  | 3        |
| ***CISO ---- | Elective course in Social Sciences | <u>3</u> |
|              |                                    | 17       |

### THIRD YEAR

#### First Semester

| Number      | Course                                 | Credits  |
|-------------|--|----------|
| PROC 4006   | Tropical Phytopathology                | 3        |
| CIAN 4005   | Veterinary Physiology                  | 3        |
| EXAG 4005   | Extension Philosophy and<br>Objectives | 3        |
| ***HUMA --- | Elective course in Humanities          | 3        |
| **ELECTIVES | Professional Electives                 | <u>5</u> |
|             |  | 17       |

#### Second Semester

| Number      | Course   | Credits  |
|-------------|--|----------|
| CFIT 4005   | Physiological Principles of<br>Crop Production | 3        |
| SAGA 4015   | Agricultural Machinery I                       | 3        |
| EDAG 4015   | Youth Organization and<br>Programs             | 3        |
| EXAG 4006   | Extension Teaching Methods<br>and Techniques   | 3        |
| AGRO 4037   | Soil Fertility and Fertilizers                 | 3        |
| ***HUMA --- | Elective course in Humanities                  | <u>3</u> |
|             |  | 18       |

### SUMMER SESSION

| Number    | Course                           | Credits |
|-----------|----------------------------------|---------|
| EXAG 4007 | Agricultural Extension Practicum | 3       |

### FOURTH YEAR

#### First Semester

| Number      | Course                          | Credits  |
|-------------|---------------------------------|----------|
| CIAN 4036   | Farm Animals Diseases           | 3        |
| PROC 4008   | Agricultural Entomology         | 3        |
| ECAG 4007   | Marketing of Farm Products      | 3        |
| ECAG 4026   | Introduction to Rural Sociology | 3        |
| **ELECTIVES | Electives                       | <u>6</u> |
|             |                                 | 18       |

## Second Semester

| Number      | Course                          | Credits  |
|-------------|---------------------------------|----------|
| EXAG 4009   | Extension Education Seminar     | 1        |
| HORT 4009   | Horticultural Crops             | 3        |
| HORT 4008   | Vegetable Gardening             | 3        |
| ECAG 4019   | Introduction to Farm Management | 3        |
| **ELECTIVES | Electives                       | <u>6</u> |
|             |                                 | 16       |

**Total credits required for program: 142**

- \* Refer to the Academic Regulations section for information on Advanced Placement.
- \*\* Minimum requirements in electives: The Agricultural Extension Program requires a minimum of 18 credits in elective courses. At least 6 of these credits should be professional electives chosen among the course offerings of the Faculty of Agricultural Sciences, with the approval of the Director of the Department. The remaining 12 credits are free electives.
- \*\*\* The electives in Social Sciences and Humanities require authorization of the Director of the Agricultural Education Department.
- ^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## DEPARTMENTAL FACULTY

**LORNA I. CAMPOS MUÑOZ**, *Assistant Professor*, LND, RD, MHScN, 2002, University of Puerto Rico, Medical Sciences Campus, Río Piedras. **Research and Teaching Interests:** Register Dietitian Food and Nutrition Education, Renal, Diabetes and Inborn Errors of Metabolism Certifications.

**IVYS A. FIGUEROA SÁNCHEZ**, *Auxiliary Professor*, DPH, 2009, University of Puerto Rico, Medical Sciences Campus. **Research and Teaching interests:** Public Health.

**JUAN B. FREMAINT IRIZARRY**, *Specialist II and Professor*, M.S., 1997, University of Puerto Rico, Mayagüez Campus. **Research and Teaching interests:** Computer Education.

**ALAN E. IRIBARREN SÁNCHEZ**, *Professor*, M.A., 1998, University of Puerto Rico, Mayagüez Campus. **Research and Teaching Interests:** Club 4-H, Program of Youth Organization.

**ANGÉLICA MARTÍNEZ DÍAZ**, *Professor*, M.A., 2003, University of Phoenix. **Research and Teaching Interests:** Community Resources Development.

**IRCHA I. MARTÍNEZ RODRÍGUEZ**, *Auxiliary Extension Specialist in Consumer Education; Specialist in Family and Consumer Sciences; Educational Leadership*, University of Puerto Rico - Río Piedras Campus. **Research and Teaching Interests:** Personal finance; Saving; Consumer Education; Entrepreneurship; Leadership.

**GLORISSELLE NEGRÓN RÍOS**, *Associate Professor, Specialist in Environmental Health*, M.A., 1994, University of Puerto Rico, Medical Sciences Campus. **Research and Teaching Interests:** Drinking and wastewater quality and air quality.

**DAVID PADILLA VÉLEZ**, *Professor*, Ph.D., 1993, Ohio State University. **Research and Teaching Interests:** Agricultural Education, Teacher Education.

**ROBERTO L. RIGAU LLORÉNS**, *Professor*, M.A., 1997, University of Phoenix. **Research and Teaching Interests:** External Resource.

**MARÍA DEL C. RODRÍGUEZ RODRÍGUEZ**, *Professor, Extension Specialist*, Ph.D., 1997, Cornell University. **Research and Teaching Interests:** Evaluation and Research in the Field.

**EDLY SANTIAGO ANDINO**, *Associate Professor*, Ph.D., 2005, Pennsylvania State University. **Research and Teaching Interests:** Teachers Preparation in Agricultural and Environmental Education, Adult Education, Curriculum Development, Active and Experiential Learning.

**LUIS F. SILVA GUERRERO**, *Professor*, Ph.D., 1988, Cornell University. **Research and Teaching Interests:** Curriculum Development, Higher Education, Development in International Agricultural Projects, Communications, Micro-Computers in Education.

**CARLOS A. VIVONI REMUS**, *Professor, Extension Specialist*, Ph.D., 1991, University of Massachusetts. **Research and Teaching Interests:** Communication and Community empowerment through access to media.



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## COURSES OF INSTRUCTION

### DEPARTMENT OF AGRICULTURAL EDUCATION

#### Undergraduate Courses

**EDAG 3005. AGRICULTURAL ORIENTATION.** One credit hour. One hour of lecture per week.

A survey of the general goals, functions and policies of the main agricultural organizations working in Puerto Rico, emphasizing the objectives of the College of Agricultural Sciences, thus guiding the student in the selection of courses and field of specialization.

**EDAG 3006. INTRODUCTORY INTERNATIONAL AGRICULTURE.** Three credit hours. Three hours of lecture per week. Prerequisite: EDAG 3005.

Study and discussion of world agriculture and food production issues including factors such as: geographical characteristics, cultural issues, and political, social and economic problems. Special attention is given to agricultural production in developing countries and the tropics.

**EDAG 4005. METHODS IN TEACHING VOCATIONAL AGRICULTURE.** Three credit hours. Three hours of lecture per week. Prerequisite: junior standing.

This course is intended to help students develop a sound philosophy of all-day instruction in vocational agriculture. It emphasizes the preparation of annual teaching calendars, job analyzing, the learning process, methods and techniques of teaching, lesson planning and the evaluation of learning.

**EDAG 4006. CURRICULUM DEVELOPMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: EDAG 4005.

Curriculum planning theory and practices. Problems and principles in curriculum development. Defining goals and objectives. Selecting appropriate curriculum designs, and planning curriculum implementation and evaluation.

**EDAG 4007. ORGANIZATION AND ADMINISTRATION IN VOCATIONAL AGRICULTURE.** Three credit hours. Three hours of lecture per week. Prerequisite: EDAG 4005.

The Vocational Education Act: general rules and regulations for the administration and functioning of Vocational Agriculture Department, and the qualification and duties of the teachers of vocational agriculture.

**EDAG 4008. SUPERVISED OCCUPATIONAL EXPERIENCE PROGRAMS.** Three credit hours. Three hours of lecture per week. Prerequisite: EDAG 4005.

Principles, practices and procedures to planning, programming, implementing and evaluating comprehensive supervised farming programs and supervised occupational experience programs. Emphasis will be given to purpose of farm and off farm occupational experience programs. Analysis of home farm and off farms employment experience opportunities and program planning and supervision.

**EDAG 4009. TEACHING YOUNG AND ADULT FARMERS.** Three credit hours. Three hours of lecture per week. Prerequisite: EDAG 4005.

Principles and practice of planning, organizing, promoting, implementing and evaluating young adult farmer courses. Emphasis will be given to the decision-making approach, selection of methods and techniques, lesson planning, class management and evaluation techniques.

**EDAG 4015. YOUTH ORGANIZATION AND PROGRAMS.** Three credit hours. Three hours of lecture per week.

History, philosophy, importance, objectives, and work programs of youth organization. Advisors, function, and characteristics, planning programming, implementation, and evaluation of the organization work program, with emphasis in F.F.A., 4-H, and young farmers.

**EDAG 4016. AUDIOVISUAL MEDIA IN TEACHING VOCATIONAL AGRICULTURE.** Three credit hours. Two hours of lecture and three hours of laboratory per week.

Philosophical and psychological implication of the use of audiovisual media in teaching. Location, selection, and evaluation of the audiovisual material for teaching purposes. Planning, designing and preparation of audiovisual material to teach vocational agriculture. Practice in the operation and management of audiovisual equipment and a media center.

**EDAG 4017. SEMINAR.** One credit hour. One hour of lecture per week. Prerequisite: nine credits in agricultural education or agricultural extension.

Discussion of problems related to the development of instructional programs in vocational agriculture; planning, organization, development, follow-up, evaluation, related legislation and trends.

**EDAG 4018. TEACHING PRACTICE I.** Three credit hours per semester. One hour of lecture and six hours of laboratory work per week, each semester. Prerequisite: EDAG 4005, EDAG 4006. Corequisite: EDAG 4007.

Supervised observation of vocational agriculture teaching. Full time participatory experience of trainees in all phases of the work of vocational agriculture teachers.

**EDAG 4019. TEACHING PRACTICE II.** Three credit hours per semester. One hour of lecture and six hours of laboratory work per week, each semester. Prerequisite: EDAG 4018.

Supervised observation of vocational agriculture teaching. Full time participatory experience of trainees in all phases of the work of vocational agriculture teachers.

**EDAG 4025. EVALUATION OF STUDENTS IN VOCATIONAL AGRICULTURE.** Three credit hours. Three hours of lecture per week. Prerequisite: EDAG 4005.

Principles, criteria, procedures and techniques employed in the evaluation of the performance of students in Vocational Agriculture.

**EDAG 4026. SUPERVISION IN AGRICULTURAL EXTENSION AND VOCATIONAL AGRICULTURE.** Three credit hours. Three hours of lecture per week.

Theories, principles and practice pertaining to supervision in agricultural extension and vocational agriculture; factors that influence needs, philosophies, and types of supervision at the local, regional, state and national levels; training, responsibilities, personal traits and duties of the supervisor.

**EDAG 4030. STUDY TOUR IN AGRICULTURE AND NATURAL RESOURCES.** Three credit hours. Twelve to fifteen hours of orientation meetings and a trip during the summer session. Prerequisite: have completed a minimum of 48 credits of its program of study in the Agricultural Sciences Faculty.

Study tour to foreign countries with the purpose of observing and studying the agricultural industry and the management and conservation of natural resources. The opportunity to become familiarized with governmental agencies, universities, agricultural experimental stations, and natural resources will be provided. Activities to incorporate the cultural aspects of the visited country will be included.

## **AGRICULTURAL EXTENSION**

### **Undergraduate Courses**

**EXAG 4005. EXTENSION PHILOSOPHY AND OBJECTIVES.** Three credit hours. Three hours of lecture per week.

This course is designed to familiarize students with the organization, philosophy, and objectives of the Agricultural Extension Service.

**EXAG 4006. TEACHING METHODS AND TECHNIQUES IN EXTENSION.** Three credit hours. Three hours of lecture per week.

This course covers the various educational methods used by the Extension Service. The students will participate in the major activities of the extension work in the district in cooperation with the local agent of the Puerto Rico Agricultural Extension Service.

**EXAG 4007. AGRICULTURAL EXTENSION PRACTICUM.** Three credit hour. Thirty hours of practice per week. Prerequisites: (INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012))) and (INPE 4005 or CIAN 4005) and CFIT 3005 and (AGRO 3005 or (AGRO 3011 and AGRO 3013)) and EDAG 3005 and HORT 3005 and PROC 4006 and EXAG 4005 and CFIT 4005 and EXAG 4006 and AGRO 4037 and EDAG 4015 and authorization of the Director of the Department.

Practical work experience in agricultural extension. It is carried out under the supervision of the department in collaboration with public and private entities.

**EXAG 4008. SPECIAL PROBLEMS IN EXTENSION.** One to three credit hours. One to three research periods per week. Prerequisite: EXAG 4005.

The student selects and studies an area of extension of his interest, and reports the findings.

**EXAG 4009. SEMINAR IN EXTENSION EDUCATION.** One credit hour. One hour of lecture per week. Prerequisite: EXAG 4005.

Discussions of problems related to Program Planning Development, Rural Development, Farm Home Development, or other phases of Extension work. Areas to be discussed are selected at the beginning of the course.

**EXAG 4015. INTRODUCTION TO AGRICULTURAL COMMUNICATION.** Three credit hours. Three hours of lecture per week.

Principles and practices in communications; skills and knowledge for person to person, group, and mass communication; panel and group discussions. Practical exercises.

**EXAG 4016. GROUP DYNAMICS AND LEADERSHIP.** Three credit hours. Three hours of lecture per week.

Discussion of the research and theory in the study of small groups with emphasis on motivational forces involved, and the leadership function in the attainment of the group goals.

# DEPARTMENT OF AGRICULTURAL AND BIOSYSTEMS ENGINEERING

## Mission

To prepare professionals, by means of education and research, and to help society implement new knowledge and technology through public outreach in the areas of agricultural and environmental systems and engineering.

## Vision

Be a key source of knowledge and support for the betterment and sustainability of agro-industry and the environment through research, public outreach and the preparation of professionals capable of applying technology and engineering practices to achieve sound solutions.

## DEFINITION OF GENERAL EDUCATION

The program of Agricultural and Environmental Systems is administered by the Agricultural and Biosystems Engineering Department. It focuses on practical application of engineering principles and technology to the problems encountered in agriculture and natural resources. In pursuing these objectives, all the main divisions of the agricultural engineering field are considered: farm power and machinery, soils and water management, farm structures and environmental controls, rural electrification, irrigation and drainage and agricultural products processing. Also, it integrates business management concepts to the agricultural and food industries.

## STUDENT LEARNING OUTCOMES

The students completing the academic program of Agricultural and Environmental Systems will be able to:

1. Manage projects for the construction of agricultural structures or electrical installations, including the generation of bill of materials and cost estimate, given the appropriate drawings and specifications.
2. Recommend and adapt agricultural machinery and equipment that meets the

functionality, power and cost requirements of a real life situation.

3. Analyze soil and water conditions of a particular area (i.e., farm or watershed) and perform the necessary calculations to design soil and water management strategies (e.g., irrigation systems, conservation structures).
4. Explain the required processes to transform and add value to the agricultural product.

## COURSE REQUIREMENTS

| Subject Area                 | Total Number of Required Credits | Accepted Courses  |
|------------------------------|----------------------------------|---|
| Spanish                      | 6                                | ESPA 3101, ESPA 3102  |
| English                      | 12                               | INGL 3101, INGL 3102, INGL 3201, (INGL3202 or INGL 3191) or advanced placement  |
| Humanities                   | 6                                | ALEM, ARTE, CHIN, FILO, FRAN, GRIE, HUMA, ITAL, JAPO, LATI, LITE, MUSI, RUSO, TEAT  |
| Social Sciences              | 3                                | ANTR, CIPO, CISO, ECAG 3005, ECAG 3015, ECAG 4006, ECAG 4015, ECAG 4026, ECAG 4027, ECON 3022, ECON 3091, ECON 3092, ECON 4037, ECON 4056, GEOG, HIST, PSIC, SOCI |
| Mathematics                  | 9                                | MATE 3171, MATE 3172, MATE 3049   |
| Sciences                     |                                  |   |
| Biology                      | 8                                | BIOL 3051, BIOL 3052  |
| Physics                      | 4                                | FISI 3091, FISI3092   |
| Chemistry                    | 8                                | QUIM 3131, QUIM 3132, QUIM 3133, QUIM 3134  |
| Physical Education           | 2                                | EDFI, RECR  |
| Free Electives               | 12                               |   |
| Professional Electives       | 11                               | ADMI 4001, AGRO, CIAG, CITA, ECAG, ECON 3022, ECON 3085, EDAG, EXAG, HORT, INAG, INPE, MERC 3115, PROC, SAGA, TMAG  |
| General Education Curriculum | 62                               |   |

## GENERAL REQUIREMENTS

The Agricultural and Environmental Systems Curriculum requires a total of 143 credits. The first year is similar in content as other undergraduate curricula in the College of Agricultural Sciences; specialization gradually begins during the second year. The students, in consultation with the advisor, select 11 credits of professional electives from a list of courses from the Agricultural and Biosystems Engineering Department and other courses from the College of Agricultural Sciences. Also, the students select 12 credits of free electives to refine curricular balance in accordance with their particular interests. During summer, between the third and fourth year, the student participates in a summer practice which is administered in cooperation with various government agencies and the private sector.

## PROGRAM OF STUDY

### AGRICULTURAL AND ENVIRONMENTAL SYSTEMS CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits | Course  |
|------------|---------|---|
| *INGL 3101 | 3       | Basic course in English   |
| *ESPA 3101 | 3       | Basic course in Spanish I   |
| *MATE 3171 | 3       | Pre-Calculus I  |
| ECAG 3007  | 3       | Introduction to the Use of Computers in the Agricultural Sciences |
| BIOL 3051  | 4       | General Biology I   |
| INGE 3011  | 2       | Engineering Graphics I  |
|            | 18      |   |

##### Second Semester

| Number     | Credits | Course                          |
|------------|---------|---------------------------------|
| *INGL 3102 | 3       | Basic course in English I       |
| *ESPA 3102 | 3       | Basic course in Spanish II      |
| *MATE 3172 | 3       | Pre-Calculus II                 |
| CFIT 3005  | 4       | Fundamentals of Crop Production |
| BIOL 3052  | 4       | General Biology II              |
| EDAG 3005  | 1       | Agricultural Orientation        |
|            | 18      |                                 |

## SECOND YEAR

### First Semester

| Number    | Credits | Course  |
|-----------|---------|---|
| INGL 3201 | 3       | English Composition and Reading               |
| QUIM 3131 | 3       | General Chemistry I                           |
| QUIM 3133 | 1       | General Chemistry Laboratory I                |
| FISI 3091 | 3       | Elements of Physics                           |
| FISI 3092 | 1       | Elements of Physics Laboratory                |
| ECON 3021 | 3       | Principles of Economics: Microeconomics       |
|           |         | or  |
| ECAG 3005 | 3       | Principles of Agricultural Economic Analysis  |
| MATE 3049 | 3       | Mathematical Analysis for Management Sciences |
| ELECTIVE  | 1       | Physical Education Elective                   |
|           | 18      |   |

### Second Semester

| Number     | Credits | Course                                    |
|------------|---------|---|
| ^INGL 3--- | 3       | Second year course in English             |
| QUIM 3132  | 3       | General Chemistry II                      |
| QUIM 3134  | 1       | General Chemistry Lab. II                 |
| SAGA 4005  | 3       | Farm Electrification                      |
| CIAN 3011  | 3       | Fundamentals of Animal Science            |
| CIAN 3012  | 1       | Laboratory of Practices in Animal Science |
| CISO ----  | 3       | Elective course in Social Sciences        |
| ELECTIVE   | 1       | Physical Education Elective               |
|            | 18      |   |

## THIRD YEAR

### First Semester

| Number    | Credits | Course                           |
|-----------|---------|----------------------------------|
| AGRO 3011 | 2       | Fundamentals of Soil Sciences    |
| AGRO 3013 | 1       | Soil Sciences Laboratory         |
| SAGA 4029 | 3       | Agricultural Products Processing |
| SAGA 4015 | 3       | Agricultural Machinery I         |
| ECAG 4019 | 3       | Introduction to Farm Management  |
| ELECTIVES | 6       | **Electives                      |
|           | 18      |                                  |

### Second Semester

| Number    | Credits | Course                                      |
|-----------|---------|---|
| INCI 4005 | 3       | Agricultural Surveying                      |
| SAGA 4028 | 3       | Farm Service Buildings                      |
| SAGA 4019 | 3       | Farm Drainage and Irrigation                |
| ELECTIVES | 3       | **Electives                                 |
| CFIT 4005 | 3       | Physiological Principles of Crop Production |
| ELECTIVES | 2       | **Electives                                 |
|           | 17      |   |

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**SUMMER SESSION**

| Number    | Credits | Course   |
|-----------|---------|--|
| SAGA 4008 | 3       | Mechanical Technology in Agriculture Practicum |

**FOURTH YEAR****First Semester**

| Number    | Credits  | Course                             |
|-----------|----------|------------------------------------|
| SAGA 4009 | 3        | Agricultural Power                 |
| SAGA 4035 | 4        | Soil and Water Management          |
| SAGA 4036 | 1        | Seminar in Mechanized Agriculture  |
| ECAG 4007 | 3        | Marketing of Agricultural Products |
| ELECTIVES | 3        | **Electives                        |
| HUMA ---- | <u>3</u> | Elective course in Humanities      |
|           | 17       |                                    |

**Second Semester**

| Number    | Credits  | Course                            |
|-----------|----------|-----------------------------------|
| ECAG 4028 | 3        | Agricultural Finance              |
| SAGA 4037 | 1        | Seminar in Mechanized Agriculture |
| ELECTIVES | 9        | **Electives                       |
| ELECTIVE  | <u>3</u> | Elective Course in Social Science |
|           | 16       |                                   |

**Total credits required for this program: 143**

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\* The Program in Agricultural and Environmental Systems requires a minimum of 23 credits in elective courses. It includes eleven credits in professional electives selected from the offerings of the Department of Agricultural and Biosystems Engineering and related areas and with the authorization of the Departmental Head. The other twelve credits are free electives.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

**DEPARTMENTAL FACULTY**

**CARMEN V. GONZÁLEZ-TORO**, *Extension Specialist*, M.S.C., 1985, Michigan State University.

**ERIC W. HARMSSEN**, *Professor*, Ph.D., 1989, University of Wisconsin.

**JAVIER A. HUERTAS-MIRANDA**, *Associate Professor*, Ph.D., 2012, University of Puerto Rico at Mayagüez.

**ERIC A. IRIZARRY-OTAÑO**, *Professor*, M.E.S., P.E., 2001, Universidad Metropolitana de Puerto Rico.

**HÉCTOR O. LÓPEZ-MÉNDEZ**, *Professor*, M.E.M., 1998, Texas A & M University.

**SUNIL K. MATHANKER**, *Associate Professor*, Ph.D., 2010, Oklahoma State University.

**FRANCISCO M. MONROIG-SALTAR**, *Professor*, Ph.D., P.E., 2003, Purdue University.

**LUIS R. PÉREZ-ALEGRÍA**, *Professor*, Ph.D., P.E., 1987, Pennsylvania State University.

**FERNANDO J. PÉREZ-MUÑOZ**, *Associate Professor*, Ph.D., 1996, Iowa State University.

**COURSES OF INSTRUCTION****DEPARTMENT OF AGRICULTURAL ENGINEERING****Undergraduate Courses**

**INAG 4018. COMPUTER AIDED DESIGN IN AGRICULTURE.** Two credit hours. One hour of lecture and one three-hour laboratory per week. Prerequisite: INGE 3011.

Introduction to computer aided design for agricultural structures, irrigation systems, machinery elements and other agricultural applications.

**INAG 4990. SELECTED TOPICS.** One to three credit hours. One to three hours of lecture per week.

Selected topics in Agricultural Engineering. Topics will vary according to the needs and interests of the students and the faculty.

**INAG 4996. AGRICULTURAL ENGINEERING PROJECTS.** Two to four credit hours.

Supervised projects in areas of agricultural engineering. A written report is required.

**SAGA 3016. COMPUTING AND COMMUNICATION IN AGRICULTURAL AND ENVIRONMENTAL SYSTEMS.** Three credit hours. Three hours of lecture per week.

Application of systems programming functions for data management and organization, basic programming, and preparation of technical reports and presentations to solve problems related to agricultural and environmental systems.

**SAGA 4005. FARM ELECTRIFICATION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: FISI 3172, or FISI 3152, or FISI 3091.

Application of electrical energy to agricultural production and rural living. Fundamentals of selection, installation, operation, and maintenance of electrical farm equipment; safety rules and regulations.

**SAGA 4007. METALWORKING AND WELDING.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: FISI 3172 or FISI 3152 or FISI 3091.

Agricultural mechanics shop skills, with emphasis on metal work, oxyacetylene cutting and welding, electric arc welding, safety and organization of the farm shop.

**SAGA 4008. MECHANICAL TECHNOLOGY IN AGRICULTURE PRACTICUM.** Three credit hours. A minimum of thirty hours per week during six consecutive weeks. Prerequisite: A minimum of nine credits approved in Mechanical Technology in Agriculture and authorization of the Director of the Department.

Practical work experience in Mechanical Technology in Agriculture. It is carried out under the supervision of the Department in collaboration with public or private entities.

**SAGA 4009. MECHANICAL POWER IN AGRICULTURE.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: FISI 3171 or FISI 3151, or FISI 3091.

Sources, measurement, transmission, and economic application of mechanical power on the farm. Principles of construction and operation of various

types of farm power units, with particular emphasis on internal combustion engines. Classification, selection, operation, and maintenance of agricultural farm power units.

**SAGA 4010. MECHANICAL TECHNOLOGY IN AGRICULTURE INTERNSHIP.** One to six credit hours. One to six hours of internship per week. Prerequisites: MATE 3172 or authorization of the Director of the Department.

Work experience in the area of Mechanical Technology in Agriculture in a business enterprise or a state or federal government agency, under the supervision of a faculty member in coordination with an immediate supervisor at the internship location.

**SAGA 4015. AGRICULTURAL MACHINERY I.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: FISI 3171, or FISI 3151, or FISI 3091.

Principles of construction and operation, maintenance procedures, power relationships, and economic utilization of the main tillage, planning, harvesting, and other agricultural machinery.

**SAGA 4017. SAFETY IN AGRICULTURE.** Two credit hours. Two hours of lecture per week.

Principles of personnel and property protection as applied to agricultural operations and use of agricultural machinery, with emphasis on the development of a philosophy of safety as a basis for effective accident prevention.

**SAGA 4019. FARM DRAINAGE AND IRRIGATION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: AGRO 3005 or (AGRO 3011 and AGRO 3013).

Principles of irrigation and drainage of farm lands. Drainage systems, sources of water supply, water quality, irrigation distribution systems through gravity, sprinkler or trickle.

**SAGA 4025. AGRICULTURAL MACHINERY II.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: (TMAG 4009 or SAGA 4009) and (TMAG 4015 or SAGA 4015).

Advanced study of agricultural machinery, including machinery for application of chemical products, harvesting, and others.

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**SAGA 4026. DAIRY MECHANICS**

TECHNOLOGY. Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: (INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012))) and (FISI 3171 or FISI 3151 or FISI 3091).

Space distribution, installation, operation and management of mechanical equipment used in dairy industries.

**SAGA 4028. AGRICULTURAL STRUCTURES.**

Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: (INGE 3011 or INGE 4005) and (FISI 3171 or FISI 3151 or FISI 3091).

Planning of agricultural structures, functional requirements, construction materials, construction; principles and procedures, with particular reference to main agricultural structures.

**SAGA 4029. AGRICULTURAL PRODUCTS**

PROCESSING. Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: FISI 3171 or FISI 3091 or FISI 3151.

Unit operations, equipment, techniques, and processes used in handling and preparing of farm products for marketing, utilization, or storage.

**SAGA 4035. SOIL AND WATER**

MANAGEMENT. Four credit hours. Three hours of lecture and three hours of laboratory per week. Prerequisites: (AGRO 3005 or (AGRO 3011 and AGRO 3013)) and INCI 4005.

Soil-water-plant relationships; principles and practice of irrigation and drainage of farm lands; land improvement by means of mechanical procedures, or structures for soil and water management and conservation.

**SAGA 4036. SEMINAR IN MECHANIZED**

AGRICULTURE. One credit hour per semester. One meeting per week each semester. Prerequisite: (TMAG 4008 or SAGA 4008) or authorization of the Director of the Department.

Oral reports and discussion concerning experiences and observations gathered during the summer field practice. During the second semester, emphasis will be on a review and discussion of current developments, in the field of Agricultural Engineering.

**SAGA 4037. SEMINAR IN MECHANIZED**

AGRICULTURE. One credit hour per semester. One meeting per week each semester. Prerequisite:

(TMAG 4008 or SAGA 4008) or authorization of the Director of the Department.

Oral reports and discussion concerning experiences and observations gathered during the summer field practice. During the second semester, emphasis will be on a review and discussion of current developments, in the field of Agricultural Engineering.

**SAGA 4038. AGRICULTURAL HYDROLOGY.**

Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: FISI 3171 or FISI 3151 or FISI 3091.

The study of the hydrologic cycle, weather elements and climate, water precipitation, evaporation, transpiration, infiltration, soil moisture and run-off as related to soil and water management.

**SAGA 4039. AGRICULTURAL WASTE**

MANAGEMENT. Three credit hours. Two hours of lecture per week and one three-hour laboratory per week. Prerequisites: AGRO 3005 or (AGRO 3011 and AGRO 3013).

Study of characteristics and management of agricultural waste. Biological and physicochemical treatments. Environmental impact and pollution problems. Legal and economic aspects.

**SAGA 4045. FLUID POWER IN AGRICULTURE.**

Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: MATE 3172.

Study of the operation, main components, power requirements and maintenance of hydraulic and pneumatic systems used in agricultural machinery and processes.

**SAGA 4048. FARM BUILDINGS.**

Three credit hours. Three hours of lecture per week. Prerequisites: INGE 3011-ENGINEERING GRAPHICS I and (MATE 3172-PRECALCULUS II or MATE 3005-PRECALCULUS).

Discussion of construction planning principles and procedures, functional requirements, and the selection of construction materials in main agricultural structures.

**SAGA 4105. FERMENTATION**

BIOTECHNOLOGY. Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3172 and QUIM 3132 and QUIM 3134.

Use of microorganisms in diverse agricultural, industrial, and environmental applications. Topics include the use of silage for livestock feed

production, manufacturing of alcoholic beverages, fermentations in the food industry, the production of antibiotics, wastewater treatment and bioremediation. Field trips required.

**SAGA 4501.** RENEWABLE ENERGY IN AGRICULTURE. Three credit hours. Three hours of lecture per week. Prerequisites: FISI 3091 or FISI 3172 or FISI 3052.

Study of the principles of operation and components of renewable energy systems and their applications to agriculture. Determination of electrical demand and strategies for energy conservation. Emphasis will be given to solar thermal, solar photovoltaic, wind, and micro-hydro systems, among others. A design project of a renewable energy system with application to agriculture is required.

**SAGA 4990.** SUPERVISED PROFESSIONAL OCCUPATIONAL EXPERIENCE FOR COOP STUDENTS. Three to six credit hours. A minimum of two practice periods is required, one of them in a semester. Prerequisite: authorization of the Director of the Department and to be a Coop program student.

Practical experience in Mechanical Technology in Agriculture in cooperation with the private sector or government. To be jointly supervised by the academic department, the Coop program coordinator, and an official from the cooperating entity. Written reports will be required upon completion of each work period.

**SAGA 4991.** SPECIAL PROBLEMS. One to three credit hours. One to three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Problems pertaining to the applied and technical aspects of Agricultural Engineering related to the agriculture of Puerto Rico. Conferences, library research, laboratories, of field trips will be assigned on an individual basis.

**SAGA 4992.** SPECIAL PROBLEMS. One to three credit hours. One to three hours of lecture per week.

Problems pertaining to the applied and technical aspects of Agricultural Engineering related to the agriculture of Puerto Rico. Conferences, library studies, laboratories or field trips will be assigned on an individual basis.

### **Advanced Undergraduate and Graduate Courses**

**INAG 5990.** SELECTED TOPICS. One to three hours of lecture per week. One to three hours of lecture per week.

Selected topics in Agricultural Engineering. Topics will vary according to the needs and interest of the students and the faculty.

**SAGA 5005.** EQUIPMENT FOR APPLICATION OF CHEMICAL AND BIOLOGICAL PRODUCTS. Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: (TMAG 4015 or SAGA 4015) or authorization of the Director of the Department.

Study of techniques and equipment used for the application of chemical and biological products in agriculture.

**SAGA 5006.** MANAGEMENT OF AGRICULTURAL MACHINERY. Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: (TMAG 4015 or SAGA 4015) or authorization of the Director of the Department.

Study of the principles and practices for managing agricultural machinery. Analysis of the relationship among machinery, implements, agricultural production and economic aspects.

**SAGA 5007.** ADVANCED SOIL AND WATER MANAGEMENT. Three credit hours. Three hours of lecture per week. Prerequisite: (TMAG 4035 or SAGA 4035) or authorization of the Director of the Department.

Soil water and plant relationships. Principles and practice of irrigation and drainage of farm lands. Land improvement by mechanical procedures or structures for soil and water management and conservation.

**SAGA 5008.** GEOGRAPHIC INFORMATION SYSTEM IN NATURAL RESOURCES MANAGEMENT. Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: MATE 3172 or authorization of the Director of the Department.

Study of fundamentals of a geographic information system (GIS) and its applications in agriculture and natural resources management. Development of interfaces with hydrology-hydraulic models, watershed management, soil erosion and sediment



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transport models, crop simulation models, and precision agriculture models.

**SAGA 5015. MICROIRRIGATION SYSTEMS.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: (AGRO 3005 or (AGRO 3011 and AGRO 3013)) or authorization of the Director of the Department.

Study of the microirrigation systems and its components, soil-water-plant relationships, crop water requirements and field evaluation.

**SAGA 5016. ANAEROBIC DIGESTION OF AGRICULTURAL WASTE.** Three credit hours. Two hours of lecture per week and one period of laboratory of three hours per week. Prerequisites: (QUIM 3131 and QUIM 3133) or authorization of the Director of the Department.

Study of the use of anaerobic digesters for agricultural waste management. Production of methane gas and its conversion to electrical and mechanical energy.

**SAGA 5017. AGROCLIMATOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study and application of the climatology and meteorology related to agriculture with emphasis on the Caribbean Region.

**SAGA 5025/CITA 6005. FOOD PACKAGING.** Three credit hours. Three hours of lecture per week.

Study of food packaging and its multiple roles in protecting packaged food and beverage products and facilitating distribution and communication with retailers, consumers and users. Study of the relationship between food packaging and health, safety and economic wellbeing. Use of technology and its integration with products, distribution, and marketing.

**SAGA 5026/CITA 6006. FOOD SAFETY.** Three credit hours. Three hours of lecture per week.

Practices and methods to guarantee food safety and product integrity. Topics such as laws and regulations, good manufacturing practices (GMP's), hazard analysis and critical control points (HACCP), and food labeling will be discussed.

**SAGA 5030. PRECISION AGRICULTURE TECHNOLOGIES.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: TMAG 4015 or SAGA 4015 or authorization of the Director of the Department.

Analysis of the foundations of precision technologies in modern agriculture including Global Positioning System (GPS) receivers, Geographical Information Systems (GIS) software, automatic tractor guidance systems, variable rate technologies, and sensing technologies.

**SAGA 5991. SELECTED TOPICS.** One to three credit hours. One to three hours of lecture per week.

Selected topics in Agricultural Engineering. Topics will vary according to the needs and interests of the students and the faculty.

**SAGA 5995. PROBLEMS IN MECHANIZED AGRICULTURE.** One to three credit hours. One to three research periods per week.

Problems pertaining to the applied and less technical aspects of Agricultural Engineering as related to the agriculture of Puerto Rico. Conferences, library laboratory and/or field work on an assigned problem, on an individual basis, with complete written report required.

# DEPARTMENT OF AGROENVIRONMENTAL SCIENCES

## Mission:

Contribute through research and education for a better quality of life, protecting the environment, conserving natural resources and sustainably managing production of food and plants.

## Vision:

Assume leadership in higher education, outreach and research in the production and use of crops and the conservation and management of natural resources.

Conduct collaborative and interdisciplinary work with the public and private sectors to promote agricultural development.

Go beyond the border of Puerto Rican society, benefiting the agriculture of other tropical and subtropical regions.

## Definition of General Education for your Department

The general education in our department is divided in three major areas:

1. Basic knowledge in language and sociohumanistics
2. Reasoning on quantitative and qualitative courses
3. Major courses in Soil and Crop Sciences

## General Education Student Learning Outcomes for your Department

### *Agronomy*

Demonstrate knowledge of basic and applied concepts and techniques for sustainable use of inputs and resources for commercial production of agronomical crops.

### *Soil*

Explain the basic interaction among soil, crops and the environment.

### *Crop Protection*

Demonstrate knowledge of basic and applied concepts and techniques related to the diagnosis of the causal agent of plant diseases and pests, as well as interaction within the environment.

### *Horticulture*

Demonstrate knowledge of basic and applied concepts and techniques for sustainable use of inputs and resources for commercial production of horticultural crops.

## Courses that fulfill the General Education requirements for your Department

### -Basic Courses:

1. INGL 3XXX
2. ESPA 3101
3. CISO XXXX
4. HUMA XXXX

### -Analytic Courses:

1. MATE 3171
2. QUIM 3131-34
3. QUIM 3061-62
4. FISI 3091-92

### -Major Courses:

1. CFIT 3005
2. AGRO 3011, 3013

The Department of Agro-Environmental Sciences offers a curriculum leading to the degree of Bachelor of Agricultural Sciences in the program areas of Agronomy, Crop Protection, Horticulture, and Soil Sciences. The first year of study is similar in requirements as other undergraduate curricula in Agricultural Sciences. Specialization gradually begins during the sophomore year.

The curriculum of the program areas of Agronomy, Crop Protection, Horticulture, and Soil Sciences emphasize in sustainability and environmentally sound approaches that increase the efficiency of crop production, assists in the use and development of cropland, forest and water resources, and improves the overall quality of the human environment in rural and urban settings. The department enjoys close collaboration with

the USDA-ARS Tropical Agriculture Research Station, which adds substantial strength to the research and graduate education capabilities in the four areas of study. Teaching facilities include laboratories, greenhouses, and an on-campus experimental farm, and seven research centers of the Agricultural Experiment Station located off-campus.

All the programs require a three-credit summer practicum. Students usually participate in this practicum between the third and fourth year of study.

The Department Agro-Environmental Sciences also offers a graduate curriculum leading to a Master of Science (M.S.) degree (see UPRM Graduate Catalog). Applicants can contact the Department Director or individual faculty members to get more information. General areas of specialty within each program are described below.

## PROGRAM OF AGRONOMY

The Program of Agronomy leads to the degree of Bachelor of Agricultural Sciences. Its curriculum emphasizes in plant breeding, production and management of crops, crop ecology, crop physiology, crop modeling, or management of forestry and water resources. The Agronomy major requires a minimum of 27 credits in elective courses. At least 15 of these credits should be in professional electives chosen with the consent of the Department Director.

## PROGRAM OF STUDY

### CURRICULUM IN AGRONOMY

#### FIRST YEAR

##### First Semester

| Number     | Course                          | Credits |
|------------|---------------------------------|---------|
| *INGL 3--- | First year course in English    | 3       |
| *ESPA 3101 | Basic course in Spanish I       | 3       |
| *MATE 3171 | Pre-Calculus I                  | 3       |
| QUIM 3131  | General Chemistry I             | 3       |
| QUIM 3133  | General Chemistry Laboratory I  | 1       |
| CFIT 3005  | Fundamentals of Crop Production | 4       |
|            | or                              |         |
| CIAN 3011  | Fundamentals of Animal Science  | 3       |

|           |   |          |
|-----------|---|----------|
| CIAN 3012 | Laboratory Of Practices in Animal Science | 1        |
| EDFI ---- | Basic course in Physical Education        | <u>1</u> |
|           |   | 18       |

#### Second Semester

| Number     | Course                                    | Credits  |
|------------|---|----------|
| *INGL 3--- | First year course in English              | 3        |
| *ESPA 3102 | Basic course in Spanish II                | 3        |
| *MATE 3172 | Pre-Calculus II                           | 3        |
| QUIM 3132  | General Chemistry II                      | 3        |
| QUIM 3134  | General Chemistry Lab. II                 | 1        |
| CFIT 3005  | Fundamentals of Crop Production           | 4        |
|            | or  |          |
| CIAN 3011  | Fundamentals of Animal Science            | 3        |
| CIAN 3012  | Laboratory Of Practices in Animal Science | 1        |
| EDFI ----  | Basic course in Physical Education        | <u>1</u> |
|            |   | 18       |

## SECOND YEAR

#### First Semester

| Number    | Course   | Credits  |
|-----------|--|----------|
| INGL 3--- | Second year course in English                        | 3        |
| BIOL 3051 | General Biology I                                    | 4        |
| QUIM 3061 | Fundamentals of Organic Chemistry and Biochemistry I | 4        |
| ECON 3021 | Principles of Economics: Microeconomics              | 3        |
|           | or   |          |
| ECAG 3005 | Principles of Agricultural Economic Analysis         | 3        |
| AGRO 3011 | Fundamentals of Soil Sciences and                    | 2        |
| AGRO 3013 | Soil Sciences Laboratory                             | 1        |
| EDAG 3005 | Agricultural Orientation                             | <u>1</u> |
|           |  | 18       |

#### Second Semester

| Number     | Course  | Credits  |
|------------|---|----------|
| *INGL 3--- | Second year course in English                         | 3        |
| FISI 3091  | Elements of Physics                                   | 3        |
| FISI 3092  | Elements of Physics Laboratory                        | 1        |
| QUIM 3062  | Fundamentals of Organic Chemistry and Biochemistry II | 4        |
| BIOL 3052  | General Biology II                                    | 4        |
| ELECTIVES  | **Electives   | <u>3</u> |
|            |   | 18       |

### THIRD YEAR

#### First Semester

| Number    | Course                                      | Credits  |
|-----------|---|----------|
| BIOL 3300 | Genetics                                    | 3        |
| HUMA ---- | ***Elective course in Humanities            | 3        |
| CFIT 4005 | Physiological Principles of Crop Production | 3        |
| AGRO 4037 | Soil Fertility and Fertilizers              | 3        |
| ELECTIVES | **Electives                                 | <u>6</u> |
|           |   | 18       |

#### Second Semester

| Number    | Course  | Credits  |
|-----------|---|----------|
| SAGA 4015 | Agricultural Machinery I<br>or                              | 3        |
| SAGA 4019 | Farm Drainage and Irrigation<br>or                          | 3        |
| SAGA 5008 | Geographic Information System<br>in Natural Resources<br>or | 3        |
| SAGA 5015 | Microirrigation Systems                                     | 3        |
| BIOL 3770 | General Microbiology  | 3        |
| HUMA ---  | ***Elective course in Humanities                            | 3        |
| ECAG 4019 | Introduction to Farm<br>Management                          | 3        |
| AGRO 4045 | Mineral Nutrition in Plants                                 | 3        |
| ELECTIVES | **Electives   | <u>3</u> |
|           |   | 18       |

### SUMMER SESSION

| Number    | Course  | Credits |
|-----------|---|---------|
| AGRO 4038 | Agronomy and Soils Practicum<br>or                                      | 3       |
| AGRO 4995 | Supervised Professional<br>Occupational Experience<br>for Coop Students |         |

### FOURTH YEAR

#### First Semester

| Number    | Course                                | Credits  |
|-----------|---------------------------------------|----------|
| CISO ---- | ***Elective course in Social Sciences | 3        |
| PROC 4006 | Tropical Phytopathology               | 3        |
| PROC 4017 | Weed Control                          | 3        |
| AGRO 4019 | Seminar                               | 1        |
| ELECTIVES | **Electives                           | <u>6</u> |
|           |                                       | 16       |

### Second Semester

| Number    | Course                  | Credits  |
|-----------|-------------------------|----------|
| PROC 4008 | Agricultural Entomology | 3        |
| AGRO 4025 | Seminar                 | 1        |
| ELECTIVES | **Electives             | <u>9</u> |
|           |                         | 13       |

#### Total credits required for program: 140

\* Refer to the Academic Regulations section for information on Advanced Placement.

\*\* Minimum requirements in electives. The Agronomy major requires a minimum of 27 credits in elective courses. At least 15 of these credits are in professional electives. These should be selected from the list of recommended professional electives. The remaining 12 credits are free electives.

\*\*\* No specific elective courses in Social Sciences and Humanities are required.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

### PROGRAM OF SOIL

The Program of Soil leads to the degree of Bachelor of Agricultural Sciences. The curriculum in Soil Sciences include chemistry, classification, fertility, genesis, morphology, microbiology, mineralogy, and physics. It also covers soil and water conservation. The Soil major requires a minimum of 18 credits in elective courses. At least 6 of these credits should be in professional electives chosen with the consent of the Department Director.

### CURRICULUM IN SOIL

#### FIRST YEAR

##### First Semester

| Number     | Course                                       | Credits  |
|------------|--|----------|
| *INGL 3--- | First year course in English                 | 3        |
| *ESPA 3101 | Basic course in Spanish I                    | 3        |
| *MATE 3171 | Pre-Calculus I                               | 3        |
| QUIM 3131  | General Chemistry I                          | 3        |
| QUIM 3133  | General Chemistry Laboratory I               | 1        |
| CFIT 3005  | Fundamentals of Crop Production<br>or        | 4        |
| CIAN 3011  | Fundamentals of Animal Science               | 3        |
| CIAN 3012  | Laboratory Of Practices<br>in Animal Science | 1        |
| EDFI ----  | Basic course in Physical Education           | <u>1</u> |
|            |  | 18       |

**Second Semester**

| Number     | Course                             | Credits  |
|------------|------------------------------------|----------|
| *INGL 3--- | First year course in English       | 3        |
| *ESPA 3102 | Basic course in Spanish II         | 3        |
| *MATE 3172 | Pre-Calculus II                    | 3        |
| QUIM 3132  | General Chemistry II               | 3        |
| QUIM 3134  | General Chemistry Lab. II          | 1        |
| CFIT 3005  | Fundamentals of Crop Production    | 4        |
|            | or                                 |          |
| CIAN 3011  | Fundamentals of Animal Science     | 3        |
| CIAN 3012  | Laboratory Of Practices            |          |
|            | in Animal Science                  | 1        |
| EDFI ----  | Basic course in Physical Education | <u>1</u> |
|            |                                    | 18       |

**SECOND YEAR****First Semester**

| Number    | Course                        | Credits  |
|-----------|-------------------------------|----------|
| INGL 3--- | Second year course in English | 3        |
| EDAG 3005 | Agricultural Orientation I    |          |
| BIOL 3051 | General Biology I             | 4        |
| QUIM 3061 | Fundamentals of Organic       |          |
|           | Chemistry and Biochemistry I  | 4        |
| AGRO 3011 | Fundamentals of Soil Sciences | 2        |
|           | and                           |          |
| AGRO 3013 | Soil Sciences Laboratory      | 1        |
| ECON 3021 | Principles of Economics:      |          |
|           | Microeconomics                | 3        |
|           | or                            |          |
| ECAG 3005 | Principles of Agricultural    |          |
|           | Economic Analysis             | <u>3</u> |
|           |                               | 18       |

**Second Semester**

| Number               | Course                         | Credits  |
|----------------------|--------------------------------|----------|
| ^INGL 3---           | Second year course in English  | 3        |
| FISI 3091            | Elements of Physics            | 3        |
| FISI 3092            | Elements of Physics Laboratory | 1        |
| BIOL 3052            | General Biology II             | 4        |
| QUIM 3062            | Fundamentals of Organic        |          |
|                      | Chemistry and Biochemistry II  | 4        |
| ELECTIVES**Electives |                                | <u>3</u> |
|                      |                                | 18       |

**THIRD YEAR****First Semester**

| Number    | Course                           | Credits |
|-----------|----------------------------------|---------|
| BIOL 3300 | Genetics                         | 3       |
| HUMA ---  | ***Elective course in Humanities | 3       |
| CFIT 4005 | Physiological Principles of      |         |
|           | Crop Production                  | 3       |
| AGRO 4037 | Soil Fertility and Fertilizers   | 3       |

|                      |                       |          |
|----------------------|-----------------------|----------|
| AGRO 4018            | Physical and Chemical |          |
|                      | Properties of Soils   | 3        |
| ELECTIVES**Electives |                       | <u>3</u> |
|                      |                       | 18       |

**Second Semester**

| Number               | Course                           | Credits  |
|----------------------|----------------------------------|----------|
| SAGA 4015            | Agricultural Machinery I         | 3        |
|                      | or                               |          |
| SAGA 4019            | Farm Drainage and Irrigation     | 3        |
|                      | or                               |          |
| SAGA 5008            | Geographic Information System    |          |
|                      | in Natural Resources             | 3        |
|                      | or                               |          |
| SAGA 5015            | Microirrigation Systems          | 3        |
| BIOL 3770            | General Microbiology             | 3        |
| ECAG 4019            | Introduction to Farm Management  | 3        |
| AGRO 4045            | Mineral Nutrition in Plants      | 3        |
| HUMA ---             | ***Elective course in Humanities | 3        |
| ELECTIVES**Electives |                                  | <u>3</u> |
|                      |                                  | 18       |

**SUMMER SESSION**

| Number    | Course                       | Credits |
|-----------|------------------------------|---------|
| AGRO 4038 | Agronomy and Soils Practicum | 3       |
|           | or                           |         |
| AGRO 4995 | Supervised Professional      |         |
|           | Occupational Experience      |         |
|           | for Coop Students            |         |

**FOURTH YEAR****First Semester**

| Number                | Course                                | Credits  |
|-----------------------|---------------------------------------|----------|
| PROC 4006             | Tropical Phytopathology               | 3        |
| PROC 4017             | Weed Control                          | 3        |
| AGRO 4019             | Seminar                               | 1        |
| AGRO 5006             | Genesis, Morphology and               |          |
|                       | Classification of Soils               | 3        |
| CISO ----             | ***Elective course in Social Sciences | 3        |
| ELECTIVES **Electives |                                       | <u>3</u> |
|                       |                                       | 16       |

**Second Semester**

| Number               | Course                  | Credits  |
|----------------------|-------------------------|----------|
| PROC 4008            | Agricultural Entomology | 3        |
| AGRO 4025            | Seminar                 | 1        |
| AGRO 5008            | Soils of Puerto Rico    | 3        |
| ELECTIVES**Electives |                         | <u>6</u> |
|                      |                         | 13       |

### **Total credits required for program: 140**

- \* Refer to the Academic Regulations section for information on Advanced Placement.
- \*\* Minimum requirements in electives. The Soil Science major requires a minimum of 18 credits in elective courses. At least 6 of these credits are in professional electives. These should be selected from the list of recommended professional electives. The remaining 12 credits are free electives.
- \*\*\*No specific elective courses in Social Sciences and Humanities are required.
- ^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## **COURSES OF INSTRUCTION**

### **Programs of Agronomy and Soils**

#### **Undergraduate Courses**

**AGRO 3010. INTRODUCTION TO WETLAND ECOSYSTEMS.** Three credit hours. Two hours of lecture and a three hour laboratory per week. Prerequisite: QUIM 3002 or (QUIM 3132 and QUIM 3134).

Study of the different types of wetlands with emphasis on the factors that determine their formation and stability. The functions and value of each wetland type and the use of these ecosystems to improve the environment will be discussed.

**AGRO 3011. FUNDAMENTALS OF SOIL SCIENCES.** Two credit hours. Two hours of lecture per week. Prerequisites: QUIM 3002 or (QUIM 3132 and QUIM 3134-General Chemistry II).

Analysis of the origin, classification and the physical, chemical, and biological properties of soils and their role in crop growth. Tropical soils will be emphasized.

**AGRO 3013. SOIL SCIENCES LABORATORY.** One credit hour. Three hours of laboratory per week. Corequisites: AGRO 3011 (Fundamentals of Soil Sciences).

Laboratory on the origin, classification and physical chemical and biological properties of soils and their role in crop growth.

**AGRO 4005. SOIL CONSERVATION.** Three credit hours. Two hours of lecture and one three-hour field or laboratory per week. Prerequisites: AGRO 3005 or (AGRO 3011 and AGRO 3013).

The use of vegetation, plant barriers, terraces, mechanical structures, crop rotations, and other practices for soil and water conservation, forest and wildlife conservation, conservation problems, adjustments, and programs in Puerto Rico. Field trips.

**AGRO 4007. SOIL MICROBIOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3770 or PROC 4016.

Biological soil processes; occurrence and activity of soil microorganisms as applied to soil fertility; their influence on organic matter transformation, and nitrogen economy in soils.

**AGRO 4008. TROPICAL CEREALS AND LEGUMES.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: CFIT 3005 and (AGRO 3005 or (AGRO 3011 and AGRO 3013)).

Adaptation, botany, distribution, varieties, culture, crop improvement, harvesting and marketing of corn, rice, cotton and sweet potatoes. Field trips.

**AGRO 4010. SILVICULTURE.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: CFIT 3005 or BIOL 3435 or BIOL 3051.

Study of the establishment, management and conservation of forest resources with economical, ecological and recreational purposes.

**AGRO 4015-4016. SPECIAL PROBLEMS.** One to three credit hours. One to three research periods per week. Prerequisite: authorization of the Director of the Department.

Problems in the production, improvement and genetics of crop plants will be assigned, or may be selected, subject to the approval of the professor in charge.

**AGRO 4018. PHYSICAL AND CHEMICAL PROPERTIES OF SOILS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: AGRO 3005 or (AGRO 3011 and AGRO 3013).

An advanced course in the physical and chemical processes of soils, with emphasis on their practical application and significance. Laboratory practice in the use of physical and physicochemical techniques used in soil investigations.

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**AGRO 4019. SEMINAR.** One credit hour per semester. One hour of lecture per week each semester. Prerequisite: authorization of the Director of the Department.

Reports and discussions of observations and problems in farm practices and recent crop investigations.

**AGRO 4025. SEMINAR.** One credit hour per semester. One hour of lecture per week each semester. Prerequisite: authorization of the Director of the Department.

Reports and discussions of observations and problems in farm practices and recent crop investigations.

**AGRO 4026. CROP ECOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: CFIT 3005 and (AGRO 3005 or (AGRO 3011 and AGRO 3013)).

Study of the environmental conditions which determine the adaptation, distribution and productivity of crops.

**AGRO 4029. MANAGEMENT OF TROPICAL SOILS.** Three credit hours. Three hours of lecture per week. Prerequisites: AGRO 3005 or (AGRO 3011 and AGRO 3013).

Application of the principles of soil science and crop science, in the evaluation of management practices on tropical soils.

**AGRO 4035. INTRODUCTION TO CONSERVATION OF NATURAL RESOURCES.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study of the natural resources of Puerto Rico and the principles involved in their utilization, management and development. Study of the effect of demand and activities of people on the natural resources and related to the conservation of natural resources and the quality of environment will be discussed. Field trips and a written report are required.

**AGRO 4037. SOIL FERTILITY AND FERTILIZERS.** Three credit hours. Three hours of lecture per week. Prerequisites: CFIT 3005 and (AGRO 3005 or (AGRO 3011 and AGRO 3013)).

Fundamental principles underlying the maintenance of soil productivity; sources, manufacture, and utilization of fertilizer materials and mixed

fertilizers, and their effect on the plant and on the soil.

**AGRO 4038. AGRONOMY AND SOILS PRACTICUM.** Three credit hours. A minimum of thirty hours per week during six consecutive weeks. Prerequisite: a minimum of twelve credits in Agronomy and Soils and authorization of the Director of the Department.

Practical work experience in crops and soils. It will be conducted under the supervision of the Department in collaboration with public and private entities.

**AGRO 4045. MINERAL NUTRITION IN PLANTS.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: (AGRO 3005 or (AGRO 3011 and AGRO 3013)) and CFIT 4005.

The basic processes and principles of mineral nutrition of higher plants will be covered. Special emphasis will be given to the factors that affects absorption and translocation as well as the function of essential elements in higher plants.

**AGRO 4046. AGROSTOLOGY AND FORAGE AND PASTURE MANAGEMENT.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: CFIT 3005 and (AGRO 3005 or (AGRO 3011 and AGRO 3013)).

A fundamental study of grasses, specially those of economic importance in the Caribbean area: the main characteristics of various genera and species of grasses, their identification, distribution, propagation, and economic uses. Will also include knowledge on the adaptation, management, and nutritive value of cultivated and native pasture plants, with special emphasis on the establishment, management, and improvement of temporary and permanent pasture. Required field trips.

**AGRO 4057. SOIL, PLANT, AND WATER CHEMICAL ANALYSIS.** Three credit hours. Two hours of lecture and one four-hour laboratory per week. Prerequisites: QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134).

Study of the basic concepts of theory and practice in instrumental analytical chemistry applied to the analysis of soil, plant, and water. Practice in the process of collecting and preparing samples, as well as principles of the operation of instruments. Emphasis to the analysis related to problems in soil, plant, and environmental sciences.

**AGRO/HORT 4066. TURFGRASS MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: CFIT 3005 and (AGRO 3005 or (AGRO 3011 and AGRO 3013)).

Study of the physiology, management, and characteristics of tropical and subtropical turfgrasses. Establishment, fertilization, irrigation, mowing, and pest and disease control practices will be emphasized.

**AGRO 4990. SELECTED TOPICS IN AGRONOMY AND SOILS.** One to three credit hours. One to three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Selected topics in soils, pastures, genetic improvement of agronomic crops, biotechnology, sustainable agriculture, and related areas.

**AGRO 4995. SUPERVISED PROFESSIONAL OCCUPATIONAL EXPERIENCE FOR COOP STUDENTS.** Three to six credit hours. A minimum of two practice periods is required, one of them in a semester. Prerequisite: authorization of the Director of the Department and to be a Coop program student.

Practical experience in agronomy or soil sciences in cooperation with the private sector or government. To be jointly supervised by the academic department, the Coop program coordinator, and an official from the cooperating entity. Written reports will be required upon completion of each work period.

### **Advanced Undergraduate and Graduate Courses**

**AGRO 5005. BIOMETRICS.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: authorization of the Director of the Department.

Basic concepts of statistical reasoning applied to problems in agricultural, biological and environmental sciences. Data gathering, graphical description and numerical summarization. Concepts of probability and sampling. Estimation and hypothesis testing, analysis of variance, linear regression and correlation. Students describe and analyze real data sets and use statistical computing programs.

**AGRO 5006. GENESIS, MORPHOLOGY AND CLASSIFICATION OF SOILS.** Three credit hours. Three hours of lecture per week. Prerequisites: (AGRO 3005 or (AGRO 3011 and AGRO 3013)) or authorization of the Director of the Department.

Historical development of concepts of soil and systems of soil classification; principles and nomenclature of "Soil Taxonomy"; environmental factors and processes of soil formation; and field study of soil profiles. Field trips are required.

**AGRO 5007. SOIL PHYSICS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week.

Physical properties of soils, and factors affecting them; soil consistency, structure, water, air, temperature, tillage; evaluation and influence in determination of soil productivity.

**AGRO 5008. SOILS OF PUERTO RICO.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: AGRO 5006 or authorization of the Director of the Department.

Study of the genesis and distribution of the soils of Puerto Rico, based on environmental conditions; classification of soils using the "Soil Taxonomy" system; evaluation of the morphological, chemical, physical, and mineralogical properties of soils with respect to agricultural and not agricultural uses. Representative soil profiles are studied during field trips.

**AGRO 5010. MANAGEMENT OF NATURAL FORESTS.** Three credit hours. Two hours of lecture and one three hour laboratory per week. Prerequisites: BIOL 3435 or BIOL 3051 or CFIT 3005 or authorization of the Director of the Department.

Study of the composition and structure of the different forest systems of the tropics, such as wet forest, deciduous forest, dry forest, conifer forest and mangrove from the stand point of their multiple use and sustainability. Field trips required.

**AGRO 5015. CONSERVATION, MANAGEMENT AND DEVELOPMENT OF NATURAL RESOURCES.** Three credit hours. Three hours of lecture per week. Prerequisite: AGRO 4035 or authorization of the Director of the Department.

Study of concepts, methods and techniques in the conservation, management and development of natural resources, and their effects on environmental quality. Contemporary issues and problems in the management and allocation of natural resources will be discussed.



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**AGRO 5501. AGRICULTURAL**

**BIOTECHNOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: QUIM 3062 and (BIOL 3015 or BIOL 3300) and (BIOL 3770 or PROC 4016) or authorization of the Director of the Department.

Biological concepts for biotechnology: enzymes, nucleic acids, genetic transfer mechanisms, operons, plasmids, vectors, cloning, DNA sequencing, monoclonal antibodies, clonal production and hybridization.

**AGRO 5502. AGRICULTURAL**

**BIOTECHNOLOGY LABORATORY.** One credit hour. One three-hour laboratory per week. Corequisite: AGRO 5501.

Experiments or demonstrations on microbial growth, DNA isolation, embryo transfer, protoplast isolation, tissue culture, plant hybridization, mutagenesis plasmid isolation and DNA electrophoresis. Restriction enzymes and other DNA techniques.

**CFIT 3005. FUNDAMENTALS OF CROP PRODUCTION.** Four credit hours. Three hours of lecture and one three-hour laboratory per week.

Fundamental principles of the growth and propagation of agronomic and horticultural plants; the relation of environment to the distribution, adaptation and utilization of crops; fundamentals of soil management, tillage, rotation, plant improvement, pest control, and other practices related to the production and management of crops.

**CFIT 4005. PHYSIOLOGICAL PRINCIPLES OF CROP PRODUCTION.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: (BIOL 3051 or BIOL 3435) and ((QUIM 3132 and QUIM 3134) or QUIM 3002).

Principles of the vital processes of crops; growth differentiation and development. Mineral nutrition, plant-water relationship, photosynthesis, respiration, photoperiodism and plant hormones.

**CFIT 4007. PLANT BREEDING.** Three credit hours. Three hours of lecture per week. Prerequisite: BIOL 3015 or BIOL 3300.

The improvement of crop plants by hybridization, selection and induced mutations; methods and techniques applicable to sexually and asexually reproduced plants.

**CFIT 5006. PHYTOREMEDIATION.** Three credit hours. Three hours of lecture per week. Prerequisites: ((BIOL 3435 or BIOL 3051) and

(QUIM 3002 or QUIM 3132 and QUIM 3134))) or authorization of the Director of the Department.

Discussion of the relevant concepts used in phytoremediation. Study of the principles used in phytoremediation such as the use of vascular plants for the phytoextraction, rhizofiltration, phytostabilization and phytovolatilization of organic and inorganic contaminants from the soils and water resources.

## **PROGRAM OF CROP PROTECTION**

The Program of Crop Protection leads to the degree of Bachelor of Agricultural Sciences. Its curriculum emphasizes in sustainable, biologically-based, and crop management technologies to control economically important arthropods, nematodes, plant diseases and weeds. The Crop Protection major requires a minimum of 24 credits in elective courses. At least 12 of these credits should be in professional electives chosen with the consent of the Department Director.

### **PROGRAM OF STUDY**

#### **CURRICULUM IN CROP PROTECTION**

##### **FIRST YEAR**

###### **First Semester**

| Number     | Course                             | Credits        |
|------------|------------------------------------|----------------|
| *ESPA 3101 | Basic course in Spanish I          | 3              |
| *INGL 3--- | First year course in English       | 3              |
| QUIM 3131  | General Chemistry I                | 3              |
| QUIM 3133  | General Chemistry Lab. I           | 1              |
| *MATE 3171 | Pre-Calculus I                     | 3              |
| CFIT 3005  | Fundamentals of Crop Production    | 4              |
|            | or                                 |                |
| CIAN 3011  | Fundamentals of Animal Science     | 3              |
| CIAN 3012  | Laboratory of Practices            |                |
|            | in Animal Science                  | 1              |
| EDFI ----  | Basic course in Physical Education | $\frac{1}{18}$ |

###### **Second Semester**

| Number     | Course                          | Credits |
|------------|---------------------------------|---------|
| *ESPA 3102 | Basic course in Spanish II      | 3       |
| *INGL 3102 | Basic course in English         | 3       |
| QUIM 3132  | General Chemistry II            | 3       |
| QUIM 3134  | General Chemistry Lab. II       | 1       |
| *MATE 3172 | Pre-Calculus II                 | 3       |
| CFIT 3005  | Fundamentals of Crop Production |         |
|            | or                              |         |

|           |  |          |
|-----------|--|----------|
| CIAN 3011 | Fundamentals of Animal Science               | 3        |
| CIAN 3012 | Laboratory Of Practices<br>in Animal Science | 1        |
| EDFI ---- | Basic course in Physical Education           | <u>1</u> |
|           |  | 18       |

## SECOND YEAR

### First Semester

| Number    | Course  | Credits  |
|-----------|---|----------|
| INGL 3--- | Second year course in English                           | 3        |
| QUIM 3061 | Fundamentals of Organic<br>Chemistry and Biochemistry I | 4        |
| AGRO 3011 | Fundamentals of Soil Sciences<br>and                    | 2        |
| AGRO 3013 | Soil Sciences Laboratory                                | 1        |
| FISI 3091 | Elements of Physics                                     | 3        |
| FISI 3092 | Elements of Physics Laboratory                          | 1        |
| BIOL 3051 | General Biology I                                       | <u>4</u> |
|           |   | 18       |

### Second Semester

| Number     | Course   | Credits  |
|------------|--|----------|
| ^INGL 3--- | Second year course in English                            | 3        |
| QUIM 3062  | Fundamentals of Organic<br>Chemistry and Biochemistry II | 4        |
| ECON 3021  | Principles of Economics:<br>Microeconomics               | 3        |
|            | or   |          |
| ECAG 3005  | Principles of Agricultural<br>Economic Analysis          | 3        |
| BIOL 3052  | General Biology II                                       | 4        |
| AGRO 4026  | Crop Ecology   | 3        |
| EDAG 3005  | Agricultural Orientation                                 | <u>1</u> |
|            |  | 18       |

## THIRD YEAR

### First Semester

| Number      | Course   | Credits  |
|-------------|--|----------|
| PROC 4016   | Agricultural Bacteriology                      | 3        |
| PROC 4006   | Tropical Phytopathology                        | 3        |
| BIOL 3300   | Genetics                                       | 3        |
| CFIT 4005   | Physiological Principles of<br>Crop Production | 3        |
| CISO ----   | ***Elective course in Social Sciences          | 3        |
| ELECTIVES** | Free electives                                 | <u>3</u> |
|             |  | 18       |

### Second Semester

| Number    | Course                          | Credits |
|-----------|---------------------------------|---------|
| PROC 4008 | Agricultural Entomology         | 3       |
| ECAG 4019 | Introduction to Farm Management | 3       |
| SAGA 4015 | Agricultural Machinery I<br>or  | 3       |

|             |   |          |
|-------------|---|----------|
| SAGA 4019   | Farm Drainage and Irrigation                          | 3        |
|             | or  |          |
| SAGA 5008   | Geographic Information System<br>in Natural Resources | 3        |
|             | or  |          |
| SAGA 5015   | Microirrigation Systems                               | 3        |
| ELECTIVES** | Professional Electives                                | <u>6</u> |
|             |   | 15       |

## SUMMER SESSION

| Number    | Course                    | Credits |
|-----------|---------------------------|---------|
| PROC 4025 | Crop Protection Practicum | 3       |

## FOURTH YEAR

### First Semester

| Number      | Course                                     | Credits  |
|-------------|--|----------|
| PROC 4017   | Weed Control                               | 3        |
| PROC 4018   | Introduction to Agronomatology             | 3        |
| PROC 4019   | Pesticides and their Use in<br>Agriculture | 3        |
| HUMA ---    | ***Elective course in Humanities           | 3        |
| ELECTIVES** | Professional Electives                     | <u>6</u> |
|             |  | 18       |

### Second Semester

| Number      | Course                           | Credits  |
|-------------|----------------------------------|----------|
| CFIT 4007   | Plant Breeding                   | 3        |
| PROC 4026   | Seminar                          | 1        |
| HUMA ----   | ***Elective course in Humanities | 3        |
| ELECTIVES** | Free Electives                   | <u>9</u> |
|             |                                  | 16       |

### Total credits required for program: 142

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*Minimum requirements in electives. The Crop Protection Program requires a minimum of 24 credits in elective courses. At least twelve of these courses should be selected from the list of recommended professional electives. The remaining 12 credits are considered free electives.

\*\*\*Electives in Humanities and Social Sciences to be selected from offerings from the respective Department with the approval of the Department Director.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

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## COURSES OF INSTRUCTION

### Undergraduate Courses

**PROC 4006. TROPICAL PHYTOPATHOLOGY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: BIOL 3435 or BIOL 3051 or BIOL 3417.

Study of diseases of main tropical plants including the host range, symptoms and signs, etiology, cycles, epiphytology, distribution, economic importance, and control.

**PROC 4008. AGRICULTURAL ENTOMOLOGY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: BIOL 4015 or BIOL 3052.

Entomological study from the agricultural standpoint, including insect taxonomy, economic importance, and control. Methods of collection, mounting and preservation of insects will also be emphasized. A collection of insects of economic importance in agriculture is required.

**PROC 4016. AGRICULTURAL BACTERIOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: CFIT 3005 and QUIM 3002 or (CFIT 3005 and QUIM 3132 and QUIM 3134).

The study of the chemical, physical and biological characteristics of bacteria, associated with agricultural crops, with emphasis on the basic techniques employed for isolation, culturing, identification and control.

**PROC 4017. WEED CONTROL.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: CFIT 3005 and QUIM 3002 or (CFIT 3005 and QUIM 3132 and QUIM 3134).

Classification and identification of weeds of economic importance, discussion of physiological principles related to weed control, and eradication, commercial herbicides usage and other control methods.

**PROC 4018. INTRODUCTION TO AGRONEMATOTOLOGY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: BIOL 4015 or BIOL 3052.

History, morphology, classification and life cycles of nematodes, especially the plant parasites; laboratory methods for soil and plant tissue separation of nematodes, and identification.

**PROC 4019. PESTICIDES AND THEIR USE IN AGRICULTURE.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: QUIM 3061.

Studies of pesticides including their chemical composition, their effects as environmental contaminants, their mode of action, toxicity and determination of their residues. Orientation will be given on management and disposal, methods of protecting personnel and pertinent federal and state legislation regarding pesticides usage.

**PROC 4025. CROP PROTECTION PRACTICUM.** Three credit hours. A minimum of thirty hours per week during six consecutive weeks. Prerequisite: A minimum of twelve credits in Crop Protection and authorization of the Director of the Department.

Practical work experience in Crop Protection. It is carried out under the supervision of the Department in collaboration with public and private entities.

**PROC 4026. SEMINAR.** One credit hour. One-hour meeting per week.

Review and discussion of the recent literature in crop protection.

**PROC. 4030. INTRODUCTION TO INTEGRATED PEST MANAGEMENT.** Three credit hours. Two hours of lecture and one hour of discussion per week. Prerequisites: PROC 4008 and PROC 4006.

Study of the principles of integrated pest management as it applies to insects, pathogens, weeds, and other minor pests of phytosanitary importance. Methods of prevention, eradication, control and containment of invasive pests will be discussed.

**PROC 4035. PLANT BIOSECURITY SEMINAR.** One credit hour. One hour of seminar per week. Prerequisites: PROC 4008 and PROC 4006 and PROC 4017.

Discussion of topics in plant biosecurity, including review of scientific articles and presentations by invited speakers. An oral presentation and a written report are required.

**PROC 4993. SELECTED TOPICS I.** One to three credit hours. One to three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Selected topics in crop protection. Topics will vary according to the needs and interests of the students and the faculty.

**PROC. 4994. SELECTED TOPICS II.** One to three credit hours. One to three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Selected topics in crop protection. Topics will vary according to the needs and interests of the students and the faculty.

**PROC 4995. SPECIAL PROBLEMS.** One to three credit hours per semester. One to three study and research periods per week. Prerequisite: authorization of the Director of the Department.

Study and investigation of a specific problem in the field of crop protection.

**PROC 4996. SPECIAL PROBLEMS.** One to three credit hours per semester. One to three study and research periods per week. Prerequisite: authorization of the Director of the Department.

Study and investigation of a specific problem in the field of crop protection.

**PROC 4997. SUPERVISED PROFESSIONAL OCCUPATIONAL EXPERIENCE FOR COOP STUDENTS.** Three to six credit hours. A minimum of two practice periods is required, one of them in a semester. Prerequisites: authorization of the Director of the Department and to be a Coop Program student.

Practical experience in Crop Protection in cooperation with the private sector or government. To be jointly supervised by the academic department, the Coop program coordinator, and an official from the cooperating entity. A written report will be required upon completion of each work period.

### Advanced Undergraduate and Graduate Courses

**PROC 5005. PHYTOPATHOGENIC FUNGI.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: PROC 4006 or authorization of the Department Director.

Examination of the most interesting groups of fungi from the phytopathogenic point of view: their taxonomy, nomenclature, morphology, genetics, host-parasite relationship, physiology, and ecology. Distinctive characteristic of specific pathogens.

Field trips for collection and observation are required.

**PROC 5006. INSECTS OF TROPICAL CROPS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: PROC 4008 or CFIT 4008 or authorization of the Director of the Department.

Major insects affecting tropical crops; their biology and taxonomy; identification of damages in the field as well as in the laboratory; appropriate measures of control.

## PROGRAM OF HORTICULTURE

The Program of Horticulture leads to the degree of Bachelor of Agricultural Sciences. Its curriculum emphasizes in the application of ecological, sustainable, organic, and conventional concepts and principles to improve the production and management of vegetables, starchy crops, fruits, coffee, ornamentals, landscapes, and other intensively cultivated/high value commodities. The Horticulture major requires a minimum of 20 credits in elective courses. At least 8 of these credits should be in professional electives chosen with the consent of the Department Director.

## PROGRAM OF STUDY

### CURRICULUM IN HORTICULTURE

#### FIRST YEAR

##### First Semester

| Number     | Course                          | Credits |
|------------|---------------------------------|---------|
| *INGL 3--- | First year course in English    | 3       |
| *ESPA 3101 | Basic course in Spanish I       | 3       |
| *MATE 3171 | Pre-Calculus I                  | 3       |
| QUIM 3131  | General Chemistry I             | 3       |
| QUIM 3133  | General Chemistry Lab. I        | 1       |
| CFIT 3005  | Fundamentals of Crop Production | 4       |
| EDAG 3005  | Agricultural Orientation        | 1       |
|            |                                 | 18      |

##### Second Semester

| Number     | Course                       | Credits |
|------------|------------------------------|---------|
| *INGL 3--- | First year course in English | 3       |
| *ESPA 3102 | Basic course in Spanish II   | 3       |
| *MATE 3172 | Pre-Calculus II              | 3       |
| QUIM 3132  | General Chemistry II         | 3       |

|           |  |          |
|-----------|--|----------|
| QUIM 3134 | General Chemistry Lab. II                    | 1        |
| CIAN 3011 | Fundamentals of Animal Science               | 3        |
| CIAN 3012 | Laboratory Of Practices<br>In Animal Science | 1        |
| EDFI ---- | Basic course in Physical Education           | <u>1</u> |
|           |  | 18       |

## SECOND YEAR

### First Semester

| Number    | Course  | Credits  |
|-----------|---|----------|
| INGL 3--- | Second year course in English                           | 3        |
| QUIM 3061 | Fundamentals of Organic<br>Chemistry and Biochemistry I | 4        |
| AGRO 3011 | Fundamentals of Soil Sciences<br>and                    | 2        |
| AGRO 3013 | Soil Sciences Laboratory                                | 1        |
| HORT 3005 | Plant Propagation                                       | 3        |
| EDFI ---- | Basic course in Physical Education                      | 1        |
| BIOL 3051 | General Biology I                                       | <u>4</u> |
|           |   | 18       |

### Second Semester

| Number     | Course   | Credits  |
|------------|--|----------|
| ^INGL 3--- | Second year course in English                            | 3        |
| FISI 3091  | Elements of Physics                                      | 3        |
| FISI 3092  | Elements of Physics Laboratory                           | 1        |
| BIOL 3052  | General Biology II                                       | 4        |
| QUIM 3062  | Fundamentals of Organic<br>Chemistry and Biochemistry II | 4        |
| HORT 4005  | Ornamental Horticulture                                  | <u>3</u> |
|            |  | 18       |

## THIRD YEAR

### First Semester

| Number               | Course  | Credits  |
|----------------------|---|----------|
| SAGA 4015            | Agricultural Machinery I<br>or                              | 3        |
| SAGA 4019            | Farm Drainage and Irrigation<br>or                          | 3        |
| SAGA 5008            | Geographic Information System<br>in Natural Resources<br>or | 3        |
| SAGA 5015            | Microirrigation Systems                                     | 3        |
| PROC 4006            | Tropical Phytopathology                                     | 3        |
| BIOL 3300            | Genetics  | 3        |
| CFIT 4005            | Physiological Principles of<br>Crop Production              | 3        |
| CISO ----            | ***Elective course in Social Sciences                       | 3        |
| ELECTIVES**Electives |   | <u>3</u> |
|                      |   | 18       |

### Second Semester

| Number               | Course   | Credits  |
|----------------------|--|----------|
| BIOL 3770            | General Microbiology                             | 3        |
| PROC 4008            | Agricultural Entomology                          | 3        |
| ECON 3021            | Principles of Economics:<br>Microeconomics<br>or | 3        |
| ECAG 3005            | Principles of Agricultural<br>Economic Analysis  | 3        |
| ELECTIVES**Electives |  | <u>6</u> |
|                      |  | 15       |

## SUMMER SESSION

| Number    | Course  | Credits |
|-----------|---|---------|
| HORT 4006 | Horticulture Practicum<br>or  | 3       |
| HORT 4995 | Supervised Professional<br>Occupational Experience for<br>Coop Students |         |

## FOURTH YEAR

### First Semester

| Number               | Course                           | Credits  |
|----------------------|----------------------------------|----------|
| HORT 4015            | Tropical Fruit Culture I         | 3        |
| HORT 4029            | Coffee                           | 3        |
| HUMA ----            | ***Elective course in Humanities | 3        |
| ELECTIVES**Electives |                                  | <u>8</u> |
|                      |                                  | 17       |

### Second Semester

| Number               | Course                           | Credits  |
|----------------------|----------------------------------|----------|
| HORT 4008            | Vegetable Crops                  | 3        |
| HORT 4028            | Seminar                          | 1        |
| HUMA ---             | ***Elective course in Humanities | 3        |
| ECAG 4019            | Introduction to Farm Management  | 3        |
| HORT 4045            | Starchy Crops                    | 4        |
| ELECTIVES**Electives |                                  | <u>3</u> |
|                      |                                  | 17       |

### Total credits required for program: 142

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*Minimum requirements in electives. The Horticulture Department requires a minimum of 20 credits in electives courses. At least 8 should be in professional electives chosen from the list of recommended professional electives. The remaining 12 credits are free electives.

\*\*\*Elective courses in Social Sciences and Humanities require authorization of the Horticulture Department Director.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## COURSES OF INSTRUCTION

### Undergraduate Courses

**HORT 3005. PLANT PROPAGATION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005.

Principles and practices followed in the propagation of plants. A study of seeds, cuttings, grafting, budding, transplanting and modified organs used in the propagation of plants. Green houses, propagators, seedbeds and other structures will be discussed.

**HORT 3015. COMMERCIAL PRODUCTION OF HERBACEOUS ORNAMENTALS.** Three credit hours per semester. Three hours of lecture per week. Prerequisite: CFIT 3005.

Theory and practice of the commercial production of herbaceous ornamental plants with potential for Puerto Rico and their landscape use.

**HORT 3025. ORCHIDOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005 or BIOL 3435 or BIOL 3052.

Study of the biology, commercial production, marketing, and utilization of orchids as ornamental plants.

**HORT 4005. ORNAMENTAL HORTICULTURE.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005.

Theory and practice of the major fields of ornamental horticulture: floriculture, nursery production, turf grass management, and landscaping. Overview of the ornamental horticulture industry, including marketing, sales, design, and public relations. Field trips required.

**HORT 4006. HORTICULTURE PRACTICUM.** Three credit hours. A minimum of thirty hours per week during six consecutive weeks. Prerequisite: a minimum of nine credits in Horticulture and authorization of the Director of the Department.

Practical work experience in Horticulture. It is carry out under the supervision of the Department in collaboration with public or private entities.

**HORT 4008. VEGETABLE CROPS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005.

Study and practice of vegetables growing; varieties, planting, cultivation, and insect and disease problems of the common vegetables; handling for local markets and for shipping. Field trips required.

**HORT 4009. HORTICULTURAL CROPS.** Three credit hours. Three hours of lecture per week. Prerequisite: CFIT 3005.

A survey course covering some important horticultural enterprises on the island. Coffee, bananas, vegetable crops, and ornamentals will be discussed. Field trips required.

**HORT 4014. PLANTS FOR THE LANDSCAPE.** Three credit hours. Three hours of lecture per week.

Study of plants as material for landscaping design in Puerto Rico, their identification by scientific and common name, and by aesthetic and botanical characteristics. Emphasis in the selection of plants according to the design needs, uses, and management.

**HORT 4015. TROPICAL FRUIT CULTURE I.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005.

Study of the most important fruits in Puerto Rico, including pineapple, citrus, avocados, and bananas. Field trips required.

**HORT 4016. PRINCIPLES OF LANDSCAPE DESIGN.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: CFIT 3005 or authorization of the Director of the Department.

Principles and techniques of landscape design; preparation of plans for small areas.

**HORT 4018-4019. SPECIAL PROBLEMS.** One to three credit hours per semester. One to three research periods per semester. Prerequisite: authorization of the Director of the Department.

Research problems in horticulture selected by the student and the professor. A written report is required.

**HORT 4025. FLORICULTURE.** Two credit hours. One hour of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005.

Identification, cultural practices and management of annuals, biennials, perennials, and bulbous cut-flower plants, used for commercial purposes.

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**HORT 4026. NURSERY MANAGEMENT.**

Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005.

Principles covering the establishment of nurseries for commercial purposes; the preparation of layout plants both for retail and wholesale nurseries, structures, equipment, operation, and marketing will be discussed. Field trips required.

**HORT 4027. FLOWER ARRANGEMENT.** Two credit hours. One hour of lecture and one three-hour laboratory per week.

Principles of flower arranging. The management of a flower shop, the handling of plants and flowers, preparation of wreaths, sprays, corsages, etc., floral arrangements for special occasions such as banquets, funeral celebrations, and other events. Visits to flower shop required.

**HORT 4028. SEMINAR.** One credit hour. One meeting per week. Prerequisite: A minimum of 9 credits approved in Horticulture.

Reports and discussions of assigned or selected readings of investigation related to horticulture problems.

**HORT 4029. COFFEE.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005.

The commercial production of coffee (with special consideration given to conditions prevailing in Puerto Rico). The selection of varieties, propagation, planting, fertilization and management. Field trips required.

**HORT 4030. POSTHARVEST TECHNOLOGY OF HORTICULTURAL CROPS.** Three credit hours. Three hours of lecture per week. Prerequisite: CFIT 4005.

Study of the postharvest technology utilized in horticultural crops, including control of ripening and decay processes, and handling during harvesting, classification, packaging, transportation, and storage. Special attention will be given to tropical and subtropical products. Field trips are required.

**HORT 4035. TROPICAL FRUITS CULTURE II.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005.

Study of the origin, botany, varieties and production practices of tropical fruits with economic potential in

Puerto Rico, such as: papaya, mango, and passion fruit.

**HORT 4037. PRINCIPLES OF FRUIT AND VEGETABLE PRESERVATION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: QUIM 3002 or (QUIM 3132 and QUIM 3134).

Fundamentals principles of food spoilage, decomposition and changes, methods employed in preserving fruits and vegetables, laboratory work in freezing, canning and dehydration, the common commercial methods of preserving fruits and vegetables. Field trips required.

**HORT 4045. STARCHY CROPS.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005.

Management and production of starchy crops like plantains, bananas, yams, sweet potatoes, cassava, taro, root celery, and others with economic potential in Puerto Rico. Special attention will be given to the origin, economic situation and perspectives, botanic classification, climatic requisites, crop improvement, propagation, cultural practices, pest and disease control, harvesting, storage, processing, distribution, and marketing.

**HORT 4046. INTRODUCTION TO ORGANIC CROPS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005.

Study of organic farm management. Application of practices such as crop rotation, intercropping, fertilization, tillage, transplantation, and pest and disease control. Postharvest, marketing, and certification aspects will be studied. Field trips are required.

**HORT 4047. PLANT MICROPROPAGATION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: CFIT 3005 or BIOL 3052.

Use of tissue culture as a tool in the propagation of plants of economic importance to Puerto Rico such as ornamental plants, starchy crops, fruits, vegetables and aromatic plants.

**HORT 4048. CROP PRODUCTION IN HYDROPONICS SYSTEMS.** Three credit hours. Two hours of lecture and one three hour laboratory per week. Prerequisite: CFIT 3005 or BIOL 3051.

Study of theoretical and practical aspects in hydroponic crop production systems. Includes topics

such as: nutrient solutions preparation, equipment and infrastructure, integrated pest and disease management, harvest, postharvest management, and marketing.

**HORT 4055. AROMATIC PLANTS.** Three credit hours. Three hours of lecture per week. Prerequisite: CFIT 3005.

Production and handling of aromatic plants; medicinal, culinary, ornamental and landscape uses.

**AGRO/HORT 4066. TURFGRASS MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: CFIT 3005 and AGRO 3005.

Study of the physiology, management, and characteristics of tropical and subtropical turfgrasses. Establishment, fertilization, irrigation, mowing, and pest and disease control practices will be emphasized.

**HORT 4995. SUPERVISED PROFESSIONAL OCCUPATIONAL EXPERIENCE FOR COOP STUDENTS.** Three to six credit hours. A maximum of two practice period, one of which has to be in a semester. Prerequisites: authorization of the Director of the Department and to be a Coop student.

Practical experience in Horticulture in cooperation with the private sector or government. To be jointly supervised by the academic department, the Coop program coordinator, and an official from the cooperating entity. A written report will be required upon completion of each work period.

**HORT 4996. SELECTED TOPICS I.** One to three credit hours. One to three hours of lecture per week.

Selected topics in ornamentals, starch and tubers, vegetables, fruits, tissue culture and other related areas.

**HORT 4997. SELECTED TOPICS II.** One to three credit hours. One to three hours of lecture per week.

Selected topics in ornamentals, starch and tubers, vegetables, fruits, tissue culture and other related areas.

## **Advanced Undergraduate and Graduate Courses**

**HORT 5005. ADVANCED FLORICULTURE.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: HORT 4025 or authorization of the Director of the Department.

A comprehensive review of scientific literature and research on the ecology, physiology, propagation, improvement, and other growth processes of important flowering and foliage plants.

**HORT 5006. ADVANCED VEGETABLE GARDENING.** Two credit hours. One hour of lecture and one three-hour laboratory per week. Prerequisite: HORT 4008 or authorization of the Director of the Department.

This course aims to review the different phases of experimental work in vegetable growing with assigned field problems. Field trips required.

**HORT 5015. HORTICULTURE OF TEMPERATE ZONES.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study of the basic and applied concepts in horticulture in temperate zones. Study of the effects of environmental factors on agricultural production and how they affect plant growth and development of fruits, vegetables and ornamental crops, and urban forests. Emphasis will be given to different marketing systems for agricultural products and their postharvest physiology. The course consists of lectures and a ten-day trip to a temperate zone country.

## **DEPARTMENTAL FACULTY**

**OSCAR ABELLEIRA,** *Assistant Professor*, PhD 2015, University of Idaho.

**WANDA I. ALMODÓVAR,** *Professor*, M.S., 1989, University of Puerto Rico, Mayagüez Campus.

**ADA ALVARADO,** *Associate Professor*, M.S., 1992, University of Puerto Rico, Mayagüez Campus.

**ARÍSTIDES M. ARMSTRONG,** *Professor*, M.S., 1981, University of Puerto Rico, Mayagüez Campus.

**LUCAS AVILÉS,** *Professor*, Ad Honorem, MS 1988, University of Florida, Gainesville.



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**ALBERTO BEALE**, *Professor*, Ad Honorem, Ph.D., 1979, University of Florida, Gainesville.

**JAMES S. BEAVER**, *Professor*, Ad Honorem, Ph.D., 1980, University of Illinois.

**LINDA W. BEAVER**, *Professor*, Ad Honorem, Ph.D., 1981, University of Illinois.

**ANGEL BOSQUES**, *Professor*, Ad Honorem, MS, 1985, University of Puerto Rico-Mayaguez Campus.

**BRYAN BRUNNER**, *Professor*, Ad Honorem, PhD 1992, Michigan State University.

**IRMA CABRERA**, *Professor*, M. S., 1987, University of Puerto Rico.

**ROSA N. CHÁVEZ-JÁUREGOI**, *Assistant Professor*, Ph.D., 1995, University of Sao Paulo.

**JOAQUIN CHONG**, *Associate Professor*, PhD 2005, Clemson University.

**MAGALY CINTRÓN**, *Assistant Professor*, M.S., 2003, University of Puerto Rico, Río Piedras Campus.

**WINSTON DE LA TORRE**, *Professor*, Ad Honorem, Ph.D., 1988, North Carolina State University.

**MANUEL DÍAZ**, *Associate Professor*, MS, 1982, University of Puerto Rico, Mayagüez Campus.

**JOSÉ A. DUMAS**, *Professor*, Ph.D., 1999, University of Puerto Rico, Río Piedras.

**CONSUELO ESTÉVEZ-DE JENSEN**, *Assistant Professor*, Ph.D., 2000, University of Minnesota.

**MERARI FELICIANO**, *Assistant Professor*, Ph.D., 2011, University of Kentucky.

**FEIKO H. FERWERDA**, *Assistant Researcher*, Ph.D., 2001, University of Florida.

**CARLOS FLORES**, *Associate Professor*, MS 1993, University of Puerto Rico-Mayagüez Campus.

**MARIO FLORES**, *Assistant Professor*, Ph.D., 2009, University of Wisconsin.

**ROSA A. FRANQUI-RIVERA**, *Professor*, Ph.D., 1995, University of Wisconsin.

**FERNANDO GALLARDO**, *Professor*, Ph.D., 1990, Louisiana State University.

**JOHN M. GILL**, *Professor*, Ph.D., 1994, Rutgers University.

**MARTHA GIRALDO**, *Assistant Professor*, Ph.D., 2010, Kansas State University.

**AGENOL GONZÁLEZ**, *Professor*, Ad Honorem, MS 1983, University of Puerto Rico-Mayagüez Campus.

**LIZZETTE GONZÁLEZ-GILL**, *Professor*, Ph.D., 1996, Rutgers University.

**SALLY GONZÁLEZ-MIRANDA**, *Specialist of Extension*, MLA, 1987, Ball State University, Indiana.

**ANGELA LINARES**, *Assistant Professor*, PhD 2014, North Dakota University.

**MARÍA DE L. LUGO**, *Professor*, Ph.D., 1993, University of Arkansas.

**WANDA LUGO**, *Researcher*, M.S., 1982, North Carolina State University.

**RAÚL E. MACCHIAVELLI**, *Professor*, Ph.D., 1992, The Pennsylvania State University.

**GUSTAVO A. MARTÍNEZ**, *Professor*, Ph.D., 1995, Ohio State University.

**SILVERIO MEDINA-GAUD**, *Emeritus Professor*, Ph.D., 1978, Iowa State University.

**JOSÉ PABLO MORALES-PAYÁN**, *Professor*, Ph.D., 1999, University of Florida, Gainesville.

**MIGUEL A. MUÑOZ**, *Professor*, Ph.D., 1988, Ohio State University.

**EDNA NEGRÓN-DE BRAVO**, *Professor*, Ad Honorem, Ph.D., 1987, University of Pennsylvania.

**JULIA O'HALLORANS**, *Associate Professor*, Ph.D., 2001, New Mexico State University.

**LYNETTE ORELLANA**, *Professor*, Ph.D., 2004, Washington State University.

**CARLOS E. ORTIZ-MALAVÉ**, *Professor*, Ph.D., 1993, University of Arkansas.

**MARÍA PLAZA-DELESTRE**, *Assistant Professor*, Ph.D., 2010, University of Florida.

**VÍCTOR A. SNYDER**, *Professor*, Ph.D. 1980, Cornell University.

**ERMITA HERNÁNDEZ**, *Assistant Professor*, Ph.D., 2013, Penn State University.

**DAVID SOTOMAYOR-RAMÍREZ**, *Professor*, Ph.D., 1996, Kansas State University.

**LUIS E. RIVERA**, *Researcher*, M.S., 1983, University of Puerto Rico, Mayagüez Campus.

**DANIA RIVERA**, *Associate Professor*, PhD, 2010, Ohio State University.

**LYDIA I. RIVERA-VARGAS**, *Professor*, Ph.D., 1994, Ohio State University.

**WILFREDO ROBLES**, *Associate Professor*, Ph.D., 2009, Mississippi State University.

**ELVIN ROMÁN-PAOLI**, *Professor*, Ph.D., 1997, Kansas State University.

**JESSE ROMÁN-TORO**, *Emeritus Professor*, Ph.D., 1968, North Carolina State University.

**EVELYN ROSA-MARQUES**, *Associate Professor*, Ad Honorem, M.S., 1998, University of Puerto Rico.

**CARLOS ROSARIO-PÉREZ**, *Professor*, Ph.D., 1988, Pennsylvania State University.

**ALEJANDRO E. SEGARRA-CARMONA**, *Professor*, Ph.D., 1985, University of Maryland.

**RAMÓN I. TORRES-LÓPEZ**, *Professor*, Ph.D., 1993, Texas A&M University.

**ELIDE VALENCIA**, *Professor*, Ph.D., 1997, University of Florida.

**ROBERTO VARGAS**, *Professor*, Ph.D., 1995, Auburn University.

**JOSÉ C. VERLE RODRIGUES**, *Associate Professor*, Ph.D., 2001, Universidade de Sao Paulo, Brasil.

**JOSÉ ZAMORA**, *Associate Professor*, MS 1991, University of Puerto Rico-Mayagüez Campus.

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## DEPARTMENT OF ANIMAL SCIENCE

The **Animal Science Program** allows students to acquire knowledge and develop abilities and experience in the areas of the animal sciences related to domestic animal production, including species such as beef and dairy cattle, poultry, swine, small ruminants, horses and rabbits. Apiculture (beekeeping and honey production) and aquaculture are also included in the program. Students enrolled in the program take courses in both the basic and applied sciences, such as feeding and nutrition, breeding and reproduction, prevention and control of common diseases, biosecurity, molecular biology and product development processing and technology (milk, meat, eggs, fish, honey). Upon completion of all requirements, students are awarded the degree of Bachelor of Agricultural Sciences (BAS) with a major in Animal Science.

The Animal Science Program prepares students for work in a number of specialized occupations such as management of dairy, poultry, beef, swine, and fish enterprises; sales in the feed industry, veterinary products, farm machinery and equipment; management of milk or meat processing plants or as consultants to the Beef, Dairy, Swine, Fish, and Poultry Industry, and Agricultural Extension Service or to other federal or local governmental agencies. During their studies, students are strongly encouraged to venture as private entrepreneurs.

The **Pre-Veterinary Program** is designed to provide its students all the science and preparatory courses normally required for admission to the AVMA accredited Schools of Veterinary Medicine in the United States and abroad. This is a three-year, non-degree granting program. Students can apply for admission to those schools after finishing this program. Although numerous students after finishing the Pre-Vet program opt to easily transfer to the Animal Science Program to obtain the BAS degree upon completion of all requirements. This provides the students many options to get professional degrees in the health-related careers such as Human Medicine, Odontology, and Pharmaceutical Sciences.

The Animal Science Department also offers a graduate study program leading to the degree of Master of Sciences in Animal Science.

### Vision

We will be recognized as the main provider in Puerto Rico, and one of the top academic units in the island and beyond, for undergraduate education in Animal Science. The Department of Animal Science will also be known nationally and internationally as an outstanding academic provider of graduate education in animal science. We will strive to develop students to become leaders and conscious global citizens with a knowledge base that includes an understanding of the economic, environmental, and social implications of animal care, welfare, production for food, fiber, recreation, and companionship. The Department will have a reputation in Puerto Rico, nationally, and internationally for being a leader in developing and disseminating new knowledge in the biological sciences for the production of food, companion, and service animals. We will strive to be trans disciplinary in our vision and conscious of current social issues such as animal health, food safety, biomass utilization, and environmental sustainability.

### Mission

Our mission is to discover and communicate knowledge about animals and their products, including their role and impact on society and the environment. The accomplishment of this mission is directed to the students of University of Puerto Rico - Mayaguez, the scientific community, stakeholders of the Department, and others who are interested in animals used for food and fiber production, recreation, and companion purposes.

### Program Objectives of the Department

- To award the degree of B.S. in Animal Science
- To award the degree of M.S. in Animal Science.
- To teach skills in sciences, management, physiology, nutrition, reproduction, animal breeding and genetics, and molecular biology at all levels from basic to graduate.
- To encourage an entrepreneurial outlook.
- To strengthen research skills and to foster a positive attitude towards research that will provide useful information to solve current agricultural industry challenges.
- To promote expertise in skills involving analysis, interpretation, and evaluation.

- To provide a foundation for advanced studies in the broad disciplines of Animal Sciences.

### Outcomes of the Animal Science Department

To teach, develop, and advance our students to be proficient in:

- Communication skills
- Critical reading, writing, thinking
- Analysis, interpretation, and evaluation of problems in the animal industry
- Problem-solving strategies/abilities
- Research skills, starting at the undergraduate level
- Integrity and ethics, including awareness of plagiarism
- Understanding of the role that Animal Science plays in our society, research, production, and other related science-based professions
- A good foundation for success in advanced studies in academics and other professions.

## PROGRAM OF STUDY

### ANIMAL SCIENCE CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits  | Course                                    |
|------------|----------|---|
| *INGL 3--- | 3        | First year course in English              |
| *ESPA 3101 | 3        | Basic course in Spanish I                 |
| *MATE 3171 | 3        | Pre-Calculus I                            |
| BIOL 3051  | 4        | General Biology I                         |
| CIAN 3011  | 3        | Fundamentals of Animal Science            |
| CIAN 3012  | 1        | Laboratory of Practices in Animal Science |
| EDFI ----  | <u>1</u> | Elective course in Physical Education     |
|            | 18       |   |

##### Second Semester

| Number     | Credits  | Course                                |
|------------|----------|---------------------------------------|
| *INGL 3--- | 3        | First year course in English          |
| *ESPA 3102 | 3        | Basic course in Spanish II            |
| *MATE 3172 | 3        | Pre-Calculus II                       |
| BIOL 3052  | 4        | General Biology II                    |
| CFIT 3005  | 4        | Fundamentals of Crop Production       |
| EDFI ----  | <u>1</u> | Elective course in Physical Education |
|            | 18       |                                       |

#### SECOND YEAR

##### First Semester

| Number      | Credits  | Course                                  |
|-------------|----------|---|
| INGL 3---   | 3        | Second year course in English           |
| QUIM 3131   | 3        | General Chemistry I                     |
| QUIM 3133   | 1        | General Chemistry Laboratory I          |
| CIAN 4005   | 3        | Veterinary Physiology                   |
| ECON 3021   | 3        | Principles of Economics: Microeconomics |
| EDAG 3005   | 1        | Agricultural Orientation                |
| CISO ---*** | <u>3</u> | Elective course in Social Sciences      |
|             | 17       |   |

##### Second Semester

| Number      | Credits  | Course                         |
|-------------|----------|--------------------------------|
| ^ INGL 3--- | 3        | Second year course in English  |
| FISI 3091   | 3        | Elements of Physics            |
| FISI 3092   | 1        | Elements of Physics Laboratory |
| QUIM 3132   | 3        | General Chemistry II           |
| QUIM 3134   | 1        | General Chemistry Lab. II      |
| ELECTIVES** | 3        | Electives                      |
| CIAN 4010   | <u>4</u> | Animal Feeding and Nutrition   |
|             | 18       |                                |

#### THIRD YEAR

##### First Semester

| Number      | Credits  | Course                         |
|-------------|----------|--------------------------------|
| QUIM 3461   | 3        | Organic Chemistry I            |
| QUIM 3462   | 1        | Organic Chemistry Laboratory I |
| BIOL 3770   | 3        | General Microbiology           |
| BIOL 3300   | 3        | Genetics                       |
| AGRO 3011   | 2        | General Soils                  |
| AGRO 3013   | 1        | General Soils Laboratory       |
| ELECTIVES** | <u>3</u> | Electives                      |
|             | 16       |                                |

##### Second Semester

| Number       | Credits  | Course                                       |
|--------------|----------|--|
| HUMA --- *** | 3        | Elective course in Humanities                |
| AGRO 4046    | 3        | Agrostology, Forages and Pastures Management |
| QUIM 3463    | 3        | Organic Chemistry II                         |
| QUIM3464     | 1        | Organic Chemistry II Laboratory              |
| ECAG 4019    | 3        | Introduction to Farm Management              |
| CIAN 4006    | <u>3</u> | Reproductive Physiology of Farm Animals      |
|              | 16       |  |

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**SUMMER SESSION**

| Number    | Credits | Course                   |
|-----------|---------|--------------------------|
| CIAN 4007 | 3       | Animal Science Practicum |

**FOURTH YEAR****First Semester**

| Number       | Credits   | Course                        |
|--------------|-----------|-------------------------------|
| CIAN 4037    | 1         | Seminar                       |
| HUMA --- *** | 3         | Elective course in Humanities |
| ELECTIVES ** | <u>12</u> | Electives                     |
|              | 16        |                               |

**Second Semester**

| Number      | Credits  | Course                     |
|-------------|----------|----------------------------|
| CIAN 4019   | 3        | Animal Breeding            |
| CIAN 4038   | 1        | Seminar                    |
| SAGA 4015   | 3        | Agricultural Machinery I   |
| QUIM 5071   | 3        | General Biochemistry<br>or |
| QUIM 4055   | 3        | Biochemistry               |
| ELECTIVES** | <u>7</u> | Electives                  |
|             | 17       |                            |

**Total credits required for program: 139**

\*Refer to the Academic Regulations section of this Bulletin for information about advanced placement.

\*\*The program in Animal Science has 26 credits in elective courses. Of these, 14 are Professional Electives selected from those offered by Department (INPE code) or closely related areas, which require approval from the Director of the Department of Animal Science. The remaining 12 credits are free electives.

\*\*\*The courses taken as electives in Social Sciences and Humanities must be approved by the Director of the Department of Animal Industry.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3202, INGL 3209 or INGL 3289.

**PRE-VETERINARY CURRICULUM****FIRST YEAR****First Semester**

| Number     | Credits  | Course                                       |
|------------|----------|--|
| *INGL 3--- | 3        | First year course in English                 |
| MATE 3171  | 3        | Pre-Calculus I                               |
| QUIM 3131  | 3        | General Chemistry I                          |
| QUIM 3133  | 1        | General Chemistry Laboratory I               |
| BIOL 3051  | 4        | General Biology I                            |
| CIAN 3011  | 3        | Fundamentals of Animal Science               |
| CIAN 3012  | 1        | Laboratory of Practices<br>in Animal Science |
| EDFI ----  | <u>1</u> | Course in Physical Education                 |
|            | 19       |  |

**Second Semester**

| Number     | Credits  | Course                                     |
|------------|----------|--|
| *INGL 3--- | 3        | First year course in English               |
| *MATE 3172 | 3        | Pre-Calculus II                            |
| QUIM 3132  | 3        | General Chemistry II                       |
| QUIM 3134  | 1        | General Chemistry Lab. II                  |
| BIOL 3052  | 4        | General Biology II                         |
| ECON 3021  | 3        | Principles of Economics:<br>Microeconomics |
| EDFI ----  | <u>1</u> | Course in Physical Education               |
|            | 18       |  |

**SECOND YEAR****First Semester**

| Number    | Credits  | Course                         |
|-----------|----------|--------------------------------|
| INGL 3--- | 3        | Second year course in English  |
| MATE 3031 | 4        | Calculus I                     |
| QUIM 3461 | 3        | Organic Chemistry I            |
| QUIM 3462 | 1        | Organic Chemistry Laboratory I |
| CIAN 4005 | 3        | Veterinary Physiology          |
| CIAN 4037 | <u>1</u> | Seminar                        |
|           | 15       |                                |

**Second Semester**

| Number     | Credits  | Course                                 |
|------------|----------|--|
| ^INGL 3--- | 3        | Second year course in English          |
| CIAN 4036  | 3        | Farm Animal Diseases                   |
| CIAN 4010  | 4        | Animal Feeding and Nutrition           |
| QUIM 3463  | 3        | Organic Chemistry II                   |
| QUIM 3464  | 1        | Organic Chemistry Laboratory II        |
| FISI 3151  | 3        | Modern College Physics I               |
| FISI 3153  | <u>1</u> | Modern College Physics<br>Laboratory I |
|            | 18       |  |

### THIRD YEAR

#### First Semester

| Number      | Credits  | Course                                   |
|-------------|----------|--|
| *ESPA 3101  | 3        | Basic course in Spanish I                |
| INGL 3236   | 3        | Technical Communication                  |
| CIAN 5350   | 3        | Veterinary Clinical Parasitology         |
| CIAN 4017   | 3        | Introduction to Poultry Production<br>or |
| CIAN 4025   | 3        | Dairy Cattle and Milk Production         |
| HUMA ----** | 1        | Elective course in Humanities            |
| FISI 3152   | 3        | Modern College Physics II                |
| FISI 3154   | <u>1</u> | Modern College Physics Laboratory II     |
|             | 17       |  |

#### Second Semester

| Number       | Credits  | Course                                     |
|--------------|----------|--|
| *ESPA 3102   | 3        | Basic course in Spanish II                 |
| BIOL 3770    | 3        | General Microbiology                       |
| QUIM 5071    | 3        | General Biochemistry                       |
| BIOL 3300    | 3        | Genetics                                   |
| CIAN 4006    | 3        | Reproductive Physiology<br>of Farm Animals |
| CISO ---- ** | <u>3</u> | Elective course in Social Sciences         |
|              | 18       |  |

#### Total credits required for program: 105

\*Refer to the Academic Regulations section of this Bulletin for information about advanced placement.

\*\*The program in Animal Science has 26 credits in elective courses. Of these, 14 are Professional Electives selected from those offered by the Department (INPE code) or closely related areas, which require approval from the Department Director. The remaining 12 credits are electives.

\*\*\*The courses taken as electives in Social Sciences and Humanities must be approved by the Director of the Animal Science Department.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3202, INGL 3209 or INGL 3289.

\*Refer to the Academic Regulations section of this Bulletin for information about advanced placement.

\*\*The program in Animal Science has 26 credits in elective courses. Of these, 14 are Professional Electives selected from those offered by the Department (INPE code) or closely related areas, which require approval from the Department Director. The remaining 12 credits are electives.

\*\*\*The courses taken as electives in Social Sciences and Humanities must be approved by the Director of the Animal Science Department.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

### DEPARTMENTAL FACULTY

**ENID ARCELAY**, *Associate Professor*, Ph.D. 2009, University of Massachusetts.

**AMÉRICO CASAS-GUERNICA**, *Researcher*, M.S., 1984, University of Puerto Rico.

**JAIME E. CURBELO-RODRÍGUEZ**, *Associate Extension Specialist*, Ph.D., 2011, Mississippi State University.

**KATHERINE DOMENECH-PÉREZ**, *Assistant Researcher*, Ph.D., 2016, University of Nebraska, Lincoln.

**RENÉ F. ESTEVES-AMADOR**, *Assistant Extension Specialist*, Ph.D. 2015, University of Puerto Rico-Mayagüez.

**JOHN A. FERNÁNDEZ-VANCLEVE**, *Professor*, Ph.D., 1986, University of Kentucky.

**ESBAL JIMÉNEZ-CABÁN**, *Researcher*, Ph.D., 2008, The Ohio State University.

**JOSÉ R. LATORRE**, *Professor*, Ph.D., 1986, University of Arkansas.

**ALEXANDER MESONERO-MORALES**, *Associate Professor*, DVM, MS., 2008, Louisiana State University.

**CARLOS NAZARIO-PAGÁN**, *Associate Extension Specialist*, M.S., 1988, North Carolina State University.

**GUILLERMO ORTIZ-COLÓN**, *Associate Extension Specialist*, Ph.D., 2006, Michigan State University.

**MELVIN PAGÁN-MORALES**, *Researcher*, Ph.D., 2002, Michigan State University.

**LEYDA PONCE DE LEÓN-GONZÁLEZ**, *Professor*, Ph.D., 1999, University of Wisconsin-Madison.

**AIXA RIVERA-SERRANO**, *Extension Specialist*, M.S., 1985, University of Puerto Rico.

**ABNER RODRÍGUEZ-CARIAS**, *Professor*, Ph.D., 1996, Michigan State University.

**TEODORO RUIZ-LÓPEZ**, *Researcher*, Ph.D., 1993, University of Florida.

**HÉCTOR L. SÁNCHEZ-RODRÍGUEZ**, *Associate Professor*, Ph.D., 2011, Mississippi State University.

**CARMEN SANTANA-NIEVES**, *Associate Professor*, Ph.D., 1993, University of Illinois.

**VÍCTOR SIBERIO-TORRES**, *Professor*, Ph.D., 1996, Michigan State University.

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## COURSES OF INSTRUCTION

### DEPARTMENT OF ANIMAL SCIENCE

#### Undergraduate Courses

**CIAN 3011. FUNDAMENTALS OF ANIMAL SCIENCE.** Three credit hours. Three hours of lecture per week. Corequisite: CIAN 3012

An introductory course in Animal Sciences of economically important livestock in Puerto Rico.

**CIAN 3012. LABORATORY OF PRACTICES IN ANIMAL SCIENCE.** One credit hour. Three hour of laboratory per week. Corequisite: INPE 3011 or CIAN 3011.

Laboratory in management practices in farm animals such as: cattle, swine, equine, caprine, ovine, rabbits, and poultry.

**CIAN 3015. FUNDAMENTALS OF PHYSIOLOGY, MANAGEMENT AND CARE OF COMPANION ANIMALS.** Three credit hours. Three hours of lecture per week.

Study of anatomy, physiology, management, and care of pets, and ethical issues that relate humans to these animals.

**CIAN 3017. RABBIT PRODUCTION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 3005 or ((INPE 3011 or CIAN 3011) and INPE 3012 or CIAN 3012)).

Theoretical basis and management practices involved in commercial rabbit production, including breeds; reproductive, feeding and sanitary management; genetic improvement; and processing and marketing of the final product.

**CIAN 4005. VETERINARY PHYSIOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 3005 or (INPE 3011 and INPE 3012) and (BIOL 4015 or BIOL 3021 or BIOL 3052).

The physiology of farm animals, comprising the digestive, nervous, vascular, excretory, respiratory and endocrine systems.

**CIAN 4006. REPRODUCTIVE PHYSIOLOGY OF FARM ANIMALS.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisite: (INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012))) and (INPE 4005 or CIAN 4005).

Physiological mechanisms and anatomy of the reproductive system of farm animals, including artificial insemination.

**CIAN 4007. ANIMAL SCIENCE PRACTICUM.** Three credit hours. A minimum of thirty hours per week during six consecutive weeks. Prerequisites: (INPE{10} or CIAN{10}) and authorization of the Director of the Department.

Practical work experience in animal science. It is carried out under the supervision of the Department in collaboration with public or private entities.

**CIAN 4008. MILK AND MILK PRODUCTS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012)).

A general course covering the composition and properties of milk, and the manufacture of dairy products.

**CIAN 4009. MARKET MILK.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 4008 or CIAN 4008.

Processing and distribution of market milk and related products. Field trips required.

**CIAN 4010. ANIMAL FEEDING AND NUTRITION.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012)).

Definitions and general concepts of feeding and nutrition. Relationship between human and animal nutrition. Anatomy and physiology of the digestive tract. Nutrient digestion and absorption and excretion of waste products. Chemical composition and feed evaluation. The nutrients and their metabolism. Feedstuffs used in animal rations. Voluntary feed intake. Feeding standards for domestic animals. Ration formulation. Applied aspects of feeding dairy cattle, beef cattle, sheep, goats, horses, poultry, swine, and rabbits.

**CIAN 4015. FARM ANIMAL ECTOPARASITES.** Three credit hours. Three hours of lecture per week.

Discussion of prevention and control methods of ectoparasites. Study of the economic impact of ectoparasites in animal production.

**CIAN 4016. BEEKEEPING.** Three credit hours. Two hours of lecture and one three-hour laboratory per week.

Breeds and behavior of bees, management and apiculture production techniques. Field trips required.

**CIAN 4017. POULTRY PRODUCTION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012)).

The principles and practices of poultry breeding, feeding, incubation, brooding, rearing, housing, and sanitation.

**CIAN 4018. PHYSIOLOGY OF LACTATION.** Three credit hours. Three hours of lecture per week. Prerequisite: CIAN 4005 (Veterinary Physiology).

Discussion of the mechanisms of the biosynthesis of milk, its biological and chemical properties, its significance on the neonate and human nutrition, immunological mechanisms of the mammary gland, methods of detection of mastitis and management practices for its control in dairy herds. Study of current theories in the origin and evolution, morphology and physiology of the mammary gland among species.

**CIAN 4019. ANIMAL BREEDING.** Three credit hours. Three hours of lecture per week. Prerequisite: INPE 3005 or (((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012)) and (BIOL 3015 or BIOL 3300)).

The application of genetics to the problems and methods of livestock's improvement.

**CIAN 4025. DAIRY CATTLE AND MILK PRODUCTION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012)).

A study of the various phases of dairy cattle and milk production.

**CIAN 4026. SPECIAL PROBLEMS.** One to three credit hours each semester. One to three research periods per week per semester. Prerequisite: authorization of the Director of the Department.

Research problems in livestock feeding and nutrition, poultry feeding and nutrition, livestock management, dairy technology, animal breeding, and animal diseases.

**CIAN 4027. SPECIAL PROBLEMS.** One to three credit hours each semester. One to three research periods per week per semester. Prerequisite: authorization of the Director of the Department.

Research problems in livestock feeding and nutrition, poultry feeding and nutrition, livestock management, dairy technology, animal breeding, and animal diseases.

**CIAN 4028. INTRODUCTION TO HORSE PRODUCTION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012)).

Fundamental principles involved in the care and management of horses with emphasis on racing and the "Paso Fino". Field trips to horse farms and stables required.

**CIAN 4029. SWINE AND PORK PRODUCTION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012)).

A study of the various phases of swine production, including butchering, cutting and curing of pork.

**CIAN 4030. COMPANION ANIMAL DISEASES.** Two credit hours. Two hours of lecture per week. Prerequisite: INPE 4005 or CIAN 4005.

Study of the diseases that commonly affect the wellbeing of dogs, cats, rabbits, psitacines, and other species used as companion animals. Discussion of the etiology, pathogenesis, clinical signs, prevention, and treatment of diseases of companion animals.

**CIAN 4035. BEEF PRODUCTION.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012)).

A study of the various phases of beef cattle production, including butchering, cutting and curing of beef.

**CIAN 4036. DISEASES OF FARM ANIMALS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INPE 4005 or CIAN 4005.

The most common diseases of farm animals in Puerto Rico; their prevention, treatment, and sanitary measure.



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**CIAN 4037. SEMINAR.** One credit hour. One meeting per week. Prerequisites: INPE{12} or CIAN{12}.

Studies and discussions of research work and other topics of interest in animal science.

**CIAN 4038. SEMINAR.** One credit hour. One meeting per week. Prerequisite: INPE 4037 or CIAN 4037.

Studies and discussions of research work and other topics of interest in animal science.

**CIAN 4039. SMALL RUMIANT PRODUCTION.** Three credit hours. Three hours of lecture per week. Prerequisites: INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012)).

Management, reproduction, selection, feeding, and diseases of goats and sheep for production under tropical conditions. Field trips are required.

**CIAN 4040. BEHAVIOR OF FARM ANIMALS.** Three credit hours. Three hours of lecture per week. Prerequisite: INPE 4005 or CIAN 4005.

Study of the behavior of farm animals; the influence of genetic, and the environment on the animals conduct and the physiological aspects related to these.

**CIAN 4046. DAIRY RECORDS.** Two credit hours. Two hours of lecture per week. Prerequisites: ( INPE 3005 or ((INPE 3011 or CIAN 3011) and (INPE 3012 or CIAN 3012))) and (INPE 4025 or CIAN 4025).

Analysis, interpretation, and application of the information obtained from production records and computer use for the efficient management of a dairy farm.

**CIAN 4050. INTRODUCTION TO AQUACULTURE.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: BIOL 4015 or BIOL 3021 or BIOL 3022 or BIOL 3425 or BIOL 3052.

Study of the management practices in the culture and production of aquaculture species of economic importance in Puerto Rico. Emphasis will be given to the management of freshwater fish. Field trips are required.

**CIAN 4105. DOMESTIC ANIMAL CELL PHYSIOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: (INPE 4005 or CIAN 4005) and (QUIM 3061 or QUIM 3461).

Study of organelles, structures and macromolecules that compose eukaryotic cells of domestic animals and their interaction to mediate the eukaryotic cell functionality as individual units. Fundamentals of cell metabolism, transport and signaling between cell compartments. Discussion of basic concepts of cell cycle and protein synthesis. Emphasis on domestic and food source animal models. Introduction to biochemical and molecular biology research techniques used to study eukaryotic cell physiology in animal models.

**CIAN 4357. CIAN 4357. PRODUCTS OF ANIMAL ORIGIN.** Three credit hours. Three hours of lecture per week. Prerequisites: CIAN 3011 (Fundamentals of Animal Science) and CIAN 3012 (Laboratory Practices in Animal Science).

Analysis of diverse animal origin products, with emphasis on meat, dairy and egg products. Evaluation of slaughter and processing methods of species of major economic importance as well as components relevant to muscle tissue in meat products. Discussion of current and relevant topics that impact these products.

**CIAN 4991. SELECTED TOPICS IN ANIMAL SCIENCES I.** One to six credit hours. One hour of lecture per credit per week. Prerequisite: authorization of the Director of the Department.

Selected topics in production and management of beef and dairy cattle, poultry, swine, rabbits, bee, ovine, caprine, equine, and other related areas.

**CIAN 4995. ANIMAL SCIENCE INTERNSHIP.** One to six credit hours. One to six hours of internship per week. Prerequisite: authorization of the Director of the Department.

Work experience in the area of Animal Science, in a business enterprise or a state or federal government agency, under the supervision of a faculty member in coordination with an immediate supervisor at the internship location.

**CIAN 4997. SUPERVISED PROFESSIONAL OCCUPATIONAL EXPERIENCE FOR COOP STUDENTS.** From three to six credit hours. A maximum of two practice periods, one of which has to be in a semester. Prerequisites: authorization of the Director of the Department.

Practical experience in animal management and production and/or animal products in cooperation with the private sector or government. To be jointly supervised by the academic department, the Coop program coordinator and an official from the cooperating entity. A written report will be required upon completion of each work period.

## **Advanced Undergraduate and Graduate Courses**

**CIAN 5005. USE OF ORGANIC BY-PRODUCTS IN ANIMAL NUTRITION.** Three credit hours. Three hours of lecture per week. Prerequisite: INPE 4010 or CIAN 4010 or authorization of the Director of the Department.

Theory, concepts, and applications of the process of conversion of organic by-products into ingredients for animal use and their utilization in commercial feeds for livestock.

**CIAN 5045. ENVIRONMENT AND MANAGEMENT OF FARM ANIMALS.** Three credit hours. Three hours of lecture per week. Prerequisite: INPE 4005 or CIAN 4005 or authorization of the Director of the Department.

Study of the effects of the environment on the physiology and behavior of farm animals. Evaluation of management alternatives to minimize adverse environmental effects and to improve the productivity of livestock enterprises.

**CIAN 5346. DAIRY BY-PRODUCTS.** Three credit hours. Two lectures and one three-hour laboratory per week. Prerequisite: INPE 4008 or CIAN 4008 or authorization of the Director of the Department.

The manufacture of ice cream, cheese, and butter.

**CIAN 5350. VETERINARY CLINICAL PARASITOLOGY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: (INPE 4005 or CIAN 4005) and (INPE 4036 or CIAN 4036) or authorization of the Director of the Department.

Study of the interaction of the most common parasites of veterinary importance in domestic animals and the impact animal production. Discussion and analysis of parasite pathology, clinical manifestations, life cycles and control methods.

**CIAN 5355. ADVANCED BEEKEEPING.** Three credit hours. Two hours of conference and three hours of laboratory per week. Prerequisite: (INPE 4016 or CIAN 4016) and authorization of the Director of the Department.

Commercial management of apiaries. Including the bees, and the various methods used to obtain honey and wax.

**CIAN 5356. DISEASE CONTROL AND BIOSECURITY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisite: INPE 4005 or CIAN 4005 or authorization of the Director of the Department.

Sanitary and management practices for the control and prevention of farm animal diseases. Discussion of management practices to prevent the transmission of zoonotic diseases.

**CIAN 5357. SCIENCE AND TECHNOLOGY OF FRESH MEATS.** Three credit hours. Two hours of lecture and one four-hour laboratory per week. Prerequisite: INPE 4005 or CIAN 4005 or authorization of the Director of the Department.

Principles and practices in the handling, processing and preservation of beef, pork, and poultry meats.

**CIAN 5365. GASTROINTESTINAL MICROBIOLOGY OF DOMESTIC ANIMALS.** Three credit hours. Three hours of lecture per week. Prerequisite: ((INPE 4010 or CIAN 4010) and BIOL 3770 and QUIM 3062) or authorization of the Director of the Department.

Discussion of theory related to the microbial ecology of the gastrointestinal tract of domestic animals. Analysis of the role of intestinal microbes in the nutrition, health, and productivity of animals with emphasis on farm animals.

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## **COLLEGE OF ARTS AND SCIENCES**

### **Vision**

The College of Arts and Science strives to be a leading college, known for its high standards, its contribution to social and economic development of the local and international community by seeking and implementing new knowledge.

### **Mission**

The College of Arts and Sciences in accordance with the mission of the University of Puerto Rico at Mayagüez aspires to provide an excellent service to Puerto Rico and the World through.

- a. The formation of educated citizens cultured able to think critically and professionally trained in the arts and sciences so that they can contribute to the educational, cultural and social, technological and economic development.

Encourage creative work and conducting research and service that meets the needs of society and disseminating the results of these activities so that they are accessible to all.

With diverse curricula and degree programs the College of Arts and Sciences provides our students with the necessary sensitivity to effectively solve the problems we face and to exemplify the values and attitudes that should prevail in a democratic society which values and respects diversity.

### **Key Efforts to achieve our vision**

1. Be at the forefront of Higher Education in Puerto Rico ensuring that our students receive the best education.
2. Develop a robust planning process.
3. Strengthen creative work, research and its dissemination.
4. Implement expedite and efficient processes.
5. Increase our resources
6. Administrators, faculty and staff must be entrepreneurial to diversity and strengthen revenue streams.

7. Contribute to the sustainable economic development of the county.

Through its commitment to general education, the college will foster breadth of understanding, multiple literacies, appreciation of diverse ways of knowing and the basis of informed citizenship through the following competences.

- a. Ability to communication effective orally and in writing in both Spanish and English.
- b. Development of critical and creative thinking in both the scholarly and artistic modes.
- c. Development knowledge and skills related to their field of study and apply then to the identification and problems solution.
- d. Apply mathematical reasoning scientific method research designs and information technologies to their field of study.
- e. Recognize the ethical implication of different actions and integrate standards or codes into responsible decision-making and implementation.
- f. Appreciate and demonstrate respect for nature and environment particularly in Puerto Rico.
- g. Be knowledgeable about Puerto Rican heritage and culture.
- h. Appreciate the essential value of a democratic society.
- i. Understand contemporary social political and economic issues in a local and global context.
- j. Demonstrate respect for human diversity in all its dimensions.
- k. Develop and appreciation for the humanities, the arts and sciences.
- l. Be committed to improve the quality of life at both persons and the community level.
- m. Be able to engage in teamwork.
- n. Be firmly committed to lifelong and multi/interdisciplinary learning.

### **Degrees Offered**

The **Bachelor of Science** degree is offered in the areas of Biology, Industrial Microbiology, Industrial Biotechnology, Chemistry, Geology, Mathematics, Nursing, Physical Sciences, Pre-Medical Studies, Theoretical Physics, Computer Sciences, and Mathematics Education. The College of Arts and

Sciences provides students in these programs with an opportunity to acquire one or more of the following:

1. Specialized training for practical work in science.
2. Preparation for research in pure or applied science.
3. Preparation for the teaching of science.
4. Training in a branch of science preparatory for graduate work.
5. Preparation for admission to a professional school.
6. Preparation for the first professional degree in Nursing.

The **Bachelor of Arts** degree is offered in English, Hispanic Studies, French Language and Literature, Philosophy, Comparative Literature, Plastic Arts, Theory of Art, History, General Social Sciences, Sociology, Political Sciences, Psychology, Economics, and Physical Education. A student enrolled in one of these programs enjoys the following opportunities:

- Preparation for teaching liberal arts subjects at the elementary or secondary school level.
- Acquisition of the necessary background for continuing graduate studies or seeking admission to professional schools.
- Preparation which will enable the student to work for agencies concerned with public welfare or government service.
- Development of a broad perspective and perceptive insight in matters pertaining to human nature, achievement, and culture.
- Preparation for technical practice in Nursing.

The College of Arts and Sciences also offers graduate instruction leading to the degree of **Master of Science** in Biology, Chemistry, Geology, Marine Sciences, Mathematics, and Physics, as well as the **Master of Arts** in Hispanic Studies and English Education. The **Doctor of Philosophy** degree is offered in Marine Sciences. Additional information concerning graduate programs may be obtained by consulting the Graduate Catalogue.

## Graduation Requirements

The current number of semester hours required for graduation in each major field is indicated according to each individual curriculum. In order to graduate, a student must have a minimum general 2.00 GPA and a minimum 2.2 GPA in the main area of specialization.

## Professional Societies

**The American Chemical Society**, which has been selected as outstanding for about two decades, has had a student affiliate chapter at UPRM since 1948. Students and teachers meet to conduct scientific and social activities. The chapter sponsors trips and visits to chemical and related industries and attends scientific meetings on the island.

**The American Association of Physics Teachers** has a Regional (Puerto Rico) Section with its nucleus in the Physics Department at UPRM. A joint meeting with the American Physical Society is held annually in New York City. Regional Section's objectives include improvement in the teaching of physics and enhancement in the appreciation of its cultural value. Members meet regularly to discuss scientific topics.

The Mayagüez student chapter of the **Political Sciences Association of Puerto Rico** not only fosters research and discussion within campus, but also provides a link with political sciences majors on other campuses.

**The Student Nurses Association of the Commonwealth of Puerto Rico** aims to promote interaction and leadership among UPRM Nursing students and other chapters on the island.

**Phi Alpha Delta** has had a very active and outstanding pre-legal chapter at UPRM since the 1980's.

## Department-Sponsored Student Organizations

On May 27, 1945, Beta Beta Beta, an honorary society for biology majors, organized the Zeta Alpha Chapter at UPRM. Juniors and seniors with a minimum grade point average of 3.00, who have shown ability and interest in biological research are eligible for active membership.

There are other active student associations in the Departments of Biology, Economics, English, Geology, Humanities, Mathematics, Physics and Social Sciences, such as the Pre-medical Student's Circle, the Psychology Student Association, the University Philosophy Club, the History Student Association, the Eugenio María de Hostos Hispanic Circle, the College Drama Club, the Dancer's CAAMpany, the Sociology Student Union, the Environmental Student Association, and the Physical Education Student Association.

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## Advanced Placement

Incoming students may receive advanced placement in Spanish, English and mathematics courses if they score a 4 or 5 in the Advanced Placement Examination. Students should contact the Associate Dean of Academic and Student Affairs at the College of Arts and Sciences for any information related to advanced placement.

## Curricular Sequence in Film Studies

The Curricular Sequence in Film Studies is sponsored by the Departments of English, Humanities, Hispanic Studies and Social Sciences. It offers undergraduate students a balanced introduction to film studies designed to help them deepen their appreciation of this popular art form. It can also serve as preparation for those interested in pursuing further study in the field, or film-related careers.

The curricular sequence is equivalent to a 15 credit minor which can be completed in 2 semesters. In the four required core courses, students acquire knowledge of the history and theory of film, and of the basic techniques of digital videomaking. In addition to these courses, they take an elective film course of one credit or more.

## Admission Requirements

- Students who have completed 48 credits of undergraduate coursework and have a grade point average of 2.5 or more are eligible to enroll in the sequence of film courses.
- The applicant must fill out the application from available in the Departments of English, Humanities, Hispanic Studies, and Social Sciences, and submit it to the coordinator, or to one of the departmental representatives to the governing board, before the deadline for Readmission and Transfer established by the University Administrative Board each academic year.
- Any student who has completed 48 credits in undergraduate coursework may take any of the CINE courses as an elective.

## Core Courses

CINE 4001 Film History to 1950  
CINE 4002 Film History from 1950  
CINE 4005 Film Theory  
CINE 4015 Digital Videomaking

## Electives

CINE 4025 Special Topics  
INGL 3345 Special Topics in Film  
ESPA 3305 Hispanic Film and Literature  
ITAL 3086 Italian Film

## Requirements

- Completion of the four core courses and of one of the designated electives with a grade of “C” or more.
- The curricular sequence in film studies will be awarded to the student upon his/her completion of all the curricular sequence requirements and of the requirements for graduation from his/her faculty, and noted on his/her transcript.

## Arts and Sciences Interdisciplinary Courses:

**CINE 3005. WRITING THE SHORT FILM.** Three credit hours. Three hours of lecture per week. Prerequisite: 24 credits approved in undergraduate courses.

Application of theoretical and practical tools used in the different stages of developing a filmscript. Study of specific films, technical and formal aspects of screenwriting and of different theoretical approaches resulting in the creation of a polished screenplay.

**CINE 4001. FILM HISTORY TO 1950.** Four credit hours. Three hours of lecture and three hours of workshop per week. Prerequisites: 48 undergraduate credits.

The history of world cinema from its beginnings to 1950.

**CINE 4002. FILM HISTORY FROM 1950.** Four credit hours. Three hours of lecture and three hours of workshop per week. Prerequisites: 48 undergraduate credits.

The history of world cinema from 1950 to the present.

**CINE 4005. FILM THEORY.** Three credit hours. Three hours of lecture per week. Prerequisites: 48 undergraduate credits.

Theoretical concepts and development of critical skills for aesthetic appreciation and analysis of film.

**CINE 4015. DIGITAL VIDEOMAKING.**

Three credit hours. Three hours of lecture per week.  
Prerequisites: 48 undergraduate credits.

Development of basic skills of videomaking, such as planning the filming of a video and the use of video, sound, lighting, and editing equipment.

**CINE 4016. FILM PRODUCTION: THE CREATIVE DOCUMENTARY.** Three credit hours. Three hours of lecture per week. Prerequisite: 48 credits approved in undergraduate courses.

Theory and practice of how to creatively produce and direct non-fiction films with special emphasis on the conceptualization and development of ideas, the aesthetics of the image, and the creative processes for making short fiction films.

**CINE 4017. FILM PRODUCTION: FICTION.** Three credit hours. Three hours of lecture per week. Prerequisite: 48 credits approved in undergraduate courses.

Theory and practice of how to creatively produce and direct fiction films with special emphasis on the conceptualization and development of ideas, the aesthetics of the image, and the creative processes for making short fiction films.

**CINE 4025. SPECIAL TOPICS.** One to nine credit hours. One to nine hours of lecture per week. Prerequisites: 24 undergraduate credits.

Study of special topics in film taught via lectures, presentations of films, discussion and/or group projects. By the end of the course, the student will be able to appreciate and knowledgeably articulate ideas about film and film-related issues. This course is an elective which satisfies the elective requirement for the interdisciplinary sequence in film and video studies.

## **INDUSTRIAL BIOTECHNOLOGY PROGRAM**

The Industrial Biotechnology Program offers a five-year interdisciplinary curriculum towards a bachelor's degree with courses in biology, chemistry and chemical engineering. The program mission is to prepare professionals capable of developing and advancing biotechnology to contribute to the socioeconomic development of the island of Puerto Rico. Biotechnology has been identified as a major thrust area for the development of a knowledge-based economy in Puerto Rico. The program has an Industrial Advisory Board which provides guidelines with regards to curriculum and initiatives that address the industrial component of the Program. The student profile is characterized by knowledge in the areas of industrial microbiology, molecular biology, biochemistry, bioprocess engineering, and skills in problem solving, troubleshooting, analytical thinking and written and oral communication. Research and industrial internships are part of the required experience of a graduate from this program. Leadership and teamwork are promoted by participation in the Industrial Biotechnology Student Association and extracurricular activities sponsored by major biotechnology companies. The curriculum is complemented with short courses offered by industrial and academic partners who are tuned into the current trends of the field. The Program has a data base of its students' resumes to promote placement by participation in activities such as the annual job fair. Industrial Biotechnology graduates are well prepared for entry into the industry market or to continue advanced graduate degrees. Students are encouraged to participate in annual local, national and international congresses to present their work. By issuing newsletters, our students are informed about the most recent accomplishments and opportunities offered by the Program. High school students of Puerto Rico have been impacted by our outreach program to promote biotechnology as an alternate option for university studies and a professional career path.

**PROGRAM OF STUDY**  
**INDUSTRIAL BIOTECHNOLOGY PROGRAM**  
**CURRICULUM**

**FIRST YEAR**

**First Semester**

| Number            | Credits  | Course                       |
|-------------------|----------|------------------------------|
| <b>*MATE 3005</b> | 5        | Pre-Calculus                 |
| <b>QUIM 3041</b>  | 4        | General Chemistry I          |
| <b>BIOL 3051</b>  | 4        | General Biology I            |
| <b>*INGL 3---</b> | 3        | First year course in English |
| <b>*ESPA 3101</b> | <u>3</u> | Basic course in Spanish I    |
|                   | 19       |                              |

**Second Semester**

| Number            | Credits  | Course                       |
|-------------------|----------|------------------------------|
| <b>MATE 3031</b>  | 4        | Calculus I                   |
| <b>QUIM 3042</b>  | 4        | General Chemistry II         |
| <b>BIOL 3052</b>  | 4        | General Biology II           |
| <b>*INGL 3---</b> | 3        | First year course in English |
| <b>*ESPA 3102</b> | 3        | Basic course in Spanish II   |
| <b>EDFI 3----</b> | <u>1</u> | Course in Physical Education |
|                   | 19       |                              |

**SECOND YEAR**

**First Semester**

| Number           | Credits  | Course                                   |
|------------------|----------|--|
| <b>MATE 3032</b> | 4        | Calculus II                              |
| <b>QUIM 3450</b> | 5        | Fundamentals of Organic Chemistry        |
| <b>FISI 3151</b> | 3        | Modern College Physics I                 |
| <b>FISI 3153</b> | 1        | Modern College Physics Laboratory        |
| <b>BIND 3005</b> | 2        | Introduction to Industrial Biotechnology |
| <b>INGL 3---</b> | <u>3</u> | Second year course in English            |
|                  | 18       |  |

**Second Semester**

| Number            | Credits  | Course                              |
|-------------------|----------|-------------------------------------|
| <b>MATE 3048</b>  | 4        | Mathematical Analysis               |
| <b>QUIM 3055</b>  | 4        | Analytical Chemistry                |
| <b>FISI 3152</b>  | 3        | Modern College Physics II           |
| <b>FISI 3154</b>  | 1        | Modern College Physics Laboratory   |
| <b>*INGL 3---</b> | 3        | Second year course in English       |
| <b>INGE 3016</b>  | <u>3</u> | Algorithms and Computer Programming |
|                   | 18       |                                     |

**THIRD YEAR**

**First Semester**

| Number           | Credits  | Course  |
|------------------|----------|---|
| <b>INQU 4005</b> | 4        | Materials and Energy Balances                     |
| <b>QUIM 4057</b> | 4        | Physical Chemistry: Applications To Biotechnology |
| <b>QUIM 5071</b> | 3        | General Biochemistry I                            |
| <b>ESPA 3---</b> | 3        | Second year course in Spanish                     |
| <b>ELECTIVE</b>  | <u>3</u> | Elective  |
|                  | 17       |   |

**Second Semester**

| Number           | Credits  | Course                                      |
|------------------|----------|---|
| <b>INQU 5006</b> | 3        | Mathematical Topics in Chemical Engineering |
| <b>QUIM 5072</b> | 3        | General Biochemistry                        |
| <b>QUIM 5073</b> | 1        | General Biochemistry Laboratory I           |
| <b>BIOL 3770</b> | 3        | General Microbiology                        |
| <b>INQU 4207</b> | 3        | Bioseparation Engineering                   |
| <b>ESPA 3---</b> | <u>3</u> | Second year course in Spanish               |
|                  | 16       |   |

**FOURTH YEAR**

**First Semester**

| Number   | Credits  | Course                             |
|--|----------|------------------------------------|
| <b>QUIM 5074</b>                               | 1        | General Biochemistry Laboratory II |
| <b>+Course in Social Sciences or Economics</b> | 3        |                                    |
| <b>HUMA 3111</b>                               | 3        | Introduction to Western Culture I  |
| <b>BIOL 3300</b>                               | 3        | Genetics                           |
| <b>INQU 5035</b>                               | 3        | Bioreactor Engineering             |
| <b>ELECTIVE</b>                                | 3        | Recommended Elective               |
| <b>INQU 5029</b>                               | <u>2</u> | Bioprocess Engineering Lab         |
|  | 18       |                                    |

**Second Semester**

| Number   | Credits  | Course                             |
|--|----------|------------------------------------|
| <b>BIND 4890</b>                               | 1        | Seminar                            |
| <b>BIOL 5055</b>                               | 3        | Eukaryotic Molecular Genetics      |
| <b>BIOL 4368</b>                               | 3        | Microbial Physiology               |
| <b>+Course in Social Sciences or Economics</b> | 3        |                                    |
| <b>HUMA 3112</b>                               | 3        | Introduction to Western Culture II |
| <b>ELECTIVE</b>                                | <u>3</u> | Recommended Elective               |
|  | 16       |                                    |

**FIFTH YEAR****First Semester**

| Number           | Credits  | Course                                |
|------------------|----------|---------------------------------------|
| <b>BIND 4905</b> | <u>6</u> | Practicum in Industrial Biotechnology |
|                  | 6        |                                       |

**Second Semester**

| Number           | Credits  | Course                              |
|------------------|----------|-------------------------------------|
| <b>BIND 5005</b> | 2        | Project in Industrial Biotechnology |
| <b>BIND 5006</b> | 4        | Advanced Industrial Biotechnology   |
| <b>EDFI 3---</b> | 1        | Course in Physical Education        |
| <b>ELECTIVE</b>  | 3        | Elective                            |
| <b>ELECTIVE</b>  | 3        | Elective                            |
| <b>ELECTIVE</b>  | <u>3</u> | Elective                            |
|                  | 16       |                                     |

**Total credits required 163**

\* Refer to the Academic Regulations section for information on Advanced Placement.

+ Choose two of the following courses in Social Sciences: ANTR----, CIPO----, CISO----, ECON 3021, ECON 3022, ECON 3091, ECON 3092, ECON 4037, ECON 4056, GEOG----, HIST----, PSIC----, SOCI----

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

**RECOMMENDED ELECTIVES**

|                               |     |
|-------------------------------|-----|
| <b>BIOL 3010 -</b>            |     |
| Cell Physiology               | 3   |
| <b>BIOL 4008 -</b>            |     |
| Immunology                    | 3   |
| <b>BIOL 4366 -</b>            |     |
| Food Microbiology             | 3   |
| <b>BIOL 4367 -</b>            |     |
| Industrial Microbiology       | 3   |
| <b>BIOL 4746 -</b>            |     |
| Economic Mycology             | 3   |
| <b>BIOL 4901 -</b>            |     |
| Special Problems in Biology   | 1-3 |
| <b>BIOL 4902 -</b>            |     |
| Special Problems in Biology   | 1-3 |
| <b>BIOL 5755 -</b>            |     |
| Virology                      | 3   |
| <b>BIOL 5758</b>              |     |
| Bacterial Genetics            | 2   |
| <b>BIOL 5759</b>              |     |
| Bacterial Genetics Laboratory | 2   |
| <b>BIOL 5765</b>              |     |
| Mycology                      | 3   |

|   |     |
|---|-----|
| <b>INQU 4011</b>  |     |
| Chemical Engineering Thermodynamics I                     | 3   |
| <b>INQU 4010</b>  |     |
| Momentum Transfer Operations                              | 4   |
| <b>INQU 4998</b>  |     |
| Undergraduate Research                                    | 1-6 |
| <b>QUIM 4101</b>  |     |
| Physical Chemistry Laboratory I                           | 1   |
| <b>QUIM 3085</b>  |     |
| Environmental Chemistry                                   | 3   |
| <b>QUIM 3086</b>  |     |
| Environmental Chemistry Laboratory                        | 1   |
| <b>QUIM 3335</b>  |     |
| Introduction to Food Chemistry                            | 3   |
| <b>QUIM 4037</b>  |     |
| Laboratory Safety: Principles, Practices, and Regulations | 3   |
| <b>QUIM 4405</b>  |     |
| Introduction to Forensic Chemistry                        | 3   |
| <b>QUIM 5065</b>  |     |
| Chemistry of Synthetic Drugs                              | 3   |
| <b>QUIM 5066</b>  |     |
| Toxicological Chemistry                                   | 3   |
| <b>QUIM 5085</b>  |     |
| Food Chemistry  | 4   |
| <b>QUIM 5165</b>  |     |
| Polymer Chemistry   | 3   |
| <b>QUIM 5205</b>  |     |
| Pharmaceutical Analytical Chemistry                       | 3   |
| <b>QUIM 5150</b>  |     |
| Spectroscopic Identification of Organic Compounds         | 3   |
| <b>QUIM 4998</b>  |     |
| Undergraduate Research I                                  | 1-3 |
| <b>QUIM 4999</b>  |     |
| Undergraduate Research II                                 | 1-3 |
| <b>AGRO 4015-4016</b>                                     |     |
| Special Problems  | 1-3 |
| <b>AGRO 5501</b>  |     |
| Agricultural Biotechnology                                | 3   |
| <b>AGRO 5502</b>  |     |
| Agricultural Biotechnology Laboratory                     | 1   |
| <b>CFIT 4007</b>  |     |
| Plant Breeding  | 3   |
| <b>HORT 4018-4019</b>                                     |     |
| Special Problems  | 1-3 |
| <b>HORT 4047</b>  |     |
| Plant Micropropagation                                    | 3   |
| <b>CIAN 5055</b>  |     |
| Animal Molecular Biotechnology                            | 4   |
| <b>PROC 4995-4996</b>                                     |     |
| Special Problems  | 1-3 |
| <b>ECON 3021</b>  |     |
| Principles of Economics Microeconomics                    | 3   |
| <b>ESPA 4405</b>  |     |
| Technical and Scientific Writing                          | 3   |
| <b>FILO 4027</b>  |     |
| Bioethics   | 3   |
| <b>INGL 3236</b>  |     |
| Technical Report Writing                                  | 3   |
| <b>PSIC 3001</b>  |     |
| Principles of Psychology I                                | 3   |



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|   |   |
|---|---|
| <b>ADMI 3125</b>                              |   |
| Technology Based Entrepreneurship             | 3 |
| <b>MATE 4031</b>                              |   |
| Introduction to Linear Algebra                | 3 |
| <b>MATE 3020</b>                              |   |
| Introduction to the Foundation of Mathematics | 3 |
| <b>COMP 3010</b>                              |   |
| Introduction to Computer Programming I        | 3 |
| <b>COMP 3110</b>                              |   |
| Introduction to Computer Programming II       | 3 |
| <b>COMP 3075</b>                              |   |
| Introduction to Data Structures               | 3 |
| <b>COMP 4025</b>                              |   |
| Computing Models                              | 3 |
| <b>ESMA 4006</b>                              |   |
| Statistics for the Biological Sciences        | 3 |
| <b>ESMA 3016</b>                              |   |
| Statistical Data Analysis                     | 3 |

## INDUSTRIAL BIOTECHNOLOGY

### Undergraduate Courses

**BIND 3005. INTRODUCTION TO INDUSTRIAL BIOTECHNOLOGY.** Two credit hours. Two hours of lecture per week. Prerequisites: BIOL 3052 and QUIM 3042.

Presentation of biological and chemical principles applied to the development of new biotechnological products in areas such as health, agriculture, and environmental protection. Field trips required.

**BIND 4890. SEMINAR.** One credit hour. One hour of seminar per week. Prerequisite: Fourth year student in Industrial Biotechnology.

Discussion of current topics in the field of biotechnology. Oral and written reports required.

**BIND 4905. PRACTICUM IN INDUSTRIAL BIOTECHNOLOGY.** Six credit hours. Thirty-five hours of supervised practice per week. Prerequisite: authorization of the Coordinator of the Program after evaluation of student progress.

Practical experience in a field of industrial biotechnology to be jointly supervised by a faculty member and an appropriate official of the cooperating organization. Written and oral reports will be required.

### Advanced Undergraduate Course

**BIND 5005. PROJECT IN INDUSTRIAL BIOTECHNOLOGY.** Two credit hours. Two four to eight-hour laboratory or independent study periods per week. Prerequisite: authorization of the Coordinator of the Program after evaluation of student progress.

Undergraduate research in a field of industrial biotechnology. A written report is required.

**BIND 5006. ADVANCED INDUSTRIAL BIOTECHNOLOGY.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisites: (BIOL 3770 and QUIM 5072 and INQU 5035) or authorization of the Director of the Department.

Integration of knowledge and skills in biology, biochemistry, and chemical engineering for the development of new products in industrial biotechnology. Simulation of an industrial environment for the creation of a biotechnological product, including quality control, process support, validation, and economic impact.

## DEPARTMENT OF BIOLOGY

The Department of Biology offers programs in Biology, Industrial Microbiology and Pre-medical Studies. Exchange programs, summer internships, and undergraduate research are some of the incentive that the department favor. The students have the opportunity to belong to different student associations.

### Mission

The Biology Department promotes critical thinking, enthusiasm, initiative and lifelong learning in the biological sciences. Emphasis will be placed on basic concepts and research skills in an environment that encourage the development of professionals with social, cultural and humanistic sensibility as well as profound ethical values. In this way, the Department will contribute to the enrichment of science and society through research and dissemination of knowledge.

### Vision

The Biology Department of the University of Puerto Rico at Mayaguez will reach the highest level in superior education of Puerto Rico, through the development of new technology, a continue revision and expansion of academic programs and the modernization of its infrastructure.

[http://biology.uprm.edu/mision\\_vision.html](http://biology.uprm.edu/mision_vision.html)

<http://www.uprm.edu/biology/team/studentprofile.htm>

### Objetives

Upon graduation, every undergraduate student will have knowledge and technical competences in:

- Cellular structure and physiology
- Organismal biology (Zoology, Botany and Microbiology) with emphasis in tropical environments
- Classic, population and molecular genetics.
- Chemical, physical and mathematical applications to biology
- General and population ecology
- Biodiversity and conservation
- Evolution as unifying science

This broad knowledge will allow the students to apply for Graduate and Professional Health Schools and to apply for positions in Federal and State Agencies or private companies.

### GENERAL EDUCATION

The fundamental elements of General Education are evidenced in UPRM's institutional student learning outcomes:

- Communicate effectively.

- Identify and solve problems, think critically, and synthesize knowledge appropriate to their discipline.
- Apply mathematical reasoning skills, scientific inquiry methods, and tools of information technology.
- Apply ethical standards.
- Recognize the Puerto Rican heritage and interpret contemporary issues.
- Appraise the essential values of a democratic society.
- Operate in a global context, relate to a societal context, and demonstrate respect for other cultures.
- Develop an appreciation for the arts and humanities.
- Recognize the need to engage in life-long learning.

Information literacy is embedded in all courses of instruction.

### STUDENT LEARNING OUTCOMES FOR BIOLOGY

- Disposition to keep up-to-date knowledge in scientific topics, new techniques and scientific instrumentation.
- Proficient use of computers for scientific applications.
- Demonstrate critical thinking.
- Proper use of the scientific method.
- Know how to apply chemistry, physics and mathematics to biology.
- Proficient oral and written communication in English and Spanish.
- Performance in individual and teamwork.
- Show conscience of ethical implications in the sciences

### GENERAL EDUCATION REQUIREMENTS IN BIOLOGY, INDUSTRIAL MICROBIOLOGY AND PRE-MEDICAL

| Subject area            | Minimum required credits                             |
|-------------------------|--|
| Spanish                 | 12   |
| English                 | 12   |
| Humanities              | 6  |
| Social sciences         | 6  |
| Mathematics             | 12   |
| Sciences                | 8 (General Biology)<br>16 (Chemistry)<br>8 (Physics) |
| Physical Education      | 2  |
| Total number of credits | 82   |

The principal objective of the **Biology Program** is to guide students towards an understanding of the basic and unifying principles of biology. Students graduating from this program find employment primarily in education, in pharmaceutical or related industries, and in government agencies. This program also prepares students for admission to medical and dental school, pharmacy PhD, and other health science programs.

The **Industrial Microbiology Program** integrates and develops knowledge and skills in Microbiology, necessary to prepare biopharmaceutical and food industry specialists. The program emphasizes microbes with industrial significance, quality, regulations, and safety. Innovative technology, visits to the industry and knowledge in laboratory standard procedures and methods of monitoring are some of the experiences provided by the program.

The **program in Pre-medical** studies provide a Biology degree with emphasis in the requisites to medical or dentistry schools, medical technology, or other health science programs.

The Department of Biology offers a graduate program leading to a **Master of Science** degree in Biology.

## BACHELOR OF SCIENCE IN BIOLOGY

### Summary of Credits in Program

|                               |            |
|-------------------------------|------------|
| Faculty requirements          | 56         |
| Departmental requirements     |            |
| Major area                    | 33         |
| Non-major area                | 32         |
| Recommended electives         | 8          |
| Free electives                | <u>12</u>  |
| <b>Total required credits</b> | <b>141</b> |

## PROGRAM OF STUDY

### BIOLOGY CURRICULUM

#### First Semester

| Number         | Credits  | Course                       |
|----------------|----------|------------------------------|
| BIOL 3051      | 4        | General Biology I            |
| QUIM 3131-3133 | 4        | General Chemistry I          |
| *INGL 3---     | 3        | First year course in English |
| *ESPA 3101     | 3        | Basic course in Spanish I    |
| *MATE 3171     | 3        | Pre-Calculus I               |
| EDFI----       | <u>1</u> | Course in Physical Education |
|                | 18       |                              |

#### Second Semester

| Number         | Credits  | Course                       |
|----------------|----------|------------------------------|
| BIOL 3052      | 4        | General Biology II           |
| QUIM 3132-3134 | 4        | General Chemistry II         |
| *INGL 3---     | 3        | First year course in English |
| *ESPA 3102     | 3        | Basic course in Spanish II   |
| *MATE 3172     | 3        | Pre-Calculus II              |
| EDFI ----      | <u>1</u> | Course in Physical Education |
|                | 18       |                              |

## SECOND YEAR

#### First Semester

| Number         | Credits  | Course                              |
|----------------|----------|-------------------------------------|
| BIOL 3425      | 4        | Animal Organismal Biology or        |
| BIOL 3417      | 4        | Plant Organismal Biology            |
| QUIM 3461-3462 | 4        | Organic Chemistry I                 |
| INGL 3---      | 3        | Second year course in English       |
| ESPA 3---      | 3        | Course above level of basic Spanish |
| MATE 3021      | <u>3</u> | Calculus for Biological Sciences I  |
|                | 17       |                                     |

#### Second Semester

| Number         | Credits  | Course                              |
|----------------|----------|-------------------------------------|
| BIOL 3125      | 3        | Principles of Ecology               |
| QUIM 3463-3464 | 4        | Organic Chemistry II                |
| ^INGL 3---     | 3        | Second year course in English       |
| ESPA 3---      | 3        | Course above level of basic Spanish |
| MATE 3022      | 3        | Calculus for Biological Sciences II |
| ELECTIVES      | <u>3</u> | Electives in Biology                |
|                | 19       |                                     |

## THIRD YEAR

#### First Semester

| Number       | Credits  | Course                                       |
|--------------|----------|--|
| BIOL 3300    | 3        | Genetics                                     |
| BIOL 4505 or | 4        | Human Physiology                             |
| BIOL 4556    | 3        | Comparative Vertebrate Physiology            |
| and          |          |  |
| BIOL 4557    | 1        | Comparative Vertebrate Physiology Laboratory |
| +Course      | 3        | in Social Sciences or Economics              |
| HUMA 3111    | 3        | Introduction to Western Culture I            |
| FISI 3151    | 3        | Modern College Physics I                     |
| FISI 3153    | <u>1</u> | Modern College Physics Laboratory            |
|              | 17       |  |

**Second Semester**

| Number    | Credits  | Course                             |
|-----------|----------|------------------------------------|
| BIOL 3010 | 3        | Cell Physiology                    |
| +Course   | 3        | in Social Sciences or Economics    |
| HUMA 3112 | 3        | Introduction to Western Culture II |
| FISI 3152 | 3        | Modern College Physics II          |
| FISI 3154 | 1        | Modern College Physics Laboratory  |
| BIOL 4925 | 1        | Seminar                            |
| ELECTIVES | <u>3</u> | **Recommended Elective             |
|           | 17       |                                    |

**FOURTH YEAR****First Semester**

| Number      | Credits  | Course                     |
|-------------|----------|----------------------------|
| BIOL 4335   | 3        | Evolution                  |
| ELECTIVES   | 3        | Electives in Biology       |
| ELECTIVES   | 3        | Socio Humanistic Electives |
| **ELECTIVES | 3        | Recommended Electives      |
| ELECTIVES   | <u>6</u> | Free Electives             |
|             | 18       |                            |

**Second Semester**

| Number      | Credits  | Course                     |
|-------------|----------|----------------------------|
| ELECTIVES   | 6        | Electives in Biology       |
| ELECTIVES   | 3        | Socio Humanistic Electives |
| **ELECTIVES | 2        | Recommended Electives      |
| ELECTIVES   | <u>6</u> | Free Electives             |
|             | 17       |                            |

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*To be selected from the list recommended electives.

+Choose any course in Social Sciences:

Courses from **Social Sciences Department**:

Anthropology, Geography, History, Political Sciences, General Social Science and Sociology

**ECONOMICS COURSES** (ECON 3021, 3022, 3091, 3092, 4037, 4056); **PSYCHOLOGY COURSES** (PSIC 3001, 3002)

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3289, INGL 3202 or INGL 3209.

Note: A student may take BIOL 3770 (Microbiology) in lieu of BIOL 3425 or BIOL 3417. The resulting deficiency in credits should be satisfied with credits in biology electives.

**RECOMMENDED ELECTIVES**

(For the Bachelor of Science in Biology)

|                     |     |                                       |
|---------------------|-----|---------------------------------------|
| <b>EDFU XXXX or</b> |     | Course in Teacher                     |
| <b>EDES XXXX or</b> |     | Preparation                           |
| <b>EDPE XXXX</b>    | 3-9 | Program                               |
| <b>*ALEM 3041</b>   | 3   | (Elementary German I)                 |
| <b>*ALEM 3042</b>   | 3   | (Elementary German II)                |
| <b>ANTR 3015</b>    | 3   | Introduction to Physical Anthropology |
| <b>ARTE 3276</b>    | 3   | Art Appreciation                      |

|                   |     |   |
|-------------------|-----|---|
| <b>CIPO 3011</b>  | 3   | Principles and Problems of Political Science  |
| <b>ECON 3021</b>  | 3   | Principles of Economics: Microeconomics   |
| <b>ECON 3022</b>  | 3   | Principles of Economy: Macroeconomics   |
| <b>ESPA XXXX</b>  | 3   | Course in Spanish above the basic level (in addition to the 6 credits required by the curriculum) |
| <b>FILO 3157</b>  | 3   | Introduction to Logic   |
| <b>FILO 4025</b>  | 3   | Medical Ethics  |
| <b>FILO 4027</b>  | 3   | Bioethics   |
| <b>*FRAN 3141</b> | 3   | (Elementary French I)   |
| <b>*FRAN 3142</b> | 3   | (Elementary French II)  |
| <b>GEOL 3025</b>  | 3   | Earth Sciences  |
| <b>GEOL 3026</b>  | 3   | Life in the Past  |
| <b>GEOL 3027</b>  | 3   | Geol. Aspects of the Environmental Sciences   |
| <b>HIST 3241</b>  | 3   | History of Puerto Rico I  |
| <b>HIST 3242</b>  | 3   | History of Puerto Rico II   |
| <b>*ITAL 3071</b> | 3   | (Elementary Italian I)  |
| <b>*ITAL 3072</b> | 3   | (Elementary Italian II)   |
| <b>INGL 3236</b>  | 3   | Technical Communication   |
| <b>COMP 3010</b>  | 3   | Int to computer programming I   |
| <b>EDFI 3645</b>  | 2   | First Aid & Security  |
| <b>ESMA 3101</b>  | 3   | Applied Statistics I  |
| <b>MUSI 3135</b>  | 3   | Music Appreciation  |
| <b>PSIC 3015</b>  | 3   | Theories of Personality   |
| <b>PSIC 3027</b>  | 3   | Childhood Psychology  |
| <b>PSIC 3028</b>  | 3   | Psychology of Adulthood   |
| <b>PSIC 3035</b>  | 3   | Applied Psychology  |
| <b>PSIC 3039</b>  | 3   | Psychology of Adolescence   |
| <b>PSIC 3045</b>  | 3   | Mental Hygiene  |
| <b>QUIM 3025</b>  | 4   | Analytical Chemistry I  |
| <b>QUIM 3055</b>  | 4   | Analytical Chemistry  |
| <b>QUIM 3065</b>  | 4   | Analytical Chemistry II   |
| <b>QUIM 4998</b>  | 3-9 | Undergraduate Research I  |
| <b>QUIM 4999</b>  | 3-9 | Undergraduate Research II   |
| <b>QUIM 5071</b>  | 3   | General Biochemistry  |
| <b>QUIM 5072</b>  | 3   | General Biochemistry II   |
| <b>QUIM 5073</b>  | 1   | General Biochemistry Laboratory I   |
| <b>QUIM 5074</b>  | 1   | General Biochemistry Laboratory II  |

Note: \*Student's should take both the first and the second part of these courses as recommended electives. If the students take only the first part, it will count as a free elective or socio humanistic electives.

Note: Any course offered by the Department of Biology which is neither required by the curriculum nor a service course to other departments will be accepted as a recommended elective.

## BACHELOR OF SCIENCE IN INDUSTRIAL MICROBIOLOGY

### Curriculum Requirements

|  |                |
|--|----------------|
| Faculty requirements                       | 50             |
| Departmental requirements                  |                |
| Major area                                 | 36-37          |
| Non-major area                             | 30             |
| Recommended electives                      | 6              |
| Free electives                             | 12             |
| Electives in Biology                       | 3              |
| Electives in Social Sciences or Humanities | <u>3</u>       |
| <b>Total required credits</b>              | <b>140-141</b> |

### PROGRAM OF STUDY

#### INDUSTRIAL MICROBIOLOGY CURRICULUM

##### FIRST YEAR

###### First Semester

| Number                | Credits  | Course                       |
|-----------------------|----------|------------------------------|
| <b>BIOL 3051</b>      | 4        | General Biology I            |
| <b>QUIM 3131-3133</b> | 4        | General Chemistry I          |
| <b>*INGL 3---</b>     | 3        | First year course in English |
| <b>*ESPA 3101</b>     | 3        | Basic course in Spanish I    |
| <b>*MATE 3171</b>     | 3        | Pre-Calculus I               |
| <b>EDFI ----</b>      | <u>1</u> | Course in Physical Education |
|                       | 18       |                              |

###### Second Semester

| Number                | Credits  | Course                       |
|-----------------------|----------|------------------------------|
| <b>BIOL 3052</b>      | 4        | General Biology II           |
| <b>QUIM 3132-3134</b> | 4        | General Chemistry II         |
| <b>*INGL 3---</b>     | 3        | First year course in English |
| <b>*ESPA 3102</b>     | 3        | Basic course in Spanish II   |
| <b>*MATE 3172</b>     | 3        | Pre-Calculus II              |
| <b>EDFI ----</b>      | <u>1</u> | Course in Physical Education |
|                       | 18       |                              |

##### SECOND YEAR

###### First Semester

| Number                 | Credits  | Course                              |
|------------------------|----------|-------------------------------------|
| <b>BIOL 3770</b>       | 3        | General Microbiology                |
| <b>QUIM 3461- 3462</b> | 4        | Organic Chemistry I                 |
| <b>INGL 3---</b>       | 3        | Second year course in English       |
| <b>ESPA 3---</b>       | 3        | Course above level of basic Spanish |
| <b>MATE 3021</b>       | <u>3</u> | Calculus for Biological Sciences I  |
|                        | 16       |                                     |

##### Second Semester

| Number                | Credits  | Course                              |
|-----------------------|----------|-------------------------------------|
| <b>BIOL 3300</b>      | 3        | Genetics                            |
| <b>BIOL 4746</b>      | 3        | Economic Mycology                   |
| or                    |          |                                     |
| <b>BIOL 3745</b>      | 3        | Introduction to Medical Mycology    |
| <b>QUIM 3463-3464</b> | 4        | Organic Chemistry II                |
| <b>^INGL 3---</b>     | 3        | Second year course in English       |
| <b>ESPA 3---</b>      | 3        | Course above level of basic Spanish |
| <b>MATE 3022</b>      | <u>3</u> | Calculus for Biological Sciences II |
|                       | 19       |                                     |

##### THIRD YEAR

###### First Semester

| Number           | Credits  | Course                            |
|------------------|----------|-----------------------------------|
| <b>BIOL 4505</b> | 4        | Human Physiology                  |
| or               |          |                                   |
| <b>BIOL 4556</b> | 3        | Comparative Vertebrate Physiology |
| or               |          |                                   |
| <b>BIOL 5018</b> | 4        | Plant Physiology                  |
| <b>ESMA 3101</b> | 3        | Applied Statistics I              |
| <b>+Course</b>   | 3        | in Social Sciences or Economics   |
| <b>HUMA 3111</b> | 3        | Introduction to Western Culture I |
| <b>FISI 3151</b> | 3        | Modern College Physics I          |
| <b>FISI 3153</b> | <u>1</u> | Modern College Physics Lab        |
|                  | 16-17    |                                   |

###### Second Semester

| Number           | Credits  | Course                             |
|------------------|----------|------------------------------------|
| <b>BIOL 3125</b> | 3        | Principles of Ecology              |
| <b>+Course</b>   | 3        | in Social Sciences or Economics    |
| <b>HUMA 3112</b> | 3        | Introduction to Western Culture II |
| <b>FISI 3152</b> | 3        | Modern College Physics II          |
| <b>FISI 3154</b> | 1        | Modern College Physics Laboratory  |
| <b>BIOL 4368</b> | 3        | Microbial Physiology               |
| <b>ELECTIVES</b> | <u>2</u> |                                    |
|                  | 18       |                                    |

##### FOURTH YEAR

###### First Semester

| Number              | Credits  | Course                           |
|---------------------|----------|----------------------------------|
| <b>QUIM 5071</b>    | 3        | General Biochemistry             |
| <b>ELECTIVES</b>    | 3        | in Social Sciences or Humanities |
| <b>ELECTIVES</b>    | 4        | Free electives                   |
| <b>***ELECTIVES</b> | 3        | Recommended elective             |
| <b>BIOL 4365</b>    | 3        | Microbial Ecology                |
| <b>BIOL 4925</b>    | <u>1</u> | Seminar (Microbiology)           |
|                     | 17       |                                  |

## Second Semester

| Number              | Credits  | Course                  |
|---------------------|----------|-------------------------|
| <b>**ELECTIVES</b>  | 3        | Electives in Biology    |
| <b>***ELECTIVES</b> | 3        | Recommended elective    |
| <b>ELECTIVES</b>    | 6        | Free electives          |
| <b>BIOL 4335</b>    | 3        | Evolution               |
| <b>BIOL 4367</b>    |          | Industrial Microbiology |
| or                  |          |                         |
| <b>BIOL 4375</b>    | <u>3</u> | Clinical Microbiology   |
|                     | 18       |                         |

## Total credits required:140-141

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*To be selected from the list of courses in Biology.

\*\*\*To be selected from the list of recommended electives.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3289, INGL 3202 or INGL 3209.

+Choose any course in Social Sciences:

Courses from **Social Sciences Department**:

Anthropology, Geography, History, Political Sciences, General Social Science and Sociology

**ECONOMICS COURSES** (ECON 3021, 3022, 3091, 3092, 4037, 4056); **PSYCHOLOGY COURSES** (PSIC 3001, 3002)

## PROFESSIONAL ELECTIVES IN BIOLOGY (For the Bachelor of Science in Industrial Microbiology)

| Number           | Credits  | Course   |
|------------------|----------|--|
| <b>BIOL 3055</b> | 1        | Bibliography and Library Research in Biological Sciences |
| <b>BIOL 3225</b> | 2        | Biology of Sex   |
| <b>BIOL 3206</b> | 2        | Principles of Microscopy                                 |
| <b>BIOL 3417</b> | 4        | Plant Organismal Biology                                 |
| <b>BIOL 3425</b> | <b>4</b> | <b>Organismal Animal Biology</b>                         |
| <b>BIOL 3745</b> | 3        | An Int to Medical Mycology                               |
| <b>BIOL 4005</b> | 3        | History of Biology                                       |
| <b>BIOL 4008</b> | 3        | Immunology   |
| <b>BIOL 4025</b> | <b>3</b> | <b>Man and the Ecosystem</b>                             |
| <b>BIOL 4366</b> | 3        | Food Microbiology  |
| <b>BIOL 4367</b> | 3        | Industrial Microbiology                                  |
| <b>BIOL 4369</b> | 2        | Practice in Industrial Microbiology                      |
| <b>BIOL 4375</b> | 3        | Clinical Microbiology                                    |
| <b>BIOL 4376</b> | 3        | Freshwater Biology                                       |
| <b>BIOL 4426</b> | 3        | Animal Parasitology                                      |
| <b>BIOL 4446</b> | 3        | Int to Entomology  |
| <b>BIOL 4735</b> | 3        | Microbiology of Water and Sewage                         |
| <b>BIOL 4746</b> | 3        | Economic Mycology  |
| <b>BIOL 4761</b> | 4        | Human Anatomy I  |
| <b>BIOL 4762</b> | 4        | Human Anatomy II   |
| <b>BIOL 4778</b> | 3        | Dairy Bacteriology                                       |
| <b>BIOL 4901</b> | 1-3      | Special Problems in Biology                              |
| <b>BIOL 4902</b> | 1-3      | Special Problems in Biology                              |
| <b>BIOL 4991</b> | 1-4      | Special Topics in Biology Lab                            |

|                       |            |  |
|-----------------------|------------|--|
| <b>BIOL 4993</b>      | 1-3        | Special Topics in Biology I              |
| <b>BIOL 4994</b>      | <b>1-3</b> | <b>Special Topics in Biology II</b>      |
| <b>BIOL 4998</b>      | 3-6        | COOP Practice                            |
| <b>BIOL 5045</b>      | <b>3</b>   | <b>Scanning Electron Microscopy</b>      |
| <b>BIOL 5055</b>      | <b>3</b>   | <b>Eukaryotic Molecular Genetics</b>     |
| <b>BIOL 5056</b>      | 2          | Eukaryotic Molecular Genetics Lab        |
| <b>BIOL 5585</b>      | <b>3</b>   | <b>Medical and Veterinary Entomology</b> |
| <b>BIOL 5755</b>      | 3          | Virology                                 |
| <b>BIOL 5758</b>      | <b>2</b>   | <b>Bacterial Genetics</b>                |
| <b>BIOL 5759</b>      | 2          | Bacterial Genetics Lab                   |
| <b>BIOL 5765</b>      | 3          | Mycology                                 |
| <b>BOTA 4995-4996</b> | 1-3        | Special Problems in Botany               |

Note: Other courses that the Department of Biology considers acceptable may also be accepted as electives in Biology.

## RECOMMENDED ELECTIVES

(For the Bachelor of Science in Industrial Microbiology)

| Number                | Credits | Course   |
|-----------------------|---------|--|
| <b>BIOL 3055</b>      | 1       | Bibliography and Library Research in Biological Sciences |
| <b>BIOL 3745</b>      | 3       | An Int to Medical Mycology                               |
| <b>BIOL 3775</b>      | 3       | Aerobiology  |
| <b>BIOL 3785</b>      | 3       | Int to Mycology  |
| <b>BIOL 4008</b>      | 3       | Immunology   |
| <b>BIOL 4365</b>      | 3       | Microbial Ecology  |
| <b>BIOL 4366</b>      | 3       | Food Microbiology  |
| <b>BIOL 4367</b>      | 3       | Industrial Microbiology                                  |
| <b>BIOL 4369</b>      | 2       | Practice in Industrial Microbiology                      |
| <b>BIOL 4375</b>      | 3       | Clinical Microbiology                                    |
| <b>BIOL 4376</b>      | 3       | Freshwater Biology                                       |
| <b>BIOL 4426</b>      | 3       | Animal Parasitology                                      |
| <b>BIOL 4735</b>      | 3       | Microbiology of Water and Sewage                         |
| <b>BIOL 4746</b>      | 3       | Economic Mycology  |
| <b>BIOL 4778</b>      | 3       | Dairy Bacteriology                                       |
| <b>BIOL 4901-4902</b> | 1-3     | Special Problems in Biology                              |
| <b>BIOL 4991</b>      | 1-4     | Special Topics in Biology Lab                            |
| <b>BIOL 4993</b>      | 1-3     | Special Topics in Biology I                              |
| <b>BIOL 4994</b>      | 1-3     | Special Topics in Biology II                             |
| <b>BIOL 4998</b>      | 3-6     | COOP Practice  |
| <b>BIOL 5008</b>      | 3       | Sanitary Bacteriology                                    |
| <b>BIOL 5045</b>      | 3       | Scanning Electron Microscopy                             |
| <b>BIOL 5755</b>      | 3       | Virology   |
| <b>BIOL 5758</b>      | 3       | Bacterial Genetics                                       |
| <b>BIOL 5759</b>      | 2       | Bacterial Genetics Lab                                   |
| <b>BIOL 5765</b>      | 3       | Mycology   |
| <b>BOTA 4995-4996</b> | 1-3     | Special Problems of Botany                               |
| <b>CFIT 3005</b>      | 3       | General Soils  |
| <b>QUIM 3025/</b>     |         |  |
| <b>QUIM 3055</b>      | 4       | Analytical Chemistry I                                   |
| <b>QUIM 3065</b>      | 4       | Analytical Chemistry II                                  |

|              |     |  |
|--------------|-----|--|
| QUIM 4998    | 1-3 | Undergraduate Research I                         |
| QUIM 4999    | 1-3 | Undergraduate Research II                        |
| QUIM 5072    | 3   | General Biochemistry II                          |
| QUIM 5073    | 1   | General Biochemistry Lab I                       |
| QUIM 5074    | 1   | General Biochemistry Lab II                      |
| COMP 3010    | 3   | Int to Computer Programming I                    |
| COMP 3057    | 3   | Computer Fundamentals                            |
| ECON 3021    | 3   | Principles of Economics: Microeconomics          |
| ECON 3022    | 3   | Principles of Economy: Macroeconomics            |
| EDFI 3645    | 2   | First Aid & Security                             |
| EDFU XXXX or |     | Course in Teacher                                |
| EDES XXXX or |     | Preparation                                      |
| EDPE XXXX    | 3-9 | Program  |
| GEOL 3025    | 3   | Earth Sciences                                   |
| GEOL 3026    | 3   | History of Life                                  |
| GEOL 3027    | 3   | Geological Aspects of the Environmental Sciences |
| ESOR 4006    | 3   | Int to Organizations                             |
| ESOR 4007    | 3   | Organizational Design                            |
| ESOR 4008    | 3   | Human Resources Management                       |
| ESOR 4016    | 3   | Labor Relations                                  |
| PSIC 4009    | 3   | Industrial/ Organizational Psychology            |

## BACHELOR OF SCIENCE IN PRE-MEDICAL STUDIES

### Summary of Credits in Program

|                            |            |
|----------------------------|------------|
| Faculty requirements       | 50         |
| Departmental requirements  |            |
| Major area                 | 19         |
| Non-major area             | 43         |
| Recommended electives      | 15         |
| Free electives             | 12         |
| Electives in Soc. Sciences |            |
| Humanities or Geology      | 3          |
| <b>Total</b>               | <b>142</b> |

### PROGRAM OF STUDY

#### PRE-MEDICAL STUDIES CURRICULUM

#### FIRST YEAR

##### First Semester

| Number         | Credits | Course                       |
|----------------|---------|------------------------------|
| BIOL 3051      | 4       | General Biology I            |
| QUIM 3131-3133 | 4       | General Chemistry I          |
| *MATE 3171     | 3       | Pre-Calculus I               |
| *ESPA 3101     | 3       | Basic course in Spanish I    |
| *INGL 3---     | 3       | First year course in English |
|                | 17      |                              |

#### Second Semester

| Number         | Credits | Course                       |
|----------------|---------|------------------------------|
| BIOL 3052      | 4       | General Biology II           |
| QUIM 3132-3134 | 4       | General Chemistry II         |
| *MATE 3172     | 3       | Pre-Calculus II              |
| *ESPA 3102     | 3       | Basic course in Spanish II   |
| *INGL 3---     | 3       | First year course in English |
|                | 17      |                              |

#### SECOND YEAR

##### First Semester

| Number         | Credits | Course                             |
|----------------|---------|------------------------------------|
| INGL ----      | 3       | Second year course in English      |
| MATE 3021      | 3       | Calculus for Biological Sciences I |
| QUIM 3461-3462 | 4       | Organic Chemistry I                |
| BIOL 3300      | 3       | Genetics                           |
| ESPA 3211      | 3       | Introduction to Spanish Literature |
| or             |         |                                    |
| ESPA 3295      | 3       | Spanish Grammar                    |
| EDFI ----      | 1       | Course in Physical Education       |
|                | 17      |                                    |

##### Second Semester

| Number         | Credits | Course                              |
|----------------|---------|-------------------------------------|
| ^INGL ----     | 3       | Second year course in English       |
| MATE 3022      | 3       | Calculus for Biological Sciences II |
| QUIM 3463-3464 | 4       | Organic Chemistry II                |
| ***ELECTIVE    | 3       | Recommended elective                |
| ESPA 3212      | 3       | Introduction to Spanish Literature  |
| or             |         |                                     |
| ESPA 3216      | 3       | Formal Expository Writing           |
| EDFI ----      | 1       | Course in Physical Education        |
|                | 17      |                                     |

#### THIRD YEAR

##### First Semester

| Number    | Credits | Course                            |
|-----------|---------|-----------------------------------|
| HUMA 3111 | 3       | Introduction to Western Culture I |
| +Course   | 3       | in Social Sciences or Economics   |
| FISI 3151 | 3       | Modern College Physics I          |
| FISI 3153 | 1       | Modern College Physics Laboratory |
| PSIC 3001 | 3       | Principles of Psychology I        |
| INGL 3231 |         | English Expository Writing        |
| or        |         |                                   |

|                  |          |                         |
|------------------|----------|-------------------------|
| <b>INGL 3236</b> | 3        | Technical Communication |
| <b>BIOL 3010</b> | <u>3</u> | Cell Physiology         |
|                  | 19       |                         |

#### Second Semester

| Number           | Credits  | Course                             |
|------------------|----------|------------------------------------|
| <b>HUMA 3112</b> | 3        | Introduction to Western Culture II |
| <b>+Course</b>   | 3        | in Social Sciences or Economics    |
| <b>FISI 3152</b> | 3        | Modern College Physics II          |
| <b>FISI 3154</b> | 1        | Modern College Physics Laboratory  |
| <b>BIOL 4505</b> | 4        | Human Physiology                   |
| <b>ELECTIVE</b>  | 3        | Elective in Biology                |
| <b>BIOL 4925</b> | <u>1</u> | Seminar                            |
|                  | 18       |                                    |

#### FOURTH YEAR

##### First Semester

| Number             | Credits  | Course                          |
|--------------------|----------|---------------------------------|
| <b>FILO 4025</b>   | 3        | Medical Ethics                  |
| <b>QUIM 3025</b>   | 4        | Analytical Chemistry            |
| <b>ESMA 3101</b>   | 3        | Applied Statistics I            |
| <b>***ELECTIVE</b> | 3        | Recommended Elective in Biology |
| <b>ELECTIVES</b>   | <u>6</u> | Free Electives                  |
|                    | 19       |                                 |

##### Second Semester

| Number             | Credits  | Course                         |
|--------------------|----------|--------------------------------|
| <b>HIST ----</b>   | 3        | Course in Modern History of PR |
| <b>MUSI 3135</b>   |          | Music Appreciation             |
| or                 |          |                                |
| <b>ARTE 3276</b>   | 3        | Art Appreciation               |
| <b>**ELECTIVES</b> | 6        | Electives in Biology           |
| <b>ELECTIVES</b>   | <u>6</u> | Free Electives                 |
|                    | 18       |                                |

**Total credits required: 142**

\*Refer to the Academic Regulations section for information on Advanced Placement.

+Choose any course in Social Sciences:

Courses from **Social Sciences Department**:

Anthropology, Geography, History, Political Sciences, General Social Science and Sociology

**ECONOMICS COURSES** (ECON 3021, 3022, 3091, 3092, 4037, 4056); **PSYCHOLOGY COURSES** (PSIC 3001, 3002)

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3289, INGL 3202 or INGL 3209.

Note: The University of Puerto Rico at Mayagüez does not guarantee that a student will be admitted to a Medical

School. Application for admission to a Medical School is the student's responsibility. The University will offer orientation and help in the process.

#### RECOMMENDED ELECTIVES IN BIOLOGY

(For the Bachelor of Science in Pre-Medical)

| Number                | Credits | Course                                |
|-----------------------|---------|---------------------------------------|
| <b>BIOL 3125</b>      | 3       | Principles of Ecology                 |
| <b>BIOL 3425</b>      | 4       | Animal Organismal Biology             |
| <b>BIOL 3745</b>      | 3       | An Introduction to Medical Mycology   |
| <b>BIOL 3770</b>      | 3       | General Microbiology                  |
| <b>BIOL 4008</b>      | 3       | Immunology                            |
| <b>BIOL 4016</b>      | 3       | Histology                             |
| <b>BIOL 4027</b>      | 3       | Introduction to Vertebrate Embryology |
| <b>BIOL 4335</b>      | 3       | Evolution                             |
| <b>BIOL 4355</b>      | 2       | Human Genetics                        |
| <b>BIOL 4375</b>      | 3       | Clinical Microbiology                 |
| <b>BIOL 4426</b>      | 3       | Animal Parasitology                   |
| <b>BIOL 4761</b>      | 4       | Human Anatomy I                       |
| <b>BIOL 4762</b>      | 4       | Human Anatomy II                      |
| <b>BIOL 4901-4902</b> | 1-3     | Special Problems in Biology           |
| <b>BIOL 4991</b>      | 1-4     | Special Topics in Biology Lab         |
| <b>BIOL 4993</b>      | 1-4     | Special Topics in Biology I           |
| <b>BIOL 4994</b>      | 1-4     | Special Topics in Biology II          |
| <b>BIOL 5045</b>      | 3       | Scanning Electron Microscopy          |
| <b>BIOL 5055</b>      | 3       | Eukaryotic Molecular Genetics         |
| <b>BIOL 5056</b>      | 1       | Eukaryotic Molecular Genetics lab     |
| <b>BIOL 5755</b>      | 3       | Virology                              |
| <b>BIOL 5758</b>      | 3       | Bacterial Genetic                     |
| <b>BIOL 5759</b>      | 2       | Bacterial Genetic lab                 |
| <b>BOTA 4995-4996</b> | 1-3     | Special Problems of Botany            |

**Important Note:** Students who intend to apply for admission to a medicine or dentistry school should take 12 credits in Psychology, Sociology, Economy, Anthropology and/or Political Sciences to fulfill the requirements of the Doctors Examining Board of Puerto Rico in order to practice in Puerto Rico.

The fourth year of the Bachelor of Science degree cannot be substituted for the first year of study in a professional school.



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## DEPARTMENTAL FACULTY

**CARLOS A. ACEVEDO SUÁREZ**, *Associate Professor*, Ph.D., 2004, Vanderbilt University.

**DIMARIS ACOSTA MERCADO**, *Professor*, Ph.D., 2003, University of Guelph, Canada.

**JAIME A. ACOSTA MARTÍNEZ**, *Professor*, Ph.D., 1995, Virginia Polytechnic Institute and State University.

**MÓNICA ALFARO LOZANO**, *Professor*, Ph.D., 2002, University of Puerto Rico.

**FERNANDO J. BIRD PICÓ**, *Associate Professor*, Ph.D., 1994, University of Kansas.

**ROSA J. BUXEDA PÉREZ**, *Professor*, Ph.D., 1993, Rutgers University, New Brunswick.

**MATÍAS J. CAFARO**, *Professor*, Ph.D. 2003, University of Kansas, Lawrence.

**NANETTE DIFFOOT CARLO**, *Professor*, Ph.D., 1992, Virginia Polytechnic Institute and State University.

**SEAN LOCKE**, *Assistant Professor*, Ph.D., 2010, Concordia University.

**SANDRA L. MALDONADO RAMÍREZ**, *Professor*, Ph.D., 2001, Cornell University.

**JUAN C. MARTÍNEZ CRUZADO**, *Professor*, Ph.D., 1988, Harvard University.

**ARTURO A. MASSOL Deyá**, *Professor*, Ph.D., 1994, Michigan State University.

**RAFAEL R. MONTALVO RODRÍGUEZ**, *Professor*, Ph.D., 2003, University of Nebraska.

**ALEJANDRO ORTIZ ACEVEDO**, *Associate Professor*, Ph.D., 2000, University of California, Davis.

**CARLOS A. PÉREZ MUÑOZ**, *Professor*, Ph.D., 1991, University of California, Davis.

**ALBERTO R. PUENTE ROLÓN**, *Assistant Professor*, Ph.D., 2012, University of Puerto Rico.

**LUIS A. RÍOS HERNÁNDEZ**, *Professor*, Ph.D., 2003, University of Oklahoma.

**CARLOS RÍOS VELÁZQUEZ**, *Professor*, Ph.D., 2000, University of Wisconsin, Madison.

**ILEANA RIVERA RODRÍGUEZ**, *Associate Professor*, M.S., 1972, University of Puerto Rico.

**CARLOS RODRÍGUEZ MINGUELA**, *Associate Professor*, Ph.D., 2005, Michigan State University.

**ALEJANDRO RUIZ ACEVEDO**, *Professor*, Ph.D., 1981, University of Oklahoma.

**CARLOS J. SANTOS FLORES**, *Professor*, Ph.D., 2001, University of Wisconsin, Madison.

**DIMUTH SIRITUNGA**, *Professor*, Ph.D., 2002, Ohio State University.

**JOHN M. USCIAN**, *Professor*, Ph.D., 1994, University of Nebraska-Lincoln.

**ALEX VAN DAM**, *Assistant Professor*, Ph.D., 2013, University of California Davis.

**BENJAMIN VAN EE**, *Associate Professor*, Ph.D., 2006, University of Wisconsin – Madison.

**MARÍA M. VARGAS RODRÍGUEZ**, *Professor*, Ph.D. 1997, Arizona State University.

**ANA V. VÉLEZ DÍAZ**, *Associate Professor*, M.S., 1994, University of Puerto Rico.

## COURSES OF INSTRUCTION

### Undergraduate Courses

**CIBI 3031. INTRODUCTION TO THE BIOLOGICAL SCIENCES I.** Three credit hours. Two hours of lecture and two hours of laboratory per week.

Fundamental biological principles as inferred from the study of the diversity of living organisms and their relationships. Topics include: biological concepts and methods; the chemistry, structure, and function of cells; cell division and principles of genetics.

**CIBI 3032. INTRODUCTION TO THE BIOLOGICAL SCIENCES II.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisite: CIBI 3031.

Fundamental biological principles as inferred from the study of the diversity of living organisms and their relationships. Topics include: evolution; the systems and processes of the human body; ecology and conservation biology.

**BIOL 3010. CELL PHYSIOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: QUIM 3031 or (QUIM 3461 and QUIM 3462).

Study of the structure and function of life molecules at the cell level, and the interactions among them.

**BIOL 3021-3022. ANIMAL BIOLOGY.** Three credit hours per semester. Two hours of lecture and one three-hour laboratory per week each semester.

A survey of the animal kingdom, fundamental principles of animal biology, and the uses of the microscope. Structure, functions, habitat, and economic importance of representative groups of animals will be studied in detail. First semester: the nonchordate animals; Second semester: the chordates.

**BIOL 3051. GENERAL BIOLOGY I.** Four credit hours per semester. Three hours of lecture and one three-hour laboratory per week.

Study of the diversity of organisms, the relationships between them and their environment, the fundamental aspects of their structure and function, and the processes that regulate the perpetuation of life.

**BIOL 3052. GENERAL BIOLOGY II.** Four credit hours per semester. Three hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3051.

Study of the diversity of organisms, the relationships between them and their environment, the fundamental aspects of their structure and function, and the processes that regulate the perpetuation of life.

**BIOL 3055. BIBLIOGRAPHY AND LIBRARY RESEARCH IN BIOLOGICAL SCIENCES.** One credit hour. One hour of conference per week.

Introduction to the use of the library: the online catalogue, periodical indices, abstracts, encyclopedias, dictionaries, monographs, and other reference resources in the biological sciences.

**BIOL 3125. PRINCIPLES OF ECOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: CIBI 3002 or CIBI 3032 or BIOL 3052 or (BIOL 3043 and BIOL 3044).

The general principles of the interrelation between organisms and their environment.

**BIOL 3146. ECONOMIC BOTANY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3052 or BIOL 3435 or (CIBI 3002 or CIBI 3032).

Origin, classification, characteristics, and human utilization of plants and their products. Field trips are required.

**BIOL 3206. PRINCIPLES OF MICROSCOPY.** Two credit hours. One hour of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3052.

History, types, and use of microscopes. Construction, parts, and functions of the compound microscope; techniques to obtain its maximum resolution. Preparation of drawings with the "camera lucida". Basic photomicrography techniques.

**BIOL 3225. BIOLOGY OF SEX.** Two credit hours. Two hours of lecture per week. Prerequisite: BIOL 3052 or authorization of the Director of the Department.

Comparative study of the sexual processes in animals and humans emphasizing the sociobiological and evolutionary aspects.

**BIOL 3300. GENETICS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3022 or BIOL 3052 or BIOL 3435 or BIOL 4015 or (CIBI 3032 or CIBI 3002).

Study of nuclear and non-nuclear organisms; their nature and the transmission and mode of action of genetic material.

**BIOL 3417. PLANT ORGANISMAL BIOLOGY.** Four credit hours. Three lectures and one three-hour laboratory per week. Prerequisites: CIBI 3002 or CIBI 3032 or BIOL 3052 or (BIOL 3043 and BIOL 3044).

An introductory study of the structure and physiology of the flowering plants. A general survey of the plant kingdom, with emphasis on classification, evolution of vegetative and reproductive structures, and the study of selected life cycles.

**BIOL 3425. ORGANISMAL ANIMAL BIOLOGY.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisite: CIBI 3002 or CIBI 3032 or BIOL 3052 or (BIOL 3043 and BIOL 3044).

A survey of the different phyla of the animal kingdom. A general account of the morphology, physiology, ecology and evolution of the different groups, with references to their importance to human welfare.

**BIOL 3435. ELEMENTARY BOTANY.** Four credit hours. Three hours of lecture and one three-hour laboratory per week.

An introductory study of the structure and function of the flowering plants, and a brief survey of the plant kingdom.

**BIOL 3715. ANATOMY AND PHYSIOLOGY.** Three credit hours. Three hours of lecture per week.

A study of the structure and function of man with emphasis on the physiological principles.

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**BIOL 3716. ANATOMY AND PHYSIOLOGY LABORATORY.** One credit hour. Three hours laboratory per week. Prerequisite or corequisite: BIOL 3715.

Laboratory experiments with emphasis on the study of the structure of the human body.

**BIOL 3725. MICROBIOLOGY.** Four credit hours. Three hours of lecture and one three-hour laboratory per week.

A survey of the basic principles of microbiology, with emphasis on the study of microorganisms in relation to human health and disease.

**BIOL 3745. AN INTRODUCTION TO MEDICAL MYCOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: CIBI 3002 or CIBI 3032 or BIOL 3052 or (BIOL 3043 and BIOL 3044).

A study of fungi, with special emphasis on human pathogens. Practice is given in the isolation and identification of the most prevalent fungi.

**BIOL 3770. GENERAL MICROBIOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: (BIOL 3052 or CIBI 3032 or BIOL 3435) and (QUIM 3132 and QUIM 3134).

The structure, metabolism, growth, genetics, inhibition and death, pathogenecity, taxonomy, and applied considerations of microorganisms.

**BIOL 3775. AEROBIOLOGY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisite: BIOL 3052 or (BIOL 3435 and BIOL 3770) or BIOL 3725 or CIBI 3032.

Study of biotic agents in the atmosphere, the processes that influence their dispersion and transport, and methods for their identification and the determination of their impact.

**BIOL 3785. INTRODUCTION TO MYCOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3770.

Introduction to the groups of true fungi and fungal-like protists. The diversity, structure, life cycles, and classification of fungi will be analyzed, in order to identify them and understand their role in terrestrial and aquatic ecosystems.

**BIOL 4005. HISTORY OF BIOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department or BIOL 3052 or CIBI 3032.

Historical development of the principal concepts and theories in biology from its beginnings to the present. A term paper will be required.

**BIOL 4008. IMMUNOLOGY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: CIBI 3032 or BIOL 3052 and (QUIM 3461 and QUIM 3462).

Humoral and cellular mechanisms of the immune response; applications in medicine and biochemistry; laboratory exercises designed to demonstrate antibody production and specificity.

**BIOL 4015. GENERAL ZOOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week.

A study of modern principles and problems of animal classification, physiology, ecology and evolution. Presented by means of laboratory exercises, demonstrations, and class discussions. For agricultural students other than those taking the Agricultural Sciences Curriculum.

**BIOL 4016. HISTOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3022 or BIOL 3425.

The microscopic structure of the fundamental tissues of the animal body, with special attention to the vertebrates.

**BIOL 4025. MAN AND THE ECOSYSTEM.** Three credit hours. Three hours of lecture per week. Prerequisite: BIOL 3125.

Analysis of the ecological problems of the contemporary world and possible alternative solutions.

**BIOL 4027. INTRODUCTION TO VERTEBRATE EMBRYOLOGY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisite: authorization of the Director of the Department.

Elementary principles and fundamental details of the development processes as illustrated by vertebrates. Cell division, germ cell maturation and production, fertilization, cleavage, germ layers, tissue and organ formation. Particular study is made of organogenesis in chick and pig.

**BIOL 4038. BIOLOGICAL APPLICATIONS OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: MATE 3172 or MATE 3005 or 6 credits approved in Biology.

Students will learn the theory of extracting information from remotely sensed data, its integration into geographical information system (GIS) databases, and its use for the study and management of biological systems. Students will extract information of biological interest from remotely sensed data and other types of geographic data, will assemble at least one geographic database, and use that geographic database to study the relationships between one or several organisms and several environmental variables.

**BIOL 4039. PLANT BIOTECHNOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: (BIOL 3052 or BIOL 3435) and BIOL 3300.

Description and discussion of classical and modern approaches to genetics, as well as Arabidopsis genetics. Identification and description of the tools of molecular biology used in biotechnology, including plant transformation techniques and the analysis of transgenes. Study of bioinformatics and proteomics. Analysis of commercially available transgenic plant products. Discussion of ethical aspects related to plant biotechnology.

**BIOL 4327. GENETICS OF THE EVOLUTIONARY PROCESS.** Three credit hours. Three hours of lecture per week.

Study of phenotypic and genetic variation in natural populations and its modification due to factors that control biological phenomena, such as population structure, selection, and evolutionary adaptation.

**BIOL 4335. EVOLUTION.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department or BIOL 3052 or CIBI 3032.

Mechanisms, processes, and consequences of evolution: factors which cause genetic changes in populations; speciation; population genetics; coevolution, evolution, and the inheritance of animal behavior.

**BIOL 4355. HUMAN GENETICS.** Two credit hours. Two hours of lecture per week. Prerequisite: BIOL 3300.

A study of inheritance in man. Effects of mutation, selection and racial mixture; the application of genetics to medical problems.

**BIOL 4365. MICROBIAL ECOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3770.

Physical, chemical and biological factors involved in the development and behavior of microorganisms; their interaction with other organisms in nature, and their role in the environment.

**BIOL 4366. FOOD MICROBIOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3770.

Study of microorganisms in processed and non-processed foods.

**BIOL 4367. INDUSTRIAL MICROBIOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: BIOL 3770.

The biological activities of microorganisms; their importance in the pharmaceutical, food industries, and related areas.

**BIOL 4368. MICROBIAL PHYSIOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: BIOL 3770.

Chemical and structural composition of microorganisms. Emphasis will be given to their physiological and genetical properties and mechanisms valuable to mankind.

**BIOL 4369. PRACTICE IN INDUSTRIAL MICROBIOLOGY.** Two credit hours. Four to six hours of practice per week. Prerequisites: BIOL 3770 and BIOL 4367.

Practical experience in Industrial Microbiology in cooperation with private industries or with government.

**BIOL 4375. CLINICAL MICROBIOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3770.

Etiology, pathogenicity, epidemiology, and laboratory analysis for the diagnosis of diseases caused by microorganisms. Emphasis will be placed on those diseases of high incidence in Puerto Rico.

**BIOL 4376. FRESHWATER BIOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: BIOL 3770 and BIOL 3125.

Analysis of the freshwater ecosystem and its importance to human life. Field work is required.

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**BIOL 4426. ANIMAL PARASITOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: BIOL 3052 or CIBI 3032 or BIOL 3022 or BIOL 4015.

General principles and origin of parasitism. Study of the principal pathogenic protozoas and helminths, their life cycles, host relationships and control measures.

**BIOL 4428. GENERAL ORNITHOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3022 or BIOL 3425.

Introduction to the study of birds, their structure, classification, ecological relations, and economic status. Considerable field work is done, and practice is given in the methods of collection and preparation of study skins.

**BIOL 4446. INTRODUCTION TO ENTOMOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3022 or BIOL 3425 or BIOL 4015.

An introduction to entomology based on the study of the biology of insects. Students are required to make an insect collection, and practice is given in the determination and recognition of the most important orders and families.

**BIOL 4465. TAXONOMY OF VASCULAR PLANTS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3052 or BIOL 3435 or BIOL 3417.

The principles of taxonomy and their application. A general survey of the groups of vascular plants, with the identification and classification of representatives of the local flora. Field trips.

**BIOL 4467. COMPARATIVE VERTEBRATE ANATOMY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3022 or BIOL 3425.

Comparative anatomy of typical vertebrates; interrelation of organ systems of various groups of vertebrates.

**BIOL 4505. HUMAN PHYSIOLOGY.** Four credit hours. Three hours of lecture, and one three-hour laboratory per week. Prerequisites: CIBI 3032 or BIOL 3052 and (QUIM 3461 and QUIM 3462).

Physiological principles of the human body.

**BIOL 4556. COMPARATIVE VERTEBRATE PHYSIOLOGY.** Three credit hours. Three hours of lectures per week. Prerequisite: (QUIM 3461 and QUIM 3462) or QUIM 3071.

Study of the fundamental physiological principles of the vertebrate body.

**BIOL 4557. COMPARATIVE VERTEBRATE PHYSIOLOGY LABORATORY.** One credit hour. One three-hour laboratory per week. Prerequisite or corequisite: BIOL 4556.

Laboratory experiments involving fundamental physiological principles of the vertebrate body.

**BIOL 4607. MARINE ECOSYSTEMS OF PUERTO RICO.** Three credit hours. Two hours of lecture and one three-hour laboratory and/or field trips per week. Prerequisites: BIOL 3125 and BIOL 3425.

Ecology of shallow marine ecosystems of Puerto Rico: predominant flora and fauna, population fluctuations, effects of physical factors, life strategies, and environmental disturbances.

**BIOL 4725. MICROTECHNIQUE.** Two credit hours. Two three-hour laboratories per week. Prerequisite: BIOL 3417 or BIOL 3435 or BIOL 3022 or BIOL 3425.

The making of histological preparations of both plant and animal materials, including: (1) use of the aceto-carmin and other smear techniques, (2) the preparation of plant materials by use of the sliding microtome, and (3) the paraffin method, including killing, fixing, embedding, sectioning, staining and mounting of plant and animal tissues for microscopic examination.

**BIOL 4735. MICROBIOLOGY OF WATER AND SEWAGE.** Three credit hours. Two hours of lecture and one three-hour laboratory per week.

The fundamental principles of microbiology as they affect engineering problems encountered in connection with water supplies and sewage. Primarily for students in Civil Engineering.

**BIOL 4746. ECONOMIC MYCOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: CIBI 3002 or CIBI 3032 or BIOL 3052 or (BIOL 3043 and BIOL 3044).

A study of fungi, with emphasis on their economic importance. Fungi will be studied as they relate to food production, industrial processes, agriculture, medicine and also as a food source.

**BIOL 4761. HUMAN ANATOMY I.** Four credit hours. Three hours of lecture and three hours of laboratory per week. Prerequisite: BIOL 3425 or BIOL 4505 and (QUIM 3463 and QUIM 3464).

Human anatomy, including neuroanatomy and osteology of the head, the neck, and the extremities.

**BIOL 4762. HUMAN ANATOMY II.** Four credit hours. Three hours of lecture and three hours of laboratory per week. Prerequisite: BIOL 3425 or BIOL 4505 and (QUIM 3463 and QUIM 3464).

Human anatomy, including the great body cavities (thoracic, abdominal, pelvic) and their parieties.

**BIOL 4778. DAIRY BACTERIOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3770.

The relation of microorganisms to milk and milk products from the standpoint of economic dairy bacteriology, and also of milk hygiene and sanitary control.

**BIOL 4901. SPECIAL PROBLEMS IN BIOLOGY.** One to three credit hours per semester. One to three hours of lecture per week. Prerequisites: Twelve credits in Biology and authorization of the Director of the Department.

Short research problems will be assigned or may be selected, subject to approval by the instructor. A written report is required upon the completion of the work assigned or selected.

**BIOL 4902. SPECIAL PROBLEMS IN BIOLOGY.** One to three credit hours per semester. One to three hours of lecture per week. Prerequisites: Twelve credits in Biology and authorization of the Director of the Department.

Short research problems will be assigned or may be selected, subject to approval by the instructor. A written report is required upon the completion of the work assigned or selected.

**BIOL 4925. SEMINAR.** One credit hour. Two hours of lecture per week.

Discussion of recent literature in biology and related fields.

**BIOL 4991. SPECIAL TOPICS IN BIOLOGY: LAB.** One to six credit hours. One to six two-to six-hour laboratories per week. Prerequisite: authorization of the Director of the Department.

Selected topics in biology, botany, microbiology, or zoology.

**BIOL 4993. SPECIAL TOPICS IN BIOLOGY I.** One to six credit hours. One to six hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Selected topics in biology, botany, microbiology, or zoology.

**BIOL 4994. SPECIAL TOPICS IN BIOLOGY II.** One to six credit hours. One to six hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Selected topics in biology, botany, microbiology, or zoology.

**BIOL 4998. COOP PRACTICE.** One to six credit hours. Supervised practice in private industry or government. Prerequisite: authorization of the Director of the Department.

Practical experience in biology in cooperation with the private industry or government to be jointly supervised by the academic department, the CO-OP program coordinator, and an official from the cooperating organization.

### Advanced Undergraduate and Graduate Courses

**BIOL 5005. ELEMENTARY PLANT ANATOMY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3417 or BIOL 3435 or authorization of the Director of the Department.

The study of simple and complex tissues of the organs of vascular plants; the study of the characteristics of parenchyma, sclerenchyma and collenchyma cells, as well as the elements composing the xylem and phloem tissues.

**BIOL 5007. GENERAL PLANT MORPHOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3417 or BIOL 3435 or authorization of the Director of the Department.

The general principles of plant morphology, including evolutionary tendencies, phylogenetic lines and the life cycles of the principal groups of plants.

**BIOL 5016. PLANT EVOLUTION.** Two credit hours. Two hours of lecture per week. Prerequisite: BIOL 3417 or BIOL 3435 or authorization of the Director of the Department.

Analysis of the geological, morphological, anatomical, physiological, and geographical evidence showing how

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the different plant phyla have evolved, with emphasis on the evolution of tracheophytes. Assigned reading reports.

**BIOL 5018. PLANT PHYSIOLOGY.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisites: BIOL 3417 or BIOL 3435 or authorization of the Director of the Department. Corequisite: QUIM 3032 or QUIM 3062 or QUIM 3463 or authorization of the Director of the Department.

Plant physiology: diffusion, transpiration, absorption and transport, mineral nutrition, metabolism, growth and development, hormones, effects of environmental factors.

**BIOL 5038. BIOLOGICAL APPLICATIONS OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: MATE 3172 or MATE 3005 or authorization of the Director of the Department.

Students will learn the theory of extracting information from remotely sensed data, its integration into geographical information system (GIS) databases, and its use for the study and management of biological systems. Students will extract information of biological interest from remotely sensed data and other types of geographic data, will assemble at least one geographic database, and use that geographic database to study the relationships between one or several organisms and several environmental variables.

**BIOL 5045. SCANNING ELECTRON MICROSCOPY (SEM).** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: authorization of the Director of the Department.

Theoretical and practical aspects of the scanning electron microscope (SEM) with emphasis on sample preparation for SEM, detection of the different types of signals emitted by the specimen, and image analysis.

**BIOL 5055. EUKARYOTIC MOLECULAR GENETICS.** Three credit hours. Three hours of lecture per week. Prerequisites: (BIOL 3300 and QUIM 5071) or authorization of the Director of the Department.

The eukaryotic genome, gene structure, transposable elements, regulation of transcription, mRNA processing, signal transduction and the genetics of development the cell cycle, and cancer. Discussion of research techniques in molecular genetics.

**BIOL 5056. EUKARYOTIC MOLECULAR GENETICS LABORATORY.** Two credit hours. Eight hours of laboratory per week. Prerequisites: (BIOL 3300 and QUIM 5071) or authorization of the Director of the Department. Corequisite: BIOL 5055.

Techniques used in eukaryotic molecular genetics such as: DNA preparation, polymerase chain reaction, restriction mapping, gene cloning, DNA sequencing, and construction of genomic and cDNA libraries.

**BIOL 5057. INTRODUCTION TO BIOLOGICAL SEQUENCE ANALYSIS.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: BIOL 3300 or authorization of the Director of the Department.

Use of bioinformatics programs for the retrieval manipulation, and analysis of DNA and protein sequences. The subjects include: description of sequence data editing software, sequence database searches (nucleotide, proteins and genomes), comparative sequence alignments, applications for the design of specific or degenerate oligonucleotides for the detection of DNA sequences via PCR, and construction of phylogenetic trees using distance, parsimony and maximum likelihood methods.

**BIOL 5116. MOLECULAR BASIS OF EUKARYOTIC CELL SIGNALING.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: (BIOL 3010 and QUIM 5071) or authorization of the Director of the Department.

Principles of molecular signaling regulating membrane, cytoplasmic and nuclear events in eukaryotic cells. Emphasis on contemporary research methods and the principles of identifying and solving problems related to cellular signal transduction.

**BIOL 5117. CELLULAR AND MOLECULAR BIOLOGY OF CANCER.** Three credit hours. Three hours of lecture per week. Prerequisite: BIOL 3010 or authorization of the Director of the Department.

Discussion of topics related to cancer research and its clinical application. Emphasis on molecular mechanisms that lead to cancer development and tumor progression and how they relate to the clinical course of the disease. Discussion of recent discoveries in the area.

**BIOL 5226. GENETICS AND EVOLUTION OF HUMAN POPULATIONS.** Three credit hours. Three hours of lecture per week. Prerequisites: (BIOL 3300 or (CIBI 3032 and ANTR 3015)) or authorization of the Director of the Department.

Study of the biology of human populations, mainly from a genetic and evolutionary perspective. Includes the study of genetic elements, their evolution and their use in studies of the evolution and dispersal of human populations and domesticated species.

**BIOL 5399. EUKARYOTIC GENOME ANNOTATION.** Two credit hours. One hour of lecture and three hours of research per week. Prerequisite: BIOL 3300 or authorization of the Director of the Department.

Practical course covering the annotation of genomic fragments in different eukaryotic species, using the genome of an evolutionarily closely related species as a reference sequence. Includes the detailed study of the structure of diverse genetic elements, molecular evolution processes, and the use of applications and computer programs useful for studies in genomics. A final report is required.

**BIOL 5416. HERPETOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week.

A study of the biology, classification and morphology of amphibians and reptiles, with emphasis on local species. Field trips.

**BIOL 5417. ICHTHYOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week.

A study of the biology, classification and morphology of fishes, with emphasis on local species. Field trips.

**BIOL 5585. MEDICAL AND VETERINARY ENTOMOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week.

This course offers the student interested in entomology, animal husbandry or veterinary science, an opportunity to become familiar with the recognition, characteristics, habits and control of insects, ticks mites, and other arthropods that attack man and domestic animals.

**BIOL 5755. VIROLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3770 or authorization of the Director of the Department.

The classification, structure, physiology and biochemical activities of viruses.

**BIOL 5758. BACTERIAL GENETICS.** Two credit hours. Two hours of lecture per week. Prerequisites: BIOL 3300 or BIOL 3770 or authorization of the Director of the Department.

DNA replication and expression in the prokaryotic cell; transfer of genetic information; the impact of genetic processes on the physiology and ecology of bacteria.

**BIOL 5759. BACTERIAL GENETICS LABORATORY.** Two credit hours. Two four-hour laboratory periods per week. Corequisite: BIOL 5758.

Molecular techniques for the study of the genetics of bacteria and bacteriophages. Practical experiences in the processes of recombination, complementation, the control of genetic expression, and the transmission of genetic information among microorganisms.

**BIOL 5760. BACTERIAL GENETICS LABORATORY.** One credit hour. One four hour laboratory per week. Corequisite: BIOL 5758.

Molecular techniques for the study of the genetics of bacteria and bacteriophages. Practical experiences in the processes of recombination, complementation, the control of genetic expression, and the transmission of genetic information among microorganisms.

**BIOL 5765. MYCOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: BIOL 3770 or authorization of the Director of the Department.

A study of the morphology, physiology, classification and relation of fungi to man. Emphasis is given to the isolation and identification of the different groups.

**BIOL 5815. ANIMAL BEHAVIOR.** Three credit hours. Two hours of lecture and one three-hour laboratory per week.

A study of activities and responses of animals in meeting their life requirements. Field trips.

**BIOL 5955. INTRODUCTION TO RESEARCH METHODS IN ECOLOGY.** Three credit hours. One hour of lecture and two three-hour laboratory periods per week. Prerequisite: BIOL 3125 or authorization of the Director of the Department.

Field and laboratory exercises serve to introduce the student to the basic methods used in ecological research. The student is trained in the use of computers for the analysis of ecological data.

**BIOL 5990. FIELD BIOLOGY WORKSHOP.** One to three credit hours. Thirty to sixty hours of workshop/practice per credit. Prerequisite: authorization of the Director of the Department.

Intensive practical experience in selected areas of field biology, in or outside of Puerto Rico. A final written report will be required.

## **BOTANY**

### **Undergraduate Course**

**BOTA 4995. SPECIAL PROBLEMS IN BOTANY.** One to three credit hours per semester. One to three research classes per week each semester. Prerequisite: Authorization of the Director of the Department.

Designed for students prepared to undertake special problems or investigations. A written report is required upon completion of the course.

**BOTA 4996. SPECIAL PROBLEMS IN BOTANY.** One to three credit hours per semester. One to three research classes per week each semester. Prerequisite: Authorization of the Director of the Department.

Designed for students prepared to undertake special problems or investigations. A written report is required upon completion of the course.

## **ZOOLOGY**

### **Advanced Undergraduate and Graduate Course**

**ZOOL 5005. INVERTEBRATES OF PUERTO RICO.** Three credit hours. Two hours of lecture and one-three hour laboratory per week.

Taxonomy and ecology of the most common invertebrates of Puerto Rico, especially Arthropoda (exclusive of insects and marine forms) and Mollusca. Field trips.



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## DEPARTMENT OF CHEMISTRY

### Mission

Our fundamental mission is to prepare professionals in the Chemistry discipline, by offering academic programs of excellence at the undergraduate and graduate level, as well as in research. Our goal is to provide students with the intellectual resources, skills and experiences that will enable them to be successful in their future professional endeavors. These resources should also provide them with the self-confidence necessary to contribute and engage in future challenging problems of diverse nature, in order to advance the development of our society, in the economic, scientific and educational platforms.

### Vision

To be able to cooperate with ideas and be leaders of the XXI century in the preparation of professionals in the discipline of chemistry and related areas, at the national and international level. Contribute to the creation, development, and dissemination of knowledge in all classical, applied and interdisciplinary areas of chemical sciences, keeping in mind the development of our future generations.

The Department of Chemistry was founded in 1948 and offers a **Bachelor of Science** degree in Chemistry, which has been fully approved by the American Chemical Society since 1978. The department also offers a graduate program leading to a **Doctor of Philosophy** degree in Applied Chemistry and a **Master of Science** degree in Chemistry, the latter since 1959 (see Graduate Catalogue). The Department's web site: <http://www.uprm.edu/chemistry>, offers additional information about the programs and the research interests of the faculty members involved in the program. The Chemistry Department collaborates with the interdisciplinary Master of Science in Food Technology and the Bachelor of Science in Biotechnology programs together with the departments of Chemical Engineering and Biology and the School of Agriculture. The Chemistry Department is the largest service department offering laboratory courses within the University of Puerto Rico system.

The mission of the department is to offer students an excellent undergraduate program in chemistry by means of a formal education, research and community service, to enable them to develop as professionals in the various fields of chemistry. Students completing

the program are made aware of the problems that affect the Puerto Rican and international communities; and of their responsibilities and opportunities as citizens and scientists in areas such as education, industry, government, and scientific research. The Chemistry Department's Student Affiliate Chapter has been declared as outstanding by the American Chemical Society's Department of Educational Activities on numerous occasions.

The department is housed in a four-story building (214,000 square feet) with modern facilities for teaching and research. The building has 40 research and 20 teaching laboratories as well as 10 classrooms, a computer center, a visualization center, and cold and dark rooms. Research facilities include a large variety of sophisticated instrumentation, including systems for femtochemistry (laser system), NMR spectroscopy, atomic force microscopy, scanning electron microscopy, and electrochemistry. The department hosts several research groups and three research centers: the Center for Protein Characterization and Function, and the Center for Development of Chemical Sensors and The Center for Education and Training in Agriculture and Related Sciences (CETARS). An outreach program, Science on Wheels, is also housed within the departmental facilities.

### Student Learning Outcomes

1. Demonstrate knowledge in the fundamental areas of chemistry (general, organic, analytical, physical, inorganic, and biochemistry)
2. Design and conduct experiments, analyze data, and interpret experimental results
3. Use laboratory safe practices
4. Use modern instrumentation and techniques needed for the profession in the industry, academia, or government
5. Work effectively in interdisciplinary tasks and as a member of a team
6. Identify, analyze, evaluate, and solve chemical problems
7. Gather, analyze, and synthesize scientific information
8. Demonstrate scientific and mathematical reasoning skills
9. Effectively communicate scientific information orally and in writing, both in Spanish and in English
10. Demonstrate the ability to employ modern bibliographical search tools to retrieve scientific

information. Critically evaluate scientific information sources

11. Demonstrate a commitment to life-long learning through participation in appropriate continuing education activities (such as workshops, seminars, and short courses)
12. Demonstrate an awareness of the ethical and social implications of the profession in our society
13. Show knowledge of the regulations of the chemical profession
14. Demonstrate awareness of applications of chemistry in the arts and humanities

## PROGRAM OF STUDY

### BACHELOR OF SCIENCE IN CHEMISTRY

|   |            |
|---|------------|
| College of Arts & Sciences requirements | 44         |
| Departmental requirements               |            |
| Major area                              | 51         |
| Non-major area                          | 26         |
| Recommended electives                   | 6          |
| Free electives                          | <u>12</u>  |
| <b>Total</b>                            | <b>139</b> |

#### FIRST YEAR

##### First Semester

| Number            | Credits  | Course                       |
|-------------------|----------|------------------------------|
| <b>QUIM 3041</b>  | 4        | General Chemistry I          |
| <b>*MATE 3005</b> | <b>5</b> | Pre-Calculus                 |
| <b>*INGL 3---</b> | 3        | First year course in English |
| <b>*ESPA 3101</b> | 3        | Basic course in Spanish I    |
| <b>HUMA 3111</b>  | <u>3</u> | Intro. to Western Culture I  |
|                   | 18       |                              |

##### Second Semester

| Number            | Credits  | Course                       |
|-------------------|----------|------------------------------|
| <b>QUIM 3042</b>  | 4        | General Chemistry II         |
| <b>MATE 3031</b>  | 4        | Calculus I                   |
| <b>*INGL 3---</b> | 3        | First year course in English |
| <b>*ESPA 3102</b> | 3        | Basic course in Spanish II   |
| <b>HUMA 3112</b>  | 3        | Intro. to Western Culture II |
| <b>EDFI _____</b> | <u>1</u> | Course in Physical Education |
|                   | 18       |                              |

#### SECOND YEAR

##### First Semester

| Number             | Credits  | Course                                 |
|--------------------|----------|--|
| <b>QUIM 3071</b>   | 4        | Organic Chemistry                      |
| <b>**CIBI 3031</b> | 3        | Intro. Biological Sciences I           |
| <b>FISI 3171</b>   | 4        | Physics I                              |
| <b>MATE 3032</b>   | 4        | Calculus II                            |
| <b>INGL 3---</b>   | <u>3</u> | 2 <sup>nd</sup> year course in English |
|                    | 18       |  |

##### Second Semester

| Number             | Credits  | Course                                 |
|--------------------|----------|--|
| <b>QUIM 3072</b>   | 4        | Organic Chemistry                      |
| <b>**CIBI 3032</b> | 3        | Intro. Biological Sciences II          |
| <b>FISI 3172</b>   | 4        | Physics II                             |
| <b>FISI 3173</b>   | 1        | Physics Laboratory I                   |
| <b>MATE 3063</b>   | 3        | Calculus III                           |
| <b>^INGL 3---</b>  | <u>3</u> | 2 <sup>nd</sup> year course in English |
|                    | 18       |  |

#### THIRD YEAR

##### First Semester

| Number                            | Credits  | Course                              |
|-----------------------------------|----------|-------------------------------------|
| <b>QUIM 3025</b>                  | 4        | Analytical Chemistry I              |
| <b>QUIM 4041</b>                  | 3        | Physical Chemistry I                |
| <b>FISI 3174</b>                  | 1        | Physics Laboratory II               |
| <b>ESPA 3---</b>                  | 3        | Course above level of basic Spanish |
| <b>+Course in Social Sciences</b> | 3        |                                     |
| <b>ELECTIVE</b>                   | <u>3</u> | Free Elective                       |
|                                   | 17       |                                     |

##### Second Semester

| Number                            | Credits  | Course                              |
|-----------------------------------|----------|-------------------------------------|
| <b>QUIM 3065</b>                  | 4        | Analytical Chemistry II             |
| <b>QUIM 4042</b>                  | 3        | Physical Chemistry II               |
| <b>QUIM 4101</b>                  | 1        | Physical Chemistry Laboratory I     |
| <b>ESPA 3---</b>                  | 3        | Course above level of basic Spanish |
| <b>EDFI ----</b>                  | 1        | Course in Physical Education        |
| <b>+Course in Social Sciences</b> | 3        |                                     |
| <b>ELECTIVE</b>                   | <u>3</u> | Free Elective                       |
|                                   | 18       |                                     |

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## FOURTH YEAR

### First Semester

| Number    | Credits  | Course                                |
|-----------|----------|---------------------------------------|
| QUIM 4000 | 3        | Intermediate Inorganic Chemistry      |
| QUIM 4007 | 1        | Inorganic Chemistry Laboratory        |
| QUIM 4102 | 1        | Physical Chemistry Laboratory II      |
| QUIM 4125 | 2        | Bibliography and Seminar in Chemistry |
| QUIM 4055 | 3        | Biochemistry                          |
| ELECTIVE  | 3        | Professional Elective                 |
| ELECTIVE  | <u>3</u> | Recommended Elective                  |
|           | 16       |                                       |

### Second Semester

| Number    | Credits  | Course                           |
|-----------|----------|----------------------------------|
| QUIM 4015 | 4        | Instrumental Methods of Analysis |
| ELECTIVE  | 3        | Professional Elective            |
| ELECTIVE  | 3        | Recommended Elective             |
| ELECTIVE  | 3        | Free Elective                    |
| ELECTIVE  | <u>3</u> | Free Elective                    |
|           | 16       |                                  |

**Total credits required: 139**

\*Refer to the Academic Regulations section for information on Advanced Placement.

+Choose any course in Social Sciences with CISO \_\_\_\_, SOCI \_\_\_\_, CIPO \_\_\_\_, HIST \_\_\_\_, PSIC \_\_\_\_, ANTR \_\_\_\_, GEOG \_\_\_\_, or ECON 3021, or ECON 3022.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

\*\*Student could take BIOL 3051 (4 crs) and BIOL 3052 (4 crs) in substitution of CIBI 3031 and CIBI 3032.

## DEPARTMENTAL FACULTY

**ARNALDO CARRASQUILLO**, *Professor*, Ph.D., 1995, Texas A&M University.

**CELINE CASSE**, *Assistant Professor*, Ph.D. 2001, Université René Descartes, Paris.

**MIGUEL E. CASTRO**, *Professor*, Ph.D., 1991, University of Texas.

**JOSÉ E. CORTÉS**, *Professor*, Ph.D., 1989, University of North Texas.

**ASTRID J. CRUZ**, *Professor*, Ph.D., 1993, University of Massachusetts.

**MARCO A. DE JESÚS**, *Professor*, Ph.D., 2004, University of Tennessee, Knoxville.

**SARA DELGADO**, *Professor*, M.S., 1981, University of Puerto Rico.

**EMILIO DÍAZ-MORALES**, *Professor*, Ph.D., 1986, University of Wisconsin.

**MARÍA GUNTÍN-BURGOS**, *Professor*, M.S., 1991, University of Puerto Rico.

**AIKOMARI GUZMÁN MARTÍNEZ**, *Assistant Professor*, Ph.D., 2007, University of California.

**SAMUEL P. HERNÁNDEZ-RIVERA**, *Professor*, Ph.D., 1986, Johns Hopkins University.

**AIDALÚ DE LOS A. JOUBERT-CASTRO**, *Associate Professor*, Ph.D., 1998, Washington State University.

**JORGE LABOY**, *Professor*, Ph.D., 1993, University of Cincinnati.

**JUAN LÓPEZ-GARRIGA**, *Professor*, Ph.D., 1986, Michigan State University.

**MARTHA LAURA LÓPEZ-MORENO**, *Associate Professor*, Ph.D. 2007, University of Texas at El Paso.

**ENRIQUE MELÉNDEZ**, *Professor and Chairman*, Ph.D., 1990, University of Utah.

**NAIRMEN MINA-CAMILDE**, *Professor*, Ph.D., 1996, Baylor University.

**LUIS A. MORELL**, *Professor*, Ph.D., 1993, University of California.

**ELSIE PARÉS**, *Professor*, Ph.D., 2000, Purdue University.

**BELINDA PASTRANA**, *Professor*, Ph.D., 1995, Rutgers University.

**FRANCIS B. PATRON**, *Professor*, Ph.D., 1997, Purdue University.

**JORGE RÍOS**, *Professor*, Ph.D., 1991, University of Puerto Rico, Río Piedras.

**ROBERT RÍOS**, *Professor*, Ph.D., 1995, Rutgers University.

**LUIS RIVERA**, *Researcher*, Ph.D., 1990, University of Puerto Rico.

**NILKA RIVERA-PORTALATÍN**, *Professor*, Ph.D., 2006, University of Florida.

**FÉLIX ROMÁN**, *Professor*, Ph.D., 1989, University of Nebraska.

**RODOLFO ROMANACH**, *Professor*, Ph.D., 1986, University of Georgia.

**VERÓNICA SÁNCHEZ**, *Professor*, M.S., 1995, University of Puerto Rico.

**ALBERTO SANTANA**, *Professor*, Ph.D., 2003, University of Florida.

**JESSICA TORRES**, *Associate Professor*, Ph.D., 2004, Johns Hopkins University.

**WILDELIZ TORRES-IRIZARRY**, *Assistant Professor*, Ph.D., 2007, University of Puerto Rico.

**CARMEN A. VEGA-OLIVENCIA**, *Professor*, Ph.D., 1975, University of Florida.

## COURSES OF INSTRUCTION

### Undergraduate Courses

**QUIM 3001. GENERAL CHEMISTRY I.** Four credit hours. Three hours of lecture and three hours of laboratory per week.

Study of the fundamentals of chemistry with emphasis on the following topics: matter and its physical and chemical properties, measures, atoms, molecules and ions, stoichiometry, types of reaction, gases, thermochemistry, periodic table, quantum theory and atomic structure, chemical bonds and molecular geometry.

**QUIM 3002. GENERAL CHEMISTRY II.** Four credit hours. Three hours of lecture and three hours of laboratory per week. Prerequisites: QUIM 3001 or (QUIM 3131 and QUIM 3133).

Study of the fundamentals of chemistry with emphasis on the following topics: molecule polarity, intermolecular forces and changes in state of matter, solutions, colligative properties, kinetics and reaction mechanism, chemical equilibrium, acids, bases and salts, buffer systems, titration curves, thermodynamics and electrochemistry.

**QUIM 3025. ANALYTICAL CHEMISTRY I.** Four credit hours. Three hours of lecture and one four-hour laboratory per week. Prerequisite: QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134).

General concepts of quantitative chemical analysis with emphasis on classical methods including volumetric and gravimetric analysis and chemical equilibria.

**QUIM 3041. GENERAL CHEMISTRY I.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Corequisite: MATE 3171 or MATE 3005 or MATE 3143 or MATE 3173.

Qualitative and quantitative aspects of fundamental chemical principles, emphasizing the relationship between the chemical behavior of matter and its atomic and molecular structure. Topics include dimensional analysis, atomic theory, and stoichiometry.

**QUIM 3042. GENERAL CHEMISTRY II.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisite: QUIM 3041.

Qualitative and quantitative aspects of fundamental chemical principles, emphasizing the relationship between the chemical behavior of matter and its atomic and molecular structure. Topics include colligative properties, chemical kinetics, and chemical equilibrium.

**QUIM 3055. ANALYTICAL CHEMISTRY.** Four credit hours. Three hours of lecture and one four-hour laboratory per week. Prerequisite: QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134).

A study of fundamental topics in analytical chemistry. Emphasis will be given to both theory and practice of current instrumental methods of analysis.

**QUIM 3061. FUNDAMENTALS OF ORGANIC CHEMISTRY AND BIOCHEMISTRY I.** Four credit hours. Three hours of lecture and one four-hour laboratory per week. Prerequisite: QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134).

Principles of organic chemistry; the chemistry of organic functional groups and reaction mechanisms, emphasizing their importance in biochemistry.

**QUIM 3062. FUNDAMENTALS OF ORGANIC CHEMISTRY AND BIOCHEMISTRY II.** Four credit hours. Three hours of lecture and one four-hour laboratory per week. Prerequisite: QUIM 3061.

Fundamental concepts of biochemistry; the nature and properties of compounds of biochemical interest.

**QUIM 3065. ANALYTICAL CHEMISTRY II.** Four credit hours. Three hours of lecture and one four-hour laboratory per week. Prerequisite: QUIM 3025.

Theory and practice of optical spectroscopy, electroanalytical methods, and modern separation techniques.

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**QUIM 3071. ORGANIC CHEMISTRY.** Four credit hours. Three hours of lecture and one four-hour laboratory per week per semester. Prerequisites: QUIM 3042 or QUIM 3002 or (QUIM 3132 and QUIM 3134). For chemistry majors.

A study of the reactions, methods of preparation and theories on structure of organic compounds, with emphasis on the mechanisms of organic reactions.

**QUIM 3072. ORGANIC CHEMISTRY.** Four credit hours. Three hours of lecture and one four-hour laboratory per week per semester. Prerequisite: QUIM 3071.

A study of the reactions, methods of preparation and theories on structure of organic compounds, with emphasis on the mechanisms of organic reactions.

**QUIM 3085. ENVIRONMENTAL CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134).

Effect of man's activities upon the biosphere, with particular emphasis on the chemistry of the processes involved.

**QUIM 3086. ENVIRONMENTAL CHEMISTRY LABORATORY.** One credit hour. One four-hour laboratory per week. Prerequisite: QUIM 3055 or QUIM 3065. Corequisite: QUIM 3085.

Environmental chemical analysis providing practical experience in spectrophotometric, titrimetric, potentiometric, and chromatographic procedures used in water, air, and soil analysis. Field trips are required.

**QUIM 3131. GENERAL CHEMISTRY I.** Three credit hours. Three hours of lecture per week. Corequisites: QUIM 3133 and (MATE 3171 or MATE 3005 or MATE 3143 or MATE 3173).

Introduction of the fundamental principles of chemistry. Liquids, solids and properties of gases; changes of matter states. Stoichiometry, atomic theory, molecular structure and chemical properties. Periodic classification and the electronic theory of the ionic and covalent bonds.

**QUIM 3132. GENERAL CHEMISTRY II.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3131 and QUIM 3133. Corequisite: QUIM 3134.

Introduction to thermodynamics, solutions, kinetics, chemical equilibrium, oxidation-reduction. Electrochemistry.

**QUIM 3133. GENERAL CHEMISTRY LABORATORY I.** One credit hour. One three-hour laboratory per week. Corequisites: QUIM 3131 and (MATE 3171 or MATE 3005 or MATE 3143 or MATE 3173).

This laboratory responds to the course QUIM 3131 whose description is the following: Introduction of the fundamental principles of chemistry. Liquids, solids and properties of gases; changes of matter status. Stoichiometry, atomic theory, molecular structure and chemical properties. Periodic classification and the electronic theory of the ionic and covalent bonds.

**QUIM 3134. GENERAL CHEMISTRY LABORATORY II.** One credit hour. Three hours of laboratory per week. Prerequisite: QUIM 3001 or (QUIM 3131 and QUIM 3133). Corequisite: QUIM 3132.

This laboratory responds to the course QUIM 3132 whose description is the following: Introduction to thermodynamics, solutions, kinetics, chemical equilibrium, oxidation-reduction. Electrochemistry.

**QUIM 3141. PRINCIPLES OF GENERAL, ORGANIC AND BIOLOGICAL CHEMISTRY I.** Four credit hours. Three hours of lecture and one three-hour laboratory per week.

Principles of organic and biochemistry with emphasis on biological applications. Topics include: atoms, molecules, chemical equations, states of matter, solutions, kinetics and equilibrium.

**QUIM 3142. PRINCIPLES OF GENERAL, ORGANIC AND BIOLOGICAL CHEMISTRY II.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisite: QUIM 3141.

Principles of organic and biochemistry with emphasis on biological applications. Topics include: organic functional groups, carbohydrates, lipids, proteins, enzymes, and nucleic acids.

**QUIM 3335. INTRODUCTION TO FOOD CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisites: QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134).

Basic aspects of the relationships of food chemistry to health, nutrition, and industry.

**QUIM 3450. FUNDAMENTALS OF ORGANIC CHEMISTRY.** Five credit hours. Four hours of lecture and one four-hour laboratory per week. Prerequisite: QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134).

Properties, reactions, synthesis, and reaction mechanisms of organic compounds.

**QUIM 3461. ORGANIC CHEMISTRY I.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3002 or (QUIM 3132 and QUIM 3134).

Nomenclature, structure, preparation, and reactions of non-aromatic and alkyl halides.

**QUIM 3462. ORGANIC CHEMISTRY LABORATORY I.** One credit hour. One four-hour laboratory per week. Corequisite: QUIM 3461.

Experimental techniques in organic chemistry: separation; purification; reactions of nonaromatic hydrocarbons and alkyl halides; polarimetry.

**QUIM 3463. ORGANIC CHEMISTRY II.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3461.

Nomenclature, structure, preparation, and reactions of aromatic hydrocarbons, alcohols, ethers, carbonyl compounds, carboxylic acids, amines, and related compounds; biological compounds.

**QUIM 3464. ORGANIC CHEMISTRY LABORATORY II.** One credit hour. One four-hour laboratory per week. Prerequisite: QUIM 3462. Corequisite: QUIM 3463.

Experimental techniques in organic chemistry: identification and preparation of organic compounds; spectroscopy.

**QUIM 4000. INTERMEDIATE INORGANIC CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 4041.

A study of the elements and their inorganic compounds based on modern concepts of atomic and molecular structure.

**QUIM 4007. INORGANIC CHEMISTRY LABORATORY.** One credit hour. Four hours of laboratory per week. Corequisite: QUIM 4000.

Inorganic chemistry laboratory including synthesis of inorganic compounds and the study of their spectroscopic properties.

**QUIM 4015. INSTRUMENTAL METHODS OF ANALYSIS.** Four credit hours. Three hours of lecture and one four-hour laboratory per week. Prerequisite: QUIM 3065.

Theory and practice of atomic and molecular spectroscopic methods, mass spectrometry, ion and

surface science techniques, and current topics in instrumental analytical chemistry.

**QUIM 4026. HISTORY OF CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134).

The development of Chemistry from antiquity to the present time with an emphasis on the critical analysis of its concepts.

**QUIM 4037. LABORATORY SAFETY: PRINCIPLES, PRACTICES, AND REGULATIONS.** Three credit hours. Three hours of lecture per week. Prerequisites: QUIM 3071 or QUIM 3461 or QUIM 3450 or QUIM 3142 or authorization of the Director of the Department.

Principles, procedures, techniques and methods to establish and transmit a safety culture in the science laboratory. Study from a chemical perspective of laboratory hazards. Emphasis on safe work practices, waste management, green chemistry, prevention, and accident management. Risk identification and management, and application of these concepts to real situations in compliance with regulatory agencies. Preparation and presentation of a safety project of an academic, industrial or government agency laboratory. Field trips to laboratory facilities required.

**QUIM 4041. PHYSICAL CHEMISTRY I.** Three credit hours. Three hours of lecture per week. Prerequisites: (QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134)) and (FISI 3151 or FISI 3171 or FISI 3011 or FISI 3032). Corequisite: MATE 3063 or MATE 3048 or MATE 3185.

Fundamentals and laws of classical thermodynamics applied to ideal and real gases, phase equilibrium, chemical equilibrium, heterogeneous equilibrium of binary systems, and solutions.

**QUIM 4042. PHYSICAL CHEMISTRY II.** Three credit hours. Three hours of lecture per week. Prerequisites: QUIM 4041 and (MATE 3063 or MATE 3048 or MATE 3185).

Chemical kinetics, molecular kinetic theory of gases, introduction to quantum mechanics and its application to vibrational, rotational, and electronic spectroscopy.

**QUIM 4055. INTRODUCTION TO BIOCHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisites: QUIM 3072 or QUIM 3450 or QUIM 3463.

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Fundamental basics of structure, conformation and function of biological molecules. Design and organization of vital processes.

**QUIM 4057. PHYSICAL CHEMISTRY:**

**APPLICATIONS TO BIOTECHNOLOGY.** Four credit hours. Four hours of lecture per week. Prerequisite: MATE 3032 and (QUIM 3042 or QUIM 3002) and (FISI 3152 or FISI 3162 or FISI 3172).

Study of the principles and applications of physical chemistry that are used to solve problems in biotechnology. Fundamental concepts of classical thermodynamics, chemical kinetics, quantum mechanics, and spectroscopy and their application to biological problems.

**QUIM 4101. PHYSICAL CHEMISTRY**

**LABORATORY I.** One credit hour. One four-hour laboratory per week. Prerequisites: QUIM4041 and (QUIM3055 or QUIM3025).

Experimental determination of thermodynamic properties such as vapor pressure, partial molar volume, enthalpy of reaction, heat capacity, eutectic composition, and equilibrium constants.

**QUIM 4102. PHYSICAL CHEMISTRY**

**LABORATORY II.** One credit hour. One four-hour laboratory per week. Prerequisite: QUIM4101. Corequisite: QUIM 4042.

Use of spectroscopic, kinetic, electrochemical, surface, polarimetric, and computational methods to determine physical and chemical properties.

**QUIM 4115. TEACHING PRACTICE IN THE**

**CHEMISTRY LABORATORY.** One to three credit hours. Four hours of practice per week per credit. Prerequisites: (QUIM 3072 or QUIM 3032 or QUIM 3450 or QUIM 3463) or (QUIM 3025 or QUIM 3055) and authorization of the Director of the Department.

Training in the teaching of chemistry, organization of a laboratory, handling of chemicals, care of equipment, safety rules and supervision of experimental and written work.

**QUIM 4125. BIBLIOGRAPHY AND SEMINAR IN**

**CHEMISTRY.** Two credit hours. Two ninety-minute periods per week. Prerequisite: twenty credit hours of chemistry.

Techniques of searching the chemical literature. The student will give a short oral presentation on a recently published paper, and prepare and discuss a review paper on a topic selected by him and approved by the instructor.

**QUIM 4137. INDUSTRIAL CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3032 or QUIM 3072 or QUIM 3450 or QUIM 3062 or QUIM 3463.

Chemical principles related to industrial processes, especially those being carried out in Puerto Rico. Field trips required.

**QUIM 4145. PRACTICE IN INDUSTRIAL**

**CHEMISTRY.** One credit hour. One laboratory of four to six hours per week. Prerequisite: authorization of the Director of the Department.

Practical experience in Industrial Chemistry in cooperation with private industry or government.

**QUIM 4399. SELECTED TOPICS IN CHEMISTRY.**

One to three credit hours. One to three hours of lecture per week. Prerequisite: third or fourth year student in Chemistry, or authorization of the Director of the Department.

Selected topics in Biochemistry, Organic Chemistry, Analytical Chemistry, Inorganic Chemistry, Physical Chemistry, and related areas.

**QUIM 4405. INTRODUCTION TO FORENSIC**

**CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisites: (QUIM (3055 or 3065) and (QUIM (3461 or 3450 or 3071 or 3061)) or authorization of the Director of the Department.

Study of the basic principles of forensic chemistry. Analysis of procedures, techniques, and applications of forensic chemistry as they relate to a crime investigation. Collection, examination, evaluation, and handling of physical evidence obtained after a crime. Description of analytical chemical methods, techniques, and instrumentation applied to forensic chemistry. Evaluation of criminal cases from a chemical perspective.

**QUIM 4997. CO-OP PRACTICE.**

Three to six credit hours. Prerequisite: authorization of the Director of the Department.

Practical experience in chemistry in cooperation with industry or government agencies, jointly supervised by the Department, the COOP Program Coordinator, and an official from the cooperating organization.

**QUIM 4998. UNDERGRADUATE RESEARCH I.**

One to three credit hours. Three to nine hours of research per week. Prerequisite: Authorization of the Director of the Department.

Introduction to chemical research under the supervision of professors of the department.

**QUIM 4999. UNDERGRADUATE RESEARCH II.** One to three credit hours. Three to nine hours of research per week. Prerequisite: three credits in QUIM 4998.

A research project under the supervision of professors of the department.

### Advanced Undergraduate and Graduate Courses

**QUIM 5005. METHODOLOGY OF ENVIRONMENTAL CHEMICAL ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisites: ((QUIM 3055 or QUIM 3065) and (QUIM 3461 or QUIM 3450 or QUIM 3071 or QUIM 3061)) or authorization of the Director of the Department.

Methods of chemical analysis used for environmental studies in monitoring air, water, and soil, including the methodology required by federal, state, and local agencies. Discussion of sampling techniques for air, surface and waste water, soil, and other matrices. Practical description of analytical instrumentation, quality control, and data analysis.

**QUIM 5065. CHEMISTRY OF SYNTHETIC DRUGS.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3032 or QUIM 3072 or QUIM 3450 or QUIM 3463 or authorization of the Director of the Department.

The chemistry of synthetic organic compounds of medical and physiological interest. Topics to be covered will include anesthetics, antispasmodics, antipyretics, analgesics, hypnotics, sedatives, anticonvulsants, anticoagulants, antihistamines, tranquilizers, antimalarials, and anthelmintics.

**QUIM 5066. TOXICOLOGICAL CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3032 or QUIM 3072 or QUIM 3450 or QUIM 3063 or QUIM 3463 or authorization of the Director of the Department.

Chemical properties, reactions, origin, and the use of toxic substances, including chemical aspects of their effects upon biological systems, and their transformation and elimination.

**QUIM 5071. GENERAL BIOCHEMISTRY I.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3463 or QUIM 3072 or QUIM 3450 or QUIM 3062 or authorization of the Director of the Department.

Chemical characterization of proteins, carbohydrates, lipids, and nucleic acids; principles of enzymology and bioenergetics; biological membranes and transport; recombinant DNA techniques; biological oxidations.

**QUIM 5072. GENERAL BIOCHEMISTRY II.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 5071 or authorization of the Director of the Department.

Biosynthesis and biodegradation of carbohydrates, lipids, amino acids, and nucleic acids; integration and regulation of animal metabolism; chemistry of genetic expression and regulation.

**QUIM 5073. GENERAL BIOCHEMISTRY LABORATORY I.** One credit hour. One four-hour laboratory per week. Corequisite: QUIM 5071.

Isolation and characterization of proteins, lipids, and nucleic acids; enzymatic processes; the use of recombinant DNA techniques.

**QUIM 5074. GENERAL BIOCHEMISTRY LABORATORY II.** One credit hour. Four hours laboratory per week. Corequisite: MATE 3021 or MATE 3031 or MATE 3144 or MATE 3183.

The use of bioinformatics, structural genomics, and the molecular modeling in the spectroscopic characterization and analysis of biological molecules.

**QUIM 5085. FOOD CHEMISTRY.** Four credit hours. Three hours of lecture and four hours of laboratory per week. Prerequisite: (QUIM 3072 and (QUIM 3463 or QUIM 3062)) or authorization of the Director of the Department.

A study of the chemistry of the principal food resources and food additives, their role in nutrition, and the effect of processing treatments on their chemical composition.

**QUIM 5095. NUCLEAR CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisites: (((QUIM 3042 or QUIM 3002) or (QUIM 3132 and QUIM 3134)) and (MATE 3183 or MATE 3031 or MATE 3144)) or authorization of the Director of the Department.

A course describing the fundamental concepts of nuclear science. Selected topics on nuclear properties, nuclear forces and structure, radioactivity, mathematical relations of radioactive decay, statistics, nuclear reactions, effects of nuclear radiations and transitions, application of nuclear phenomena to chemistry and other related fields.

**QUIM 5105. PRINCIPLES OF QUANTUM CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 4042 or authorization of the Director of the Department.

Conceptual development, postulates, and models of quantum mechanics. Approximation methods to the solution of the time-independent Schrödinger equation.



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**QUIM 5125. CHEMICAL THERMODYNAMICS.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 4042 or authorization of the Director of the Department.

Systematic analysis of the fundamental concepts of chemical thermodynamics and their applications.

**QUIM 5135. PHYSICAL ORGANIC CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisites: (QUIM 4042 and (QUIM 3450 or QUIM 3032 or QUIM 3072 or QUIM 3463)) or authorization of the Director of the Department.

A mathematical and quantitative study of organic chemical phenomena. Applications of modern theoretical concepts to the chemical and physical properties of organic compounds, and to the kinetics and mechanisms of organic reactions.

**QUIM 5145. HETEROCYCLIC COMPOUNDS.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3032 or QUIM 3072 or QUIM 3450 or QUIM 3463 or authorization of the Director of the Department.

Structure, synthesis, and reactions of ring systems containing other atoms besides carbon. Alkaloids will be given special consideration.

**QUIM 5150. SPECTROSCOPIC IDENTIFICATION OF ORGANIC COMPOUNDS.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3032 or QUIM 3072 or QUIM 3450 or QUIM 3463 or authorization of the Director of the Department.

Elucidation of the structure of organic compounds by spectroscopic methods, including infrared, ultraviolet, nuclear magnetic resonance, and mass spectrometry techniques.

**QUIM 5165. POLYMER CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3450 or QUIM 3072 or QUIM 3032 or QUIM 3463 or authorization of the Director of the Department.

Structure, properties, synthesis, reactions, and physical behavior of polymers. Experimental methods used in their analysis.

**QUIM 5175. EXPLOSIVES DETECTION AND ANALYSIS.** Four credit hours. Three hours of lecture and one four-hour laboratory period per week. Prerequisites: (QUIM 4041 and (QUIM 3065 or QUIM 3055)) or authorization of the Director of the Department.

General aspects, chemical and physical properties, and analytical techniques for the detection and analysis of explosives.

**QUIM 5205. PHARMACEUTICAL ANALYTICAL CHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisites: ((QUIM 3065 or QUIM 3055) and (QUIM 3072 or QUIM 3450) and QUIM 4041) or authorization of the Director of the Department.

Application of analytical methods and validation requirements oriented to pharmaceutical processes, materials, and regulations that apply to the pharmaceutical industry.

## DEPARTMENT OF ECONOMICS

Economics is a science of choice. Learning Economics gives students an understanding of how consumers, business managers, and government officials make choices under conditions of scarcity and the results of those choices for society. Many of the public issues that fill the mass media—unemployment, wages, taxes, public debt, budget deficit, inflation, pollution, poverty, international trade, and economic growth—are, in fundamental ways, economic subjects. The daily decisions of businesses and consumers are largely economic. Economists seek to understand the decisions of businesses, consumers, and current economic issues by developing a systematic and thorough understanding of precisely how the economic system operates, including the mechanisms by which resources are allocated, prices determined, income redistributed, and economic growth and development are promoted.

Employers demand that modern graduates have strong understanding of decision making, research and analytical skills, and how they can view issues within a national and international context. This presents many opportunities for good Economics graduates. An Economics degree opens career prospects in accounting, communications, finance and banking, law, marketing and sales, public policy, public administration, health, industrial relations, international relations, insurance and actuarial work, urban and regional planning, tourism, environmental studies, among others.

The Department of Economics offers a four-year program leading to Bachelor of Arts degree in Economics. The program is one of only two undergraduate programs in Economics offers within the UPR system and the only in Puerto Rico offering a strong development in quantitative methods and techniques necessary for economic analysis. The program requires a two semester sequence in mathematics, one year of mathematical statistics, one semester in project evaluation and one semester course in econometrics, as well as one year seminar course in research methodology.

The Bachelor of Arts degree in Economics is awarded after completion a minimum of 134 credits, 48 of which must be in department requirements, 56 in general education, 18 recommended electives, and 12 free electives. Students should see a departmental advisor for guidance on choosing the elective courses that best fits its personnel objectives.

The Bachelor of Arts in Economics course requirements are organized in a manner that first provides a broad introduction to economics, then develops the theoretical tools that provide the foundation of modern economic thought, and finishes with advanced courses designed to provide greater in-depth knowledge of specific fields (such as antitrust and regulation, business cycles, development, environment, electronic commerce, industrial organization, international economics, labor markets, managerial economics, money and banking, securities markets, public finance, transportation, urban economics, macroeconomics, microeconomics, and econometrics). Economics is frequently studied in a specialist 'single major' degree scheme, but it also lends itself to combination with other disciplines which is why the bachelor degree offer a range of elective courses.

Besides providing professional training to students majoring in Economics, the Department also offers courses that are part of the General Education requirements and other undergraduate and graduate programs. The general education component is designed to aid in the development of a professional that is aware not only of the technical needs associated with the economics profession, but also the general needs of society. Such individual needs involves to become proficient in communication skills in both languages, English and Spanish, in scientific and quantitative reasoning, in developing technological competency, and to be knowledgeable in a body of values, ethics, and diverse perspectives.

For major and no major students economics courses must be viewed as an important component of their development as an informed, effective and responsible citizenry. Economic literacy helps students to make informed and responsible choices through their lives as consumers, savers, investors, workers, citizens, and participants in the global economy. Department courses provides invaluable insight into the necessary skills to empowered students with an economic and entrepreneurial way of thinking, to be prepared for the myriad opportunities and threats they will encountered in the future. The degree to which students succeed in this endeavor will shape not only their futures and their fortunes, but the level of competitiveness and dynamism of the economy. In this way the Department also offers a Minor Concentration in Economics mainly design for student's pursuing other fields in the UPRM with an interest in complementing its career development with a knowledge's in economics.

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The Department teaching purpose is to develop students' ability to think clearly and objectively in dealing with economic decisions and problems. Students are trained specifically to replace value judgments and prejudices with sound economic reasoning based on an objective and rational analysis. Beside this function, economic research and the promotion of economic education are two integral elements within the Department.

### **MISSION**

To become an advanced department in higher education and research, distinguished internationally for its excellence in the formation of its graduates, dynamically contributing to social and economic development, transforming society through the pursuit of knowledge, in an atmosphere of ethics, justice, and peace.

### **VISION**

Provide an excellence service in education:

- Collaborating in the formation of educated, cultured citizens, able to think critically and professionally prepared in the economic discipline so that can contribute to the educational, cultural, social, technological and economic development.
- Doing creative work, research, and service, that meets the needs of the society and reporting the results of these activities so that they are accessible to everyone.
- Providing our students the skills and sensitivity needed to effectively solve the problems we face and be an example of the civic formation in education that should prevail in a democratic system that values and respects diversity.

### **PROGRAM EDUCATIONAL OBJECTIVES**

- Providing our students the theoretical and practical tools that enable them to understand and analyze the economic, social and international environment so that they can make rational decisions and proposing solutions to socio-economic problems.
- Enable them to develop their skills of communication and work as a team, with social conscience and ethics, in such a way that they reach a comprehensive education as human beings.

- Provide the tools to integrate information technology into the economic analysis.
- Train them to perform professionally in their working areas.
- Encourage them to continue graduates studies in economics or related areas.
- Encourage continuous learning, as part of their human, intellectual, and professional development.

### **STUDENT LEARNING OUTCOMES**

After successful completion of program requirements all major students are expected to:

- Know theoretical and technical research tools.
- Identify and analyze socioeconomic problems in a critical and logical manner, perform empirical research and propose solutions to these problems.
- Identify value judgments and apply economic reasoning based on the objective and rational analysis.
- Possess technical and creative skills in business and administrative aspects which can solve problems in these areas.
- Be able to integrate ethical and social values in their professional and personal performance.
- Possess interpersonal and teamwork skills and the ability to exhibit knowledge in verbal and writing in English and Spanish.
- Possess skills in mathematical reasoning and quantitative analysis.
- Possess skills in the use of statistical software's and knowledge in informatics.

### **ACADEMIC REGULATION**

The curricular program of the Bachelor of Arts in Economics and the Minor Concentration in Economics requires a minimum of C in all ECON courses which are part of the student's major field of study.

### **ACADEMIC SERVICES**

**Ceteris Paribus:** A peer-reviewed journal of socio-economics available online at <http://ceterisparibus.uprm.edu/>. Ceteris Paribus is responsible for the diffusion of research results, and other academic activities pursued by faculty members,

students, scholars, and economists. It is aimed at providing online links to data sources to other professional journals in Puerto Rico and the Caribbean, research in progress, research proposals, and professional activities.

**Center for Economic and Financial Education.** The Department of Economics has the first Center for Economic and Financial Education in Puerto Rico, affiliated to the network of the Council for Economic Education (CEE). The Center's mission is to develop in young people the understanding on how the economy works, how to make knowledgeable decisions as consumers, savers, investors, and member of the workforce, prepare them to be active and responsible citizens, successful lifelong economic and financial decision makers, and effective participants in the global economy. The Center will deliver economic and financial education by training and providing curriculum materials to in-service teachers in public and private schools in Puerto Rico. The training of teachers has a significant multiplier effect in reaching our goal in children's education.

**Student Association.** The Economics Student Association is an undergraduate club that meets regularly to discuss graduate study in economics and other fields, employment opportunities, and recent economic trends. For more information, please visit the association office located in SH-109.

**Academic Advising.** Departmental academic advisor work with current and prospective majors on walk-in basis. Majors are encouraged to see an advisor at least once an academic year to verify progress in their program requirements. Further information on courses, internships, careers, and graduated schools may be obtained from the advisors.

**Award and Recognition.** The Dr. Sir William Arthur Lewis Award is given to an outstanding economics honors student at the graduation ceremony.

**Facilities.** The Economics Department is located on the first and third floors of the Sanchez Hidalgo Building. Our physical infrastructure includes five classroom, 16 office spaces, one student association office room, and one computer lab with 25 workstations. All our classrooms are equipped with interactive smart boards, wi-fi and electronic multimedia equipment.

**Contact Information.** For more information about the Economics Department and our programs, please visit: <http://econ.uprm.edu>.

## BACHELOR OF ARTS IN ECONOMICS

### Summary of Credits in Program

|                            |            |
|----------------------------|------------|
| Institutional requirements | 2          |
| Faculty requirements       | 54         |
| Departmental requirements  |            |
| Major area                 | 42         |
| Non-major area             | 6          |
| Recommended electives      | 18         |
| Free electives             | 12         |
| <b>Total</b>               | <b>134</b> |

### PROGRAM OF STUDY

#### ECONOMICS CURRICULUM

##### FIRST YEAR

###### First Semester

| Number                 | Credits | Course                                  |
|------------------------|---------|---|
| <b>ECON 3021</b>       | 3       | Principles of Economics: Microeconomics |
| <b>MATE 3171</b>       | 3       | Pre-Calculus I                          |
| <b>*ESPA 3101</b>      | 3       | Basic course in Spanish I               |
| <b>*INGL 3 _ _ _ _</b> | 3       | First year course in English            |
| <b>HUMA 3111</b>       | 3       | Introduction to Western Culture I       |
| <b>EDFI _ _ _ _</b>    | 1       | Course in Physical Education            |
|                        | 16      |   |

###### Second Semester

| Number                 | Credits | Course  |
|------------------------|---------|---|
| <b>ECON 3022</b>       | 3       | Principle of Economics: Macroeconomics        |
| <b>MATE 3049</b>       | 3       | Mathematical Analysis for Management Sciences |
| <b>*ESPA 3102</b>      | 3       | Basic course in Spanish II                    |
| <b>*INGL 3 _ _ _ _</b> | 3       | First year course in English                  |
| <b>HUMA 3112</b>       | 3       | Intro. to Western Culture II                  |
| <b>EDFI _ _ _ _</b>    | 1       | Course in Physical Education                  |
|                        | 16      |   |

##### SECOND YEAR

###### First Semester

| Number                 | Credits | Course                        |
|------------------------|---------|-------------------------------|
| <b>ECON 3091</b>       | 3       | Micro Economic Theory         |
| <b>ECON _ _ _ _</b>    | 3       | Elective in Economics         |
| <b>ECON 4055</b>       | 3       | History of Economic Thought   |
| <b>ESMA 3101</b>       | 3       | Applied Statistics I          |
| <b>*INGL 3 _ _ _ _</b> | 3       | Second year course in English |
| <b>ELECTIVE</b>        | 3       | Recommended Elective          |
|                        | 18      |                               |

## Second Semester

| Number           | Credits  | Course   |
|------------------|----------|--|
| <b>ECON 3092</b> | 3        | Macro Economic Theory                          |
| <b>ECON 3085</b> | 3        | Economic and Social Development of Puerto Rico |
| <b>ECON 4307</b> | 3        | Project Evaluation                             |
| <b>ESMA 3102</b> | 3        | Applied Statistics II                          |
| <b>^*INGL 3</b>  | 3        | Second year course in English                  |
| <b>ELECTIVE</b>  | <u>3</u> | Recommended Elective                           |
|                  | 18       |  |

## THIRD YEAR

### First Semester

| Number           | Credits  | Course                              |
|------------------|----------|-------------------------------------|
| <b>ECON</b>      | 3        | Elective in Economics               |
| <b>ECON</b>      | 3        | Elective in Economics               |
| <b>CIBI 3031</b> | 3        | Intro. to the Biological Sciences I |
| <b>ESPA 3</b>    | 3        | Course above level of Basic Spanish |
| <b>ELECTIVE</b>  | 3        | Recommended Elective                |
| <b>ELECTIVE</b>  | <u>3</u> | Free Elective                       |
|                  | 18       |                                     |

### Second Semester

| Number           | Credits  | Course                               |
|------------------|----------|--------------------------------------|
| <b>ECON 4017</b> | 3        | Econometrics                         |
| <b>ECON</b>      | 3        | Elective in Economics                |
| <b>CIBI 3032</b> | 3        | Intro. to the Biological Sciences II |
| <b>ESPA 3</b>    | 3        | Course above level of Basic Spanish  |
| <b>ELECTIVE</b>  | 3        | Recommended Elective                 |
| <b>ELECTIVE</b>  | <u>3</u> | Free Elective                        |
|                  | 18       |                                      |

## FOURTH YEAR

### First Semester

| Number                            | Credits  | Course                                    |
|-----------------------------------|----------|---|
| <b>ECON 4391</b>                  | 3        | Research Methods in Economics I           |
| <b>+Course in Social Sciences</b> | 3        | Course in Social Sciences                 |
| <b>CIFI, QUIM, GEOL</b>           | 3        | Elective in Physics, Chemistry or Geology |
| <b>ELECTIVE</b>                   | 3        | Recommended Elective                      |
| <b>ELECTIVE</b>                   | <u>3</u> | Free Elective                             |
|                                   | 15       |   |

### Second Semester

| Number                            | Credits | Course                           |
|-----------------------------------|---------|----------------------------------|
| <b>ECON 4392</b>                  | 3       | Research Methods in Economics II |
| <b>+Course in Social Sciences</b> | 3       | Course in Social Sciences        |

|                         |          |   |
|-------------------------|----------|---|
| <b>CIFI, QUIM, GEOL</b> | 3        | Elective in Physics, Chemistry or Geology |
| <b>ELECTIVE</b>         | 3        | Recommended Elective                      |
| <b>ELECTIVE</b>         | <u>3</u> | Free Elective                             |
|                         | 15       |   |

### Total credits required: 134

\*Refer to the Academic Standards section for information on Advanced Placement and Placement in First Level Courses.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

+Choose any of the following courses: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI 3261-3262, SOCI 3315, ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

## MINOR CONCENTRATION IN ECONOMICS

The Minor in Economics is an opportunity for undergraduate students to acquire and develop skills and knowledge in areas related to economic analysis. The minor will study the two economic dimensions, the microeconomic and the macroeconomic, diverse applications of economic analysis in various contexts, the economic principles used in the development, planning and evaluation of economic policy, the principles of sustainable economics, and the analysis of the viability of projects.

### Learning Goals:

The objectives of this Minor Concentration are defined taking into account the characteristics and evolution of socio-economic activity in a context of rapid transformation and demands of quality, competitiveness and sustainability and a growing internationalization. After completing this minor, students must be capable of:

- Recognize the two economic dimensions: the macroeconomic and the microeconomic. Both dimensions are related to decisions of the agents involved in economic activities: the consumers of goods and services (the demand side), the companies in the productive sector (the supply side) and the relationship and interactions between supply and demand and the structure of markets.
- Applying the method of economic analysis to address the essential aspects that affect the economic reality.

- Understanding economic principles and identifying its various dimensions, so that it gets the ability to develop, plan, and evaluate economic policies, enabling the efficient use of resources, in accordance with the principles of economic sustainability.
- Analyze the viability of projects that propose the development of competitive advantage.

#### Requirements:

- Be an active student in Arts and Sciences, Engineering or Agriculture Sciences Faculty.
- Minimum grade point average of 2.50.
- Having passed with a minimum grade of “C” the following courses: ECON 3021 and ECON 3022.
- Once accepted to the Minor, students must pass two required courses and nine (9) credits with a minimum grade of “C” on each course.
- Interview and a favorable recommendation with the Minor Coordinator or Director of the Department of Economics.
- The Minor Concentration will be granted once the student fulfill all UPRM graduation requirements.

#### REQUIRED COURSES

|                       |   |
|-----------------------|---|
| <b>ECON 3091</b>      |   |
| Micro Economic Theory | 3 |
| <b>ECON 3092</b>      |   |
| Macro Economic Theory | 3 |

#### ELECTIVE COURSES\* (9 credits)

|   |   |
|---|---|
| <b>ECON 3085</b>                                  |   |
| Economic and Social Development of Puerto Rico    | 3 |
| <b>ECON 3086</b>                                  |   |
| Contemporary Problems of the Puerto Rican Economy | 3 |
| <b>ECON 3095</b>                                  |   |
| Securities Markets                                | 3 |
| <b>ECON 4006</b>                                  |   |
| Business Cycles                                   | 3 |
| <b>ECON 4007</b>                                  |   |
| Quantitative Methods in Economics                 | 3 |
| <b>ECON 4008</b>                                  |   |
| Uncertainty Economics                             | 3 |
| <b>ECON 4009</b>                                  |   |
| Economics of Regulation and Antitrust             | 3 |
| <b>ECON 4015</b>                                  |   |
| Economic Development                              | 3 |
| <b>ECON 4016</b>                                  |   |
| Managerial Economics                              | 3 |
| <b>ECON 4018</b>                                  |   |
| Economics of the Public Sector                    | 3 |

|   |     |
|---|-----|
| <b>ECON 4025</b>                                  |     |
| Money and Banking                                 | 3   |
| <b>ECON 4027</b>                                  |     |
| Transportation Economics                          | 3   |
| <b>ECON 4028</b>                                  |     |
| Economics of Natural Resources                    | 3   |
| <b>ECON 4037</b>                                  |     |
| Urban Economics                                   | 3   |
| <b>ECON 4038</b>                                  |     |
| Ecological Economics                              | 3   |
| <b>ECON 4045</b>                                  |     |
| Comparative Economic Systems                      | 3   |
| <b>ECON 4046</b>                                  |     |
| Input-Output Analysis                             | 3   |
| <b>ECON 4047</b>                                  |     |
| Economics of Electronic Commerce and the Internet | 3   |
| <b>ECON 4055</b>                                  |     |
| History of Economic Thought                       | 3   |
| <b>ECON 4056</b>                                  |     |
| Environmental Economics                           | 3   |
| <b>ECON 4068</b>                                  |     |
| Economics of Tourism                              | 3   |
| <b>ECON 4085</b>                                  |     |
| International Economics                           | 3   |
| <b>ECON 4185</b>                                  |     |
| Economic Problems of Latin America                | 3   |
| <b>ECON 4196</b>                                  |     |
| Economics of Industrial Organization              | 3   |
| <b>ECON 4225</b>                                  |     |
| Labor Economics                                   | 3   |
| <b>ECON 4307</b>                                  |     |
| Project Evaluation                                | 3   |
| <b>ECON 4316</b>                                  |     |
| Strategic Prospective and Scenario Building       | 3   |
| <b>ECON 4425</b>                                  |     |
| Special Topics                                    | 1-3 |
| <b>ECON 4995</b>                                  |     |
| Special Problems                                  | 3   |

**\*Important Note:** Business Administration students may select any of the above elective courses with the exception of the ECON 3085 course which is a requirement in their concentration.

#### RECOMMENDED ELECTIVES (For the Bachelor of Arts in Economics)

##### AGRICULTURAL SCIENCES:

|                         |   |
|-------------------------|---|
| <b>AGRO 5005</b>        |   |
| Biometry                | 3 |
| <b>ECAG 3015</b>        |   |
| Agricultural Law        | 3 |
| <b>ECAG 4009</b>        |   |
| Cooperative Enterprises | 3 |
| <b>ECAG 4028</b>        |   |
| Agricultural Finance    | 3 |
| <b>ECAG 4029</b>        |   |
| Agribusiness Management | 3 |

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**BUSINESS ADMINISTRATION:****ADMI 3007**

Introduction to Computer Data Processing 3

**ADMI 3009**

Introduction to Business Management and Ethics 4

**ADMI 3010**

Computer Competence for Managerial Decision Making 2

**ADMI 3015**

Introduction to International Business 3

**ADMI 3017**

Introduction to Enterprise Development 2

**ADMI 3100**

New Business Development 3

**ADMI 3150**

Business Plan Development 3

**ADMI 3155**

Creativity and Entrepreneurial Innovation 3

**ADMI 4001**

Business Law I 3

**ADMI 4002**

Business Law 3

**ADMI 4016**

Environment of Organizations 3

**ADMI 4085**

Fundamentals of Project Management 3

**ADOF 3016**

Keyboarding and Its Applications I 3

**CONT 3005**

Elementary Accounting I 4

**CONT 3006**

Elementary Accounting II 4

**CONT 3007**

Intermediate Accounting I 4

**CONT 3008**

Intermediate Accounting II 4

**CONT 3011**

Financial Accounting Principles I 3

**CONT 3012**

Financial Accounting Principles I 3

**CONT 4006**

Managerial Accounting 3

**CONT 4007**

Federal Income Tax 3

**CONT 4009**

Income Tax of Puerto Rico 3

**CONT 4015**

Advanced Accounting Problems 4

**CONT 4016**

Recent Developments in Accounting 3

**CONT 4018**

Intermediated Accounting I 3

**CONT 4019**

Intermediated Accounting II 3

**CONT 4027**

Analysis and Cost Control 3

**CONT 4035**

Cost Accounting 4

**CONT 4037**

Accounting Information 3

**CONT 4045**

Advanced Accounting I 3

**CONT 4046**

Accounting for Governmental Entities and not for Profit Organizations 3

**CONT 4048**

Advanced Accounting II 3

**CONT 4078**

Cost Accounting 3

**CONT 5006**

Tax Liabilities for Business in Puerto Rico 3

**ESOR 4005**

Government Control of Business 3

**ESOR 4006**

Principles of Management 3

**ESOR or GERH 4007**

Organizational Design 3

**ESOR or GERH 4008**

Human Resources Management 3

**ESOR or GERH 4015**

Workforce Planning and Employment 3

**ESOR or GERH 4019**

Compensation Management 3

**ESOR or GERH 4025**

Organizational Behavior 3

**FINA 3005**

Principles of Insurance 3

**FINA 3006**

Business Finance 3

**FINA 3008**

Working Capital Management 3

**FINA 3015**

Mathematics of Finance 3

**FINA 3016**

Business Analysis using Financial Reports 3

**FINA 4028**

International Finance 3

**FINA 4036**

Administration of Financial Institutions 3

**FINA 4037**

Investments 3

**GERE 4007**

Operations Management 3

**GERE 4008**

Quantitative Methods in Operations Management 3

**GERE 4009**

Production Planning and Control 3

**GERE 4085**

Project Management Applications in Business 3

**MERC 3115**

Principles of Marketing 3

**MERC 4065**

Global Marketing Strategies 3

**MERC 4075**

Marketing Research 3

**MERC 4217**

Consumer Behavior 3

**SICI 3018**

Fundamentals of Information Systems 3

**SICI 3029**

Programming Fundamentals for Business 3

**SICI 4046**

Information Systems Analysis and Designs 3

|   |     |
|---|-----|
| <b>SICI 4095</b>                                  |     |
| Database Development                              | 3   |
| <b>ECONOMICS:</b>                                 |     |
| <b>ECON 3086</b>                                  |     |
| Contemporary Problems of the Puerto Rican Economy | 3   |
| <b>ECON 3095</b>                                  |     |
| Securities Markets                                | 3   |
| <b>ECON 4006</b>                                  |     |
| Business Cycles                                   | 3   |
| <b>ECON 4007</b>                                  |     |
| Quantitative Methods in Economics                 | 3   |
| <b>ECON 4008</b>                                  |     |
| Uncertainty Economics                             | 3   |
| <b>ECON 4009</b>                                  |     |
| Economics of Regulation and Antitrust             | 3   |
| <b>ECON 4015</b>                                  |     |
| Economic Development                              | 3   |
| <b>ECON 4016</b>                                  |     |
| Managerial Economics                              | 3   |
| <b>ECON 4018</b>                                  |     |
| Economics of the Public Sector                    | 3   |
| <b>ECON 4025</b>                                  |     |
| Money and Banking                                 | 3   |
| <b>ECON 4027</b>                                  |     |
| Transportation Economics                          | 3   |
| <b>ECON 4028</b>                                  |     |
| Economics of Natural Resources                    | 3   |
| <b>ECON 4037</b>                                  |     |
| Urban Economics                                   | 3   |
| <b>ECON 4038</b>                                  |     |
| Ecological Economics                              | 3   |
| <b>ECON 4045</b>                                  |     |
| Comparative Economic Systems                      | 3   |
| <b>ECON 4046</b>                                  |     |
| Input-Output Analysis                             | 3   |
| <b>ECON 4047</b>                                  |     |
| Economics of Electronic Commerce and the Internet | 3   |
| <b>ECON 4056</b>                                  |     |
| Environmental Economics                           | 3   |
| <b>ECON 4068</b>                                  |     |
| Economics of Tourism                              | 3   |
| <b>ECON 4085</b>                                  |     |
| International Economics                           | 3   |
| <b>ECON 4185</b>                                  |     |
| Economic Problems of Latin America                | 3   |
| <b>ECON 4196</b>                                  |     |
| Economics of Industrial Organization              | 3   |
| <b>ECON 4225</b>                                  |     |
| Labor Economics                                   | 3   |
| <b>ECON 4316</b>                                  |     |
| Strategic Prospective and Scenario Building       | 3   |
| <b>ECON 4425</b>                                  |     |
| Special Topics                                    | 1-3 |
| <b>ECON 4995</b>                                  |     |
| Special Problems                                  | 1-3 |

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| <b>ENGLISH:</b>                                    |     |
| <b>INGL 3231</b>                                   |     |
| English Expository Writing                         | 3   |
| <b>INGL 3236</b>                                   |     |
| Technical Communication                            | 3   |
| <b>INGL 3238</b>                                   |     |
| Creative Writing                                   | 3   |
| <b>INGL 3250</b>                                   |     |
| Public Speaking                                    | 3   |
| <b>INGL 3268</b>                                   |     |
| Writing for the Communications Media               | 3   |
| <b>HISPANIC STUDIES:</b>                           |     |
| <b>ESPA 3216</b>                                   |     |
| Formal Expositive Writing                          | 3   |
| <b>ESPA 3215</b>                                   |     |
| Expression and Communication                       | 3   |
| <b>ESPA 3295</b>                                   |     |
| Spanish Grammar                                    | 3   |
| <b>HUMANITIES:</b>                                 |     |
| <b>FILO 3001</b>                                   |     |
| Introduction to Philosophy: Major Questions        | 3   |
| <b>FILO 3002</b>                                   |     |
| Introduction to Philosophy: Historical Approach    | 3   |
| <b>FILO 3155</b>                                   |     |
| Introduction to Ethics                             | 3   |
| <b>FILO 3156</b>                                   |     |
| Modern and Contemporary Ethics                     | 3   |
| <b>FILO 3157</b>                                   |     |
| Introduction to Logic                              | 3   |
| <b>FILO 3178</b>                                   |     |
| Business Ethics                                    | 3   |
| <b>INTERDISCIPLINARY COURSES:</b>                  |     |
| <b>INTD 3995</b>                                   |     |
| Experience in Community Development                | 1-6 |
| <b>INTD 4000</b>                                   |     |
| Congressional Internship Cordova Program           | 1-6 |
| <b>INTD 4010</b>                                   |     |
| Academic Seminar Washington Center                 | 1-6 |
| <b>INTD 4995</b>                                   |     |
| Institutional Coop Plan                            | 1-6 |
| <b>INGE 4008</b>                                   |     |
| Interdisciplinary Approaches to Project Management | 3   |
| <b>MATHEMATICS:</b>                                |     |
| <b>COMP 3010</b>                                   |     |
| Introduction to Computer Programming I             | 3   |
| <b>MATE 3031</b>                                   |     |
| Calculus I   | 4   |
| <b>MATE 3032</b>                                   |     |
| Calculus II  | 4   |
| <b>MATE 3047</b>                                   |     |
| Introductory Probability                           | 3   |
| <b>MATE 3063</b>                                   |     |
| Calculus III                                       | 3   |
| <b>MATE 3172</b>                                   |     |
| Precalculus II                                     | 3   |
| <b>MATE 4009</b>                                   |     |
| Ordinary Differential Equations                    | 3   |



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| <b>MATE 4031</b>                              |   |                   |  |
| Introduction to Linear Algebra                | 3 | <b>HIST 3201</b>  | History of the Modern World I 3                    |
| <b>MATE 4997</b>                              |   | <b>HIST 3211</b>  | History of Latin America 3                         |
| Special Topics in Mathematics                 | 3 | <b>HIST 3212</b>  | History of Latin America 3                         |
| <b>ESMA 3016</b>                              |   | <b>HIST 3241</b>  | History of Puerto Rico 3                           |
| Statistical Data Analysis                     | 3 | <b>HIST 3242</b>  | History of Puerto Rico 3                           |
| <b>ESMA 4001</b>                              |   | <b>HIST 4111</b>  | Social History of the United States of America 3   |
| Mathematical Statistics I                     | 3 | <b>HIST 4112</b>  | Social History of the United States of America 3   |
| <b>ESMA 4002</b>                              |   | <b>HIST 4117</b>  | History of Labor in the United States of America 3 |
| Mathematical Statistics II                    | 3 | <b>HIST 4345</b>  | Twentieth Century Puerto Rican History 3           |
| <b>ESMA 4005</b>                              |   | <b>SOCI 3261</b>  | Introduction to Sociology I 3                      |
| Non-Parametric Applied Statistics             | 3 | <b>SOCI 3262</b>  | Introduction to Sociology II 3                     |
| <b>ESMA 4038</b>                              |   | <b>SOCI 3305</b>  | Principles of Population 3                         |
| Sampling Methods                              | 3 | <b>SOCI 4145</b>  | Social Planning 3                                  |
| <b>ESMA 5015</b>                              |   | <b>SOCI 4165</b>  | Social Problems in the Contemporary World 3        |
| Stochastic Simulation                         | 3 | <b>SOCI 5005</b>  | Sociology in Latin America 3                       |
| <b>SOCIAL SCIENCES:</b>                       |   | <b>PSYCHOLOGY</b> |  |
| <b>CIPO 3011</b>                              |   | <b>PSIC 3001</b>  | Principles of Psychology I 3                       |
| Principles and Problems of Political Science  | 3 | <b>PSIC 3002</b>  | Principles of Psychology II 3                      |
| <b>CIPO 3025</b>                              |   | <b>PSIC 3015</b>  | Theories of Personality 3                          |
| Political System of the United States         | 3 | <b>PSIC 3028</b>  | Psychology of Adulthood 3                          |
| <b>CIPO 3035</b>                              |   |                   |  |
| Government of Puerto Rico                     | 3 |                   |  |
| <b>CIPO 3045</b>                              |   |                   |  |
| International Organization and Administration | 3 |                   |  |
| <b>CIPO 3065</b>                              |   |                   |  |
| International Relations                       | 3 |                   |  |
| <b>CIPO 3155</b>                              |   |                   |  |
| International Relations                       | 3 |                   |  |
| <b>CIPO 3175</b>                              |   |                   |  |
| Introduction to Law                           | 3 |                   |  |
| <b>CIPO 4005</b>                              |   |                   |  |
| Constitutional Law                            | 3 |                   |  |
| <b>CIPO 4015</b>                              |   |                   |  |
| Comparative Government and Politics           | 3 |                   |  |
| <b>CIPO 4016</b>                              |   |                   |  |
| Government and Politics of the Middle East    | 3 |                   |  |
| <b>CIPO 4045</b>                              |   |                   |  |
| Elements of Public Administration             | 3 |                   |  |
| <b>CIPO 4065</b>                              |   |                   |  |
| International Law                             | 3 |                   |  |
| <b>CIPO 4075</b>                              |   |                   |  |
| The Politics of the Developing Areas          | 3 |                   |  |
| <b>CIPO 4115</b>                              |   |                   |  |
| Latin American International Relations        | 3 |                   |  |
| <b>CIPO 4127</b>                              |   |                   |  |
| Globalization and World Politics              | 3 |                   |  |
| <b>CIPO 4735</b>                              |   |                   |  |
| United Nations Model                          | 5 |                   |  |
| <b>GEOG 3155</b>                              |   |                   |  |
| Human Geography                               | 3 |                   |  |
| <b>HIST 3111</b>                              |   |                   |  |
| History of the United States of America       | 3 |                   |  |
| <b>HIST 3112</b>                              |   |                   |  |
| History of the United States of America       | 3 |                   |  |
| <b>HIST 3121-3122</b>                         |   |                   |  |
| History of the Foreign Policy of the          |   |                   |  |
| United States of America                      | 3 |                   |  |
| <b>HIST 3141</b>                              |   |                   |  |
| History of Spain I                            | 3 |                   |  |

#### DEPARTMENTAL FACULTY

**JOSÉ I. ALAMEDA-LOZADA**, *Professor*, Ph.D., 1996, University of Wales at Aberystwyth, United Kingdom.

**OLBEN DELGADO-MÉNDEZ**, *Professor*, Ph.D., 1996, New York University.

**CARLOS A. DEL VALLE-GONZALEZ**, *Assistance Professor*, Ph.D., 2011, University of Colorado – Denver.

**IVONNE DEL C. DÍAZ-RODRÍGUEZ**, *Professor*, Ph.D., 2000, Ohio State University.

**EDUARDO KICINSKI-MARTÍN**, *Professor*, Ph.D., 1990, University of Wisconsin – Madison.

**ORLANDO SOTOMAYOR-RODRÍGUEZ**, *Professor*, Ph.D., 1994, Cornell University.

**JEFFRY VALENTÍN-MARI**, *Professor*, Ph.D., 1999, University of Wisconsin – Milwaukee.

## COURSES OF INSTRUCTION DEPARTMENT OF ECONOMICS

### Undergraduate Courses

**ECON 3021. PRINCIPLES OF ECONOMICS: MICROECONOMICS.** Three credit hours. Three hours of lecture per week.

Introduction to microeconomics emphasizing supply and demand, costs of production, and price and output determination under different market structures.

**ECON 3022. PRINCIPLES OF ECONOMY: MACROECONOMICS.** Three credit hours. Three hours of lecture per week.

Introduction to macroeconomics, emphasizing social accounting, equilibrium, income and output determination, unemployment, inflation, the financial system, and economic policy.

**ECON 3085. ECONOMIC AND SOCIAL DEVELOPMENT OF PUERTO RICO.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

The evolution of the economic system of Puerto Rico; an analysis of its history, structural development, and fundamental problems.

**ECON 3086. CONTEMPORARY PROBLEMS OF THE PUERTO RICAN ECONOMY.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3085.

Analysis of the contemporary Puerto Rican economy and its problems.

**ECON 3091. MICRO-ECONOMIC THEORY.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021.

A study of modern micro-economic theory; an analysis of price determination under different market structures.

**ECON 3092. MACRO-ECONOMIC THEORY.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3022.

In this course, an analysis is made of the economic determinants of the level, change and growth of production and employment. Special emphasis is given to modern theories and their policy implications.

**ECON 3095. SECURITIES MARKETS.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Nature and function of operations, and regulation of the securities' markets.

**ECON 4006. BUSINESS CYCLES.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Economic factors that affect fluctuations in income, production, employment, and prices; theories that explain this phenomenon; counter-cyclical policy.

**ECON 4007. QUANTITATIVE METHODS IN ECONOMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022 and (MATE 3101 or ESMA 3101).

Application of the concepts and techniques of quantitative analysis to the field of economics; quantitative aspects of demand-supply analysis, production functions, design of economic models, and other topics.

**ECON 4008. UNCERTAINTY ECONOMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Game theory and its economic applications; decision-making under uncertainty with emphasis on its effects on the insurance market, the labor market, investment, the strategic behavior of firms in an oligopoly, and auctions.

**ECON 4009. ECONOMICS OF REGULATION AND ANTITRUST.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021.

Applications of economic theory and analysis to understand the rationale for and consequences of governmental regulation and antitrust policies that directly affect the market power of firms and industries. Discussion of the main antitrust statutes and public policy in the areas of social and economic regulation and deregulation of different industries.

**ECON 4015. ECONOMIC DEVELOPMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

A study of the common characteristics of underdeveloped countries, with emphasis on the economic theories explaining the factors that determine economic development; an examination of economic policies designed to foster development.

**ECON 4016. MANAGERIAL ECONOMICS.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3091.

Economic techniques necessary for directing and operating business enterprises including mathematical programming, marginal economic analysis, capital budgeting, and evaluation of potential investments under conditions of risk.

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**ECON 4017. ECONOMETRICS.** Three credit hours. Three hours of lecture per week. Pre-requisites: ECON 3091 and ECON 3092. Co-requisites: ESMA 3102 or ESMA 4002 or ESTA 3002 or INCI 4136 or ININ 4020.

Analysis applied to economic questions: model building, hypothesis testing, estimation techniques, and data problems.

**ECON 4018. ECONOMICS OF THE PUBLIC SECTOR.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021.

Analysis of the role of government in a market economy and the effects of government policies on resource allocation and income distribution. Analysis of the economic basis of government activities through discussion of issues such as efficiency, market failure, externalities, public goods, public choice, and political process. Application of economic theory to public expenditures programs referring to social policy issues.

**ECON 4025. MONEY AND BANKING.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

The origin and development of money and banking with emphasis on the functions of the monetary and banking systems, central banking, especially the Federal Reserve System, domestic and international monetary institutions, and the present banking laws in Puerto Rico.

**ECON 4027. TRANSPORTATION ECONOMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Analysis of the economic structure of the transportation system and its significance in competition, monopoly, and economic organization.

**ECON 4028. ECONOMICS OF NATURAL RESOURCES.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Economic analysis of natural resources: their valuation, conservation, and sustainable development.

**ECON 4037. URBAN ECONOMICS.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021.

Urban issues in a microeconomic framework with emphasis on Puerto Rico. Topics include market forces and the development of cities, urban land-use patterns, transportation, and poverty.

**ECON 4038. ECOLOGICAL ECONOMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Study of the principles, problems, and applications of ecological economics. Discussion of the interrelationship

between the economic and ecological systems, environmental services, economic growth, and sustainable development, among other topics. Examination and formulation of possible courses of action that help to reestablish the balance between the economic, social, and ecological systems.

**ECON 4045. COMPARATIVE ECONOMIC SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

A comparative study of the different economic systems such as capitalism, socialism, communism and fascism. Emphasis is placed on the different methods used by each system to solve the fundamental economic problems.

**ECON 4046. INPUT-OUTPUT ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021, ECON 3022 and MATE 3000.

Theoretical foundations, methods, techniques, and applications of economic analysis using the Input-Output model.

**ECON 4047. ECONOMICS OF ELECTRONIC COMMERCE AND THE INTERNET.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021.

Application of economic principles and models to understand the growth and future of electronic commerce and the Internet. Discussion and analysis of market structure, competitive strategies, regulation, and applications.

**ECON 4055. HISTORY OF ECONOMIC THOUGHT.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

The course studies the beginning and growth of Economics as a scientific study, and shows the relationship between economic beliefs, historical circumstances and the life of the thinker. The different economic schools of thought, up to and including the more recent economic ideas are considered.

**ECON 4056. ENVIRONMENTAL ECONOMICS.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021.

Impact of economic development and population growth on environmental quality; the economic analysis of pollution; the role of government in environmental deterioration; and the international environmental issues.

**ECON 4065. ECONOMICS OF THE PUBLIC SECTOR AND FISCAL POLICY.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Analysis of government income and expenditures and the impact of fiscal policy on output, employment, prices, and other economic variables.

**ECON 4068. ECONOMICS OF TOURISM.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Application of economic principles and techniques in order to understand the complexities of the tourism industry. Discussion of the factors that determine demand and supply in tourism, the costs and benefits of tourism projects, as well as the industrial interaction of airlines, cruises, lodging and other intermediary sectors. Study of aggregate measurement of tourism and the determinants that sustain the competitiveness of the destination such as the role of the government, exchange rate fluctuations, the importance of foreign direct investment and the protection of the environment, among others.

**ECON 4085. INTERNATIONAL ECONOMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

A study of the fundamental aspects of international economic theory; an examination of the current international economic framework and tendency towards economic integration; a brief analysis of the aspects and problems of the international monetary system.

**ECON 4185. ECONOMIC PROBLEMS OF LATIN AMERICA.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Economic problems of Latin America; critical evaluation of the institutions and economic factors that retard or foster their solution; the role of the State in promoting economic development.

**ECON 4196. ECONOMICS OF INDUSTRIAL ORGANIZATION.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Conduct, performance and use of price theory in the determination of industrial structure. Economic aspects of market structure, mergers and innovations, models of economic behavior, and the role of advertising.

**ECON 4225. LABOR ECONOMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Theory of labor market behavior and its applications to public policy. Topics include labor supply and demand, human capital theory, migration, unemployment, unions, and discrimination.

**ECON 4307. PROJECT EVALUATION.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

Evaluation of public investment projects emphasizing cost-benefit analysis and its application.

**ECON 4316. STRATEGIC PROSPECTIVE AND SCENARIO BUILDING.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021- Principles of Economy: Microeconomics and ECON 3022- Principles of Economy: Macroeconomics.

Description of conceptual, theoretical and methodological principles of prospective strategy and scenario building. Explanation of the method's historical development, schools of thought and their proponents. Analysis of case studies in the public and private spheres and the application of the method of scenario building with emphasis on Puerto Rico.

**ECON 4391. RESEARCH METHODS IN ECONOMICS I.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 4017.

Discussion of the research process in the study of economic problems with emphasis on the scientific approach, research design, measurement concepts and analytical approaches. A research proposal is required.

**ECON 4392. RESEARCH METHODS IN ECONOMICS II.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 4391.

Development and presentation of a research project in a field of economics.

**ECON 4405. ANALYSIS OF CONTEMPORARY ECONOMIC PROBLEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3091 and ECON 3092 and (MATE 3102 or ESMA 3102).

A study of the fundamental economic problems of our time, such as production, employment, trade, consumption, inflation, and others.

**ECON 4425. SPECIAL TOPICS.** One to three credit hours. One to three hours of lecture or seminar per week. Prerequisite: authorization of the Director of the Department.

Authors, topics, and trends in the field of economics.

**ECON 4995. SPECIAL PROBLEMS.** One to three credit hours. Three to nine hours of research per week. Prerequisite: authorization of the Director of the Department.

Research under the supervision of a professor of the Department.

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## DEPARTMENT OF ENGLISH

The Department of English provides various courses of instruction for all students attending the Mayagüez Campus.

### Vision

The **Department of English** focuses its efforts and initiatives equally in three fundamental areas: instruction, research and creative work, and service to the university community.

### Mission

The **Department of English**, which exists in an academic environment where English is a Second Language, addresses the needs of all students who enter the UPR-Mayagüez. It directs its efforts towards the development of educated, responsible, and cultured citizens and professionals in all areas with focus in fields related to English Studies, primarily those involved with the study of Linguistics, Literature, Writing and Communication, English Education, and English as a Second Language. Graduates of department programs will be qualified to contribute in an effective manner to the social, cultural, and economic development of Puerto Rico and the world at large.

### DEFINITION OF GENERAL EDUCATION FOR THE DEPARTMENT OF ENGLISH

The inclusion of English courses as part of General Education in every degree program reflects UPRM deep conviction that successful, satisfying lives require a wide range of skills and knowledge. These skills include the ability to communicate effectively. General Education, in essence, augments and rounds out the specialized education students receive in their majors and aims to cultivate a knowledgeable, informed, literate human being.

### GENERAL EDUCATION STUDENT LEARNING OUTCOMES

To teach, develop, and improve in our students:

- Communication skills in reading, writing, listening, and speaking

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<sup>1</sup> Test scores used for placement are reviewed by the Department of English on a regular basis. These numbers may vary slightly becoming either higher or lower over a given set of years.

- Critical reading, writing, thinking
- Analysis, interpretation, and evaluation of sources
- Problem-solving strategies/abilities
- Research skills
- Creative work

### ENGLISH COURSES THAT FULFILL GENERAL EDUCATION REQUIREMENTS

With regard to the general requirements in English, three separate 12 credit-hour sequences exist within the Department of English.

A. **The Basic Sequence:** INGL 3101, 3102, 3201, and one of the following courses: 3202/3209/3289.

B. **The Intermediate Sequence:** INGL 3103, 3104 and six additional credit-hours in Department of English courses to be chosen from an approved list of courses provided by the Department of English.

C. **The Honors Sequence:** Six credit-hours are granted to students by means of The Advanced Placement Examination. Students must then take INGL 3211 and 3212 to complete their requirements. Note that although these two courses carry 3000-level numbers, they are actually second year courses.

Academic Senate Certification 88-24 stipulates that ONLY a score of 4 or 5 on the Advanced Placement Examination may be used to place entering first year students directly into second year courses by granting them six credit-hours of advanced placement.

Note: Students who start in one sequence **CANNOT** take courses in one of the other sequences to satisfy the university's English requirement. For example, students in the Intermediate Sequence (INGL 3103-3104) may not take either INGL 3201-3202 or INGL 3211-3212 to satisfy their second year requirement.

The basic sequence is for students who score below 570<sup>1</sup> on the ESLAT (English as a Second Language Achievement Test). They will be placed in the basic sequence of courses: INGL 3101-3102, and INGL 3201, INGL 3202 or INGL 3209 or INGL 3289.

The intermediate sequence of courses, starting with INGL 3103 and INGL 3104, is for entering students at UPR/Mayagüez who have scored above 570\*\* on the ESLAT (English as a Second Language Achievement Test), but who have either not taken the Advanced Placement Examination in English or scored a 3. Students with a score of 3 on the Advanced Placement Examination will be placed in INGL 3103. Students who successfully pass INGL 3103 and INGL 3104 must take six more credit-hours in Department of English courses in order to satisfy the university requirement in English.

The Department of English also offers additional course work in the areas of conversational English, public speaking, advanced composition, creative writing, technical writing, literature, and linguistics. All students have an opportunity to take additional courses in English to meet their particular needs.

The Honors Program of the Department of English is obtained through a score of 4 or 5 on the Advanced Placement Examination in English. For those students who desire to major in English, the department offers a two-track program leading to the degree of **Bachelor of Arts** in English. All students are required to take a common core of courses which includes: "Introduction to Linguistics," "Phonetics," "Survey of English Literature" (two semesters), "Survey of American Literature" (two semesters), and "English Expository Writing." Beyond these required core courses, students choose to emphasize coursework in the area of literature or linguistics.

The Department of English also works with other Departments of the University to offer students an opportunity to receive certificates in Education, Film, and Office Management.

The Department of English offers a graduate program leading to the degree of **Master of Arts** in English Education (M.A.E.E.). This program is grounded in the areas of linguistics, literature, and pedagogy. Although students may ultimately concentrate in one of these areas, they are required to take designated courses from each area. The program is designed for classroom teachers at all levels of instruction. Please refer to the latest Graduate Catalogue for additional information.

## Program Educational Objectives

- To award the degree of B.A. in English with a specialization in Linguistics and/or Literature.
- To award a degree of M.A. in English Education.
- To teach communication skills in listening, speaking, reading and writing at all levels from basic to graduate.
- To encourage a socio-humanistic outlook.
- To strengthen research skills and to foster a positive attitude towards research that will provide useful information for studies in English.
- To promote expertise in skills involving analysis, interpretation, and evaluation.
- To provide a foundation for advanced study in the broad disciplines of English studies.

## Student Learning Outcomes of the Department of English

To teach, develop, and improve in our students:

- Communication skills in reading, writing, listening, and speaking
- Critical reading, writing, thinking
- Analysis, interpretation, and evaluation of sources
- Problem-solving strategies/abilities
- Research skills
- Creative work
- Honesty and ethics, including awareness of plagiarism
- Awareness of the role English plays in academics and professions

A good foundation for advanced studies/success in professions.

## BACHELOR OF ARTS IN ENGLISH

### Summary of Credits in Program

|                           |            |
|---------------------------|------------|
| Faculty requirements      | 56         |
| Departmental requirements |            |
| Track courses             | 33         |
| Core courses              | 21         |
| Recommended electives     | 12         |
| Free electives            | <u>12</u>  |
| <b>Total</b>              | <b>134</b> |

| PROGRAM OF STUDY                        |          |   |
|---|----------|---|
| ENGLISH CURRICULUM                      |          |   |
| <b>FIRST YEAR</b>                       |          |   |
| <b>First Semester</b>                   |          |   |
| Number                                  | Credits  | Course  |
| *INGL 3---                              | 3        | First year course in English                    |
| *ESPA 3101                              | 3        | Basic course in Spanish I                       |
| HUMA 3111                               | 3        | Intro. to Western Culture I                     |
| *MATE 3086                              | 3        | Mathematical Reasoning                          |
| or                                      |          |   |
| MATE 3171                               | 3        | Pre-Calculus I                                  |
| EDFI ----                               | 1        | Course in Physical Education                    |
| ELECTIVE                                | <u>3</u> | Free Elective                                   |
|   | 16       |   |
| <b>Second Semester</b>                  |          |   |
| Number                                  | Credits  | Course  |
| *INGL 3---                              | 3        | First year course in English                    |
| *ESPA 3102                              | 3        | Basic course in Spanish II                      |
| HUMA 3112                               | 3        | Intro. to Western Culture II                    |
| MATE 3---                               | 3        | **Recommended course in Mathematics             |
| EDFI ----                               | 1        | Course in Physical Education                    |
| ELECTIVE                                | <u>3</u> | Free Elective                                   |
|   | 16       |   |
| <b>SECOND YEAR</b>                      |          |   |
| <b>First Semester</b>                   |          |   |
| Number                                  | Credits  | Course  |
| INGL 3---                               | 3        | Second year course in English                   |
| INGL 3225                               | 3        | Intro. to Linguistics                           |
| ESPA 3---                               | 3        | Course above the level of basic Spanish         |
| +Course in Social Sciences or Economics | 3        | Elective course in Social Sciences or Economics |
| CIBI 3031                               | 3        | Intro. to the Biological Sciences I             |
| ELECTIVE                                | <u>3</u> | Free Elective                                   |
|   | 18       |   |
| <b>Second Semester</b>                  |          |   |
| Number                                  | Credits  | Course  |
| INGL 3---                               | 3        | Second year course in English                   |
| INGL 3227                               | 3        | Phonetics of English                            |

|   |          |   |
|---|----------|---|
| ESPA 3---                               | 3        | Course above the level of basic Spanish |
| +Course in Social Sciences or Economics | 3        | See note below                          |
| CIBI 3032                               | 3        | Intro. to the Biological Sciences II    |
| ELECTIVE                                | <u>3</u> | Free Elective                           |
|   | 18       |   |

#### TRACK I: LITERATURE

#### THIRD YEAR

##### First Semester

| Number             | Credits  | Course                               |
|--------------------|----------|--------------------------------------|
| INGL 3351          | 3        | American Literature to 1860          |
| INGL 3321          | 3        | Survey of English Literature to 1660 |
| INGL 3231          | 3        | Expository Writing in English        |
| INGL 3---          | 3        | English Elective                     |
| FISI, QUIM or GEOL | 3        | Electives                            |
| ELECTIVE           | <u>3</u> | Recommended Electives                |
|                    | 18       |                                      |

##### Second Semester

| Number              | Credits  | Course  |
|---------------------|----------|---|
| INGL 3352           | 3        | American Lit. from 1860 to the Modern Period  |
| INGL 3322           | 3        | English Literature from 1798 to Modern Period |
| INGL 4025           | 3        | Shakespeare                                   |
| INGL 3---           | 3        | English Elective                              |
| -FISI, QUIM or GEOL | 3        | Electives                                     |
| ELECTIVE            | <u>3</u> | Recommended Electives                         |
|                     | 18       |   |

#### FOURTH YEAR

##### First Semester

| Number    | Credits  | Course                             |
|-----------|----------|------------------------------------|
| INGL 4030 | 3        | Research and Writing in Literature |
| INGL ---- | 9        | English Electives                  |
| ELECTIVE  | <u>3</u> | Recommended Electives              |
|           | 15       |                                    |

**Second Semester**

| Number           | Credits  | Course               |
|------------------|----------|----------------------|
| <b>INGL ----</b> | 12       | English Electives    |
| <b>ELECTIVE</b>  | <u>3</u> | Recommended Elective |
|                  | 15       |                      |

**Total credits required: 134****TRACK II: LINGUISTICS****THIRD YEAR****First Semester**

| Number            | Credits  | Course                         |
|-------------------|----------|--------------------------------|
| <b>INGL 3351</b>  | 3        | American Literature to 1860    |
| <b>INGL 3321</b>  | 3        | Survey of English Lit. to 1660 |
| <b>INGL 3231</b>  | 3        | Expository Writing in English  |
| <b>INGL 4206</b>  | 3        | The Structure of English       |
| <b>FISI, QUIM</b> |          |                                |
| or                |          |                                |
| <b>GEOL</b>       | 3        | Electives                      |
| <b>ELECTIVE</b>   | <u>3</u> | Recommended Elective           |
|                   | 18       |                                |

**Second Semester**

| Number            | Credits  | Course  |
|-------------------|----------|---|
| <b>INGL 3352</b>  | 3        | American Lit. from 1860 to the Modern Period  |
| <b>INGL 3322</b>  | 3        | English Literature from 1798 to Modern Period |
| <b>INGL 4075</b>  | 3        | Psycholinguistics                             |
| <b>INGL ----</b>  | 3        | English Electives                             |
| <b>FISI, QUIM</b> |          |   |
| or                |          |   |
| <b>GEOL</b>       | 3        | Electives                                     |
| <b>ELECTIVE</b>   | <u>3</u> | Recommended Elective                          |
|                   | 18       |   |

**FOURTH YEAR****First Semester**

| Number           | Credits  | Course  |
|------------------|----------|---|
| <b>INGL 4028</b> | 3        | Research and Writing in Lang. and Linguistics |
| <b>INGL ----</b> | 9        | English Electives                             |
| <b>ELECTIVE</b>  | <u>3</u> | Recommended                                   |
|                  | 15       |   |

**Second Semester**

| Number           | Credits  | Course                          |
|------------------|----------|---------------------------------|
| <b>INGL 4208</b> | 3        | History of the English Language |
| <b>INGL ----</b> | 9        | English Electives               |
| <b>ELECTIVE</b>  | <u>3</u> | Recommended                     |
|                  | 15       |                                 |

**Total credits required: 134**

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*Choose from the alternatives defined by the Department: MATE 3000, COMP 3057, ESMA 3015, MATE 3171, MATE 3172.

+Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI 3261-3262, SOCI 3315, or ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

**DEPARTMENTAL FACULTY**

**NANDITA BATRA**, *Professor*, Ph.D., 1987, University of Rochester-New York.

**RICIA A. CHANSKY**, *Professor*, Ph.D., 2009, Illinois State University.

**LAURENCE CHOTT**, *Assistant Professor*, Ph.D. 1985, Ball State University, Indiana.

**CATHERINE FLECK**, *Professor*, Ph.D., 2003, Michigan State University.

**JOCELYN A. GÉLIGA**, *Professor*, Ph.D., 1999, UMASS Amherst.

**GAYLE W. GRIGGS**, *Professor*, Ed.D., 2011, Nova Southeastern University.

**NICKOLAS A. HAYDOCK**, *Professor*, Ph.D., 1994, University of Iowa.

**JOSÉ M. IRIZARRY-RODRÍGUEZ**, *Professor*, Ph.D., 1999, Indiana University of Pennsylvania.

**ERIC D. LAMORE**, - *Professor*, Ph.D., 2007, Illinois State University.

**NEVIN LEDER**, *Professor*, Ph.D., 2003, Michigan State University.



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**MARY LEONARD**, *Professor*, Ph.D., 2003, The University of the West Indies.

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**ROSITA L. RIVERA**, *Professor*, Ph.D., 2006, Penn State University.

**AIXA L. RODRÍGUEZ**, *Professor*, Ph.D., 1995, University of Massachusetts, Amherst.

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**ROSA I. ROMÁN-PÉREZ**, *Associate Professor*, Ph.D., 2007, Pennsylvania State University.

**MARY E. SEFRANEK**, *Professor*, Ed.D., 2006, Teachers College, Columbia University.

**SANDRA L. SOTO SANTIAGO**, *Associate Professor*, Ph.D. 2014, University of Arizona.

**GREGORY K. STEPHENS**, *Associate Professor*, Ph.D. 2007, University of West Indies-Mona.

**IRIS TORO-MANZANO**, *Assistant Professor*, M.A.E.E., 1997, University of Puerto Rico at Mayagüez.

**NANCY V. VICENTE**, *Associate Professor*, Ph.D., 2009, Penn State University.

**BILLY WOODALL**, *Professor*, Ph.D., 2000, University of Washington.

## COURSES OF INSTRUCTION

### Undergraduate Courses

**INGL 3046. LITERATURE FROM BRITISH POSTCOLONIES.** Three credit hours. Three hours of lecture per week.

An introduction to and study of the major topics that characterize Anglophone literature in postcolonies that were colonies or dependent states of the British empire, including Canada, Australia, and New Zealand; and in particular, non-settler colonies in Sub-Saharan Africa, the Indian subcontinent, the Caribbean and Eire.

**INGL 3056. INTRODUCTION TO THE COMMUNICATION PROCESS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Critical analysis of the process of communication. Study and evaluation of communication as a social process, theories of communication, and the communication process in diverse contexts.

**INGL 3057. MEDIA LITERACY.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3056 or INGL 3268 or authorization of the Director of the Department.

Development of critical literacy skills required to comprehend mass media messages. Identification of rhetorical, production and ideological devices used in the construction of meaning in media. Acquisition of new communication competencies to access, analyze, evaluate and present analysis of media texts such as print media, advertisements, television, film, music videos and public relations material. Study of the interaction of language and visual communication with the cultural environment.

**INGL 3101. BASIC COURSE IN ENGLISH.** Three credit hours per semester. Three hours of lecture per week, supplemented by work in the language laboratory, each semester.

This course is designed to meet the student's immediate needs, and to give him or her a command of the fundamental structure of the English language. The oral approach is used. Skills in reading and writing are developed. Students will be grouped according to their ability to use the language, and arrangements will be made to give additional help to those students who show poor preparation in English.

**INGL 3102. BASIC COURSE IN ENGLISH.** Three credit hours per semester. Three hours of lecture per week, supplemented by work in the language laboratory, each semester. Prerequisite: INGL 3101.

This course is designed to meet the student's immediate needs, and to give him or her a command of the fundamental structure of the English language. The oral approach is used. Skills in reading and writing are developed. Students will be grouped according to their ability to use the language, and arrangements will be made to give additional help to those students who show poor preparation in English.

**INGL 3103. INTERMEDIATE ENGLISH I.** Three credit hours. Three hours of lecture per week. Prerequisite: Placement by examination.

Analysis of selected readings, such as essays, fiction, poetry or drama, and practice in writing compositions with attention given as needed to grammar and idiomatic expressions.

**INGL 3104. INTERMEDIATE ENGLISH II.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3103.

Analysis of selected readings, such as essays, fiction, poetry or drama, and practice in writing compositions with attention given as needed to grammar and idiomatic expression.

**INGL 3175. POETRY WRITING.** Three credit hours. Two hours of lecture and one hour of discussion per week. Prerequisites: INGL 3103 and INGL 3104 or INGL 3211 and INGL 3212.

Intensive individual work and group workshop in poetry writing techniques.

**INGL 3195. PROFESSIONAL CONVERSATION.** One credit hour. One hour of lecture per week. Prerequisites: INGL 3012 or INGL 3212 or INGL 3202 or authorization of the Director of the Department.

An introductory communication course with emphasis on interpersonal conversation in business and professional settings.

**INGL 3197. PROFESSIONAL PRESENTATIONS.** One credit hour. One hour of lecture per week. Prerequisites: INGL 3012 or INGL 3212 or INGL 3202 or authorization of the Director of the Department.

An introductory course with emphasis on developing skills for presentations in business and professional settings.

**INGL 3198. PROFESSIONAL INTERVIEWS.** One credit hour. One hour of lecture per week. Prerequisites: INGL 3012 or INGL 3212 or INGL 3202 or authorization of the Director of the Department.

An introductory communication course with emphasis on developing job interviews skills in business and professional settings.

**INGL 3201. ENGLISH COMPOSITION AND READING.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: INGL 3102.

Practice in writing compositions and making oral reports upon selected readings, including essays, short stories, poems, dramas and novels. Attention will be given as needed to grammar and idiomatic expressions. This course or its equivalent is a requisite for graduation.

**INGL 3202. ENGLISH COMPOSITION AND READING.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: INGL 3201.

Practice in writing compositions and making oral reports upon selected readings, including essays, short stories, poems, dramas and novels. Attention will be given as needed to grammar and idiomatic expressions. This course or its equivalent is a requisite for graduation.

**INGL 3205. GRAMMAR AND USAGE OF ENGLISH.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week. Prerequisites: INGL 3202 or INGL 3191 or INGL 3209 or INGL 3104 or INGL 3212 or INGL 3289.

Strengthening of knowledge and skills of non-native speakers of English in English grammar and usage. Intensive practice of question and negative formation, placement of frequency adverbs, verb tenses, modals, gerund and infinitive phrases, prepositions and punctuation as it relates to grammatical structure.

**INGL 3209. COMMUNICATION IN SCIENCE.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3201.

Theory and practice of effective oral and written communication in the sciences using English as a second language. Discussion of formulation of hypothesis, avoiding plagiarism, appropriate use of reliable references, summarizing scientific articles, writing research reports, and preparing oral and poster presentations, among other topics.

**INGL 3211. ADVANCED ENGLISH I.** Three credit hours. Three hours of lecture per week. Prerequisite: placement by College Board Achievement Exam.

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Development of reading, discussion, and writing skills through the experience, interpretation, and evaluation of short story, modern drama, poetry, and the essay. Introduction to library skills related to literary study.

**INGL 3212. ADVANCED ENGLISH II.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3211.

Development of reading, discussion, and writing skills through the experience, interpretation, and evaluation of the novel, Shakespearean drama, and the complex texture of poetry. A research paper related to literary study will be required.

**INGL 3225. INTRODUCTION TO LINGUISTICS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

An introductory survey of linguistics with special attention to the English language, emphasizing phonology, morphology, syntax, semantics, historical change, and social and regional variations.

**INGL 3227. PHONETICS OF ENGLISH.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Articulation, rhythm, and intonation of English, including its phonetic description, transcription, and oral practice in the laboratory.

**INGL 3231. ENGLISH EXPOSITORY WRITING.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Practice in the various forms of expository writing. Detailed class criticism of diction, phrasing, and sentence structure. A research paper will be required.

**INGL 3236. TECHNICAL COMMUNICATION.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

The planning, writing, and production of formal technical reports, memos, letters, and other short technical documents commonly written by professionals in a wide variety of workplace settings.

**INGL 3238. CREATIVE WRITING.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Theory and practice in the writing of fiction, poetry, and drama. Detailed class criticism of students works.

**INGL 3250. PUBLIC SPEAKING.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Principles and practice of oral presentations, their preparation, composition, and delivery, including formal, informal, and impromptu speech.

**INGL 3268. WRITING FOR THE MEDIA.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Theory and practice in writing to broadcast information to an audience through the communications media.

**INGL 3276. INTRODUCTION TO LITERATURE: SHORT STORY.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Introduction to the literary elements, and analysis of the movements and key writers of short fiction in english.

**INGL 3277. INTRODUCTION TO LITERATURE: THE NOVEL.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Introduction to the literary elements and analysis of the novel. Critical reading, writing, and thinking approaches. Discussion of the fictional techniques and literary contexts exemplified in novels. Literary analysis and interpretation using critical theory techniques.

**INGL 3286. CREATIVE WRITING FICTION.** Three credit hours. One hour of lecture and two hours of discussion per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Intensive individual work and group discussion of techniques of fiction writing.

**INGL 3289. CONVERSATIONAL ENGLISH.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3201 or authorization of the Director of the Department.

Skills in English in academic, professional, and social settings to increase fluency and confidence as well as to improve pronunciation and listening comprehension.

**INGL 3295. PRINCIPLES OF SPEECH COMMUNICATION.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3201- English Composition and Reading.

Recognition of the basic principles of speech communication to increase knowledge and ability in communicating effectively at the professional and social levels. Explanation of topics such as nonverbal communication, diction, organization of speech, and small group communication.

**INGL 3296. WORLD ENGLISHES.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Linguistic evolution of the english language as a result of contact with english-speaking nations and its emergence in local social, historical, cultural, and political contexts around the world. Emphasis on english as an international, second and foreign language in different types of english using societies. Includes case studies from the Caribbean and Puerto Rico contexts.

**INGL 3300. SPECIAL TOPICS IN ENGLISH STUDIES.** One to six credit hours. One to six hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3012.

Study of a special topic directed by an instructor specialized in the particular field of study of the course.

**INGL 3305. MODERN AMERICAN LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Major american writers of the present century with particular attention to the development of prose fiction and modern cultural attitudes.

**INGL 3306. MODERN BRITISH LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Major british writers of the present century with particular attention to the development of prose fiction and modern cultural attitudes.

**INGL 3307. INTRODUCTION TO COMMUNICATION IN THE WORKPLACE.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week. Prerequisites: INGL 3202 or INGL 3289 or INGL 3209 or INGL 3104 or INGL 3212.

Application of the fundamentals of business writing and oral communication in professional contexts to help intermediate-level students build on their English language communication skills in different workplace situations. Emphasis on reading, writing and responding in different types of professional interactions.

**INGL 3308. INTRODUCTION TO LITERARY THEORY FROM 1900 TO THE PRESENT.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3351 or INGL 3352 or INGL 3321 or INGL 3322.

Application of different theoretical approaches to literature in English. Introduction to the study of the major schools of literary theory since 1900 such as New Criticism, psychoanalysis, structuralism, deconstruction, Marxism, feminism and gender studies, new historicism, postcolonial theory, cultural Studies, reception theory, posthumanism and eco-criticism.

**INGL 3312. THE NOVEL IN ENGLISH LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Discussion of the works of the major english novelists from the eighteenth century to the present.

**INGL 3317. THE NOVEL IN AMERICAN LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Discussion of the major american novelists of the nineteenth and twentieth centuries.

**INGL 3318. LITERATURE OF THE ENGLISH SPEAKING CARIBBEAN.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Caribbean novelists, short story writers, poets, and playwrights of the 20th century who write in english.

**INGL 3321. ENGLISH LITERATURE TO 1798.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Representative authors and major movements from the beginnings of english literature to the end of the neoclassical period.

**INGL 3322. ENGLISH LITERATURE FROM 1798 TO MODERN PERIOD.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

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Representative authors and major movements in english literature from the beginnings of the romantic period to the modern era.

**INGL 3323. MODERN DRAMA IN ENGLISH SINCE 1890.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

A survey of modern drama in England, Ireland, and the United States including such figures as Wilde, Shaw, O'casey, O'Neill, Miller, Albee, and Pinter.

**INGL 3325. MODERN POETRY.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Lectures on the beginning of modern poetry, the imagist movement, and the chief lines of development throughout the thirties and forties to the contemporary period. Special attention will be given to the major work of William Butler Yeats, Robert Frost, Wallace Stevens, William Carlos Williams, Ezra Pound, T.S. Eliot, and Dylan Thomas.

**INGL 3326. LITERATURE OF MINORITY IN THE UNITED STATES.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

English-language literature of minorities in the United States, with particular attention to african american, asian american, native american, and latino works.

**INGL 3345. TOPICS IN CINEMA.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Introduction to english language cinema in the context of linguistic and literary analysis: history, theory, selected genres, cinematic analysis and criticism, aesthetic response, and semiotics.

**INGL 3351. AMERICAN LITERATURE TO 1860.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Major works of the literature of the United States from the colonial period to the onset of the civil war.

**INGL 3352. AMERICAN LITERATURE FROM 1860 TO THE EARLY MODERN PERIOD.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3212 or INGL 3209 or INGL 3289.

Major works of the literature of the United States from the civil war up to the early modern period.

**INGL 4000. ENGLISH LITERATURE OF THE 17TH CENTURY.** Three credit hours. Three hours of lecture per week. Prerequisite: One literature course at the level of INGL 33-- or higher, or authorization of the Director of the Department.

Major poetic and intellectual traditions in the seventeenth century as represented in the works of Donne, Johnson, Herbert, Marvell, and others, with special emphasis given to the work of John Milton.

**INGL 4008. CREATIVE NON-FICTION WRITING.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3231 and INGL 3238 or authorization of the Director of the Department.

Development of creative non-fiction writing using elements and genres of fiction such as plays, poetry, memoirs, plot, characterization and dialogue. Reading and writing of texts in non-fiction genres. Preparation of a manuscript for publication and submission of a portfolio will be required.

**INGL 4009. LITERATURE OF THE ENGLISH RENAISSANCE.** Three credit hours. Three hours of lecture per week. Prerequisite: One literature course at the level of INGL 33-- or higher, or authorization of the Director of the Department.

Exploration of the major literary traditions and figures of the English Renaissance including More, Wyatt, Surrey, Spencer, Sidney, Marlowe, and Shakespeare.

**INGL 4017. THE ROMANTIC MOVEMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: One literature course at the level of INGL 33-- or higher, or authorization of the Director of the Department.

A study of the works of the principal poets of the Romantic Movement, with reading and interpretation of the chief poems of Wordsworth, Coleridge, Byron, Shelly, and Keats.

**INGL 4025. SHAKESPEARE.** Three credit hours. Three hours of lecture per week. Prerequisite: One literature course at the level of INGL 33-- or higher, or authorization of the Director of the Department.

Shakespeare's dramatic craftsmanship, poetry, humor characterization, psychology, and modern pertinence, as illustrated in representative tragedies, comedies, and history plays.

**INGL 4026. SOCIOLINGUISTICS.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3225 or authorization of the Director of the Department.

Language as a means of social interaction; linguistic variations and their relation to sociological, economic geographic, and cultural factors with reference to bilingual areas such as Puerto Rico.

**INGL 4027. OLD AND MIDDLE ENGLISH LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisite: One literature course at the level of INGL 33-- or higher, or authorization of the Director of the Department.

Development of English literature from Anglo-Saxon times through the medieval period with special emphasis given to the work of Chaucer.

**INGL 4028. RESEARCH AND WRITING IN LANGUAGE AND LINGUISTICS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3231 and six credit hours in linguistics.

A course in the methods of research, including the use of bibliographies and other reference works. Students will do individual work based upon assigned topics in language and linguistics, and will prepare a paper to be read and defended before the class.

**INGL 4030. RESEARCH AND WRITING IN LITERATURE.** Three credit hours. Three hours of seminar per week. Prerequisites: INGL 3231 and six credit hours in English Literature.

A course in the methods of research, including the use of bibliographies and other reference works. Students will do individual work based upon assigned topics in literature and will prepare papers to be read and defended in class.

**INGL 4045. LITERATURE OF THE ENGLISH-SPEAKING CARIBBEAN.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3202 or INGL 3104 or INGL 3012 or INGL 3212 or six credits in English 3000-level.

Caribbean novelists, short story writers, poets, and playwrights of the 20th century who write in English.

**INGL 4047. ENGLISH PHONOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: (INGL 3225 and INGL 3227) or authorization of the Director of the Department.

An examination of the systematic use of sounds in English and other languages; methods and techniques of analysis; theory and history of phonology.

**INGL 4059. PERSUASIVE WRITING.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3231 and INGL 3268 or authorization of the Director of the Department.

Understanding, analysis and preparation of persuasive texts for publication in diverse media. Analysis of arguments using Toulmin and other models is emphasized. Final project required.

**INGL 4066. RESEARCH IN WRITING AND COMMUNICATION.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3231 and six credits among (INGL 3236, INGL 3238, INGL 3268, INGL 4107, and INGL 4108).

Study of the methods of research in writing and communication. Use of databases, bibliographies, and other library resources, with emphasis on citation, documentation, and intellectual honesty. Application of qualitative and quantitative methodologies to conduct research projects on writing and communication. Presentation and defense of a written paper.

**INGL 4075. PSYCHOLINGUISTICS.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3225 or authorization of the Director of the Department.

Psychology and language learning; analysis of the process of first and second language acquisition; introduction to research and theory of language acquisition, and its application to the teaching of English as a second language.

**INGL 4095. THE VICTORIAN PERIOD.** Three credit hours. Three hours of lecture per week. Prerequisite: One literature course at the level of INGL 33—or higher, or authorization of the Director of the Department.

The major works of the Victorian period in poetry, criticism, and thought, with particular attention to cultural interchange with the European continent.

**INGL 4097. ENGLISH LITERATURE OF THE 18TH CENTURY.** Three credit hours. Three hours of lecture per week. Prerequisite: One literature course at the level of INGL 33-- or higher, or authorization of the Director of the Department.

Literature of the Restoration and eighteenth century with emphasis given to the work of Dryden, Swift, Pope, and Samuel Johnson.

**INGL 4107. RHETORICAL THEORY.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3231 or authorization of the Director of the Department.

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The interrelation of classical and modern rhetorical theory including the nature of persuasion, the rhetorical situation, and the structure of discourse.

**INGL 4108. ADVANCED TECHNICAL COMMUNICATION.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3236 or authorization of the Director of the Department.

Principles and practice of writing and presenting technical communications.

**INGL 4125. INTRODUCTION TO SEMANTICS.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3225 or authorization of the Director of the Department.

The semantics of English from the perspective of linguistics: relation of syntactic form to meaning, the analysis of presupposition, word meaning, strategies for establishing meaning in the context of discourse, and semantic universals.

**INGL 4196. GROUP COMMUNICATION.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3056.

Analysis of communication theories and research in order to develop group communication skills in a professional setting. Planning, implementation and evaluation of group communication using oral, written, and visual forms of communication. Development of communication skills that address workplace conflict, problem solving, and design of successful group communication strategies. Discussion of basic intercultural communication concepts. Analysis of non-verbal communication within a professional group.

**INGL 4205. MORPHOLOGY AND SYNTAX.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3225.

Theory of language structure, primarily from the viewpoint of transformational-generative grammar.

**INGL 4206. THE STRUCTURE OF ENGLISH.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3225 or authorization of the Director of the Department.

Advanced grammar course, especially in syntax.

**INGL 4208. HISTORY OF THE ENGLISH LANGUAGE.** Three credit hours. Three hours of lecture per week. Prerequisite: INGL 3225 or authorization of the Department Director.

The English language from its Anglo-Saxon origins to modern times.

**INGL 4255. PROFESSIONAL EDITING.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 4008 or INGL 3231 and (INGL 3236 or INGL 3238 or INGL 3268).

Study of the editorial process from initial contact by the author to the production of the final manuscript. Acquisition of foundations in professional editorial practices in diverse editorial positions. Analysis of editorial projects including fiction, nonfiction, literary works, trade publications, mass markets paperbacks, reference books, self-help books and other genres.

**INGL 4285. FEATURE WRITING.** Three credit hours. Three hours of lecture per week. Prerequisites: INGL 3268 and INGL 4008 or authorization of the Director of the Department.

A journalism course that builds on news writing and focuses on the theory and practice of writing feature articles for newspapers, magazines, and electronic publications. Generation and development of ideas for feature stories targeted to specific audiences. Application of grammatical rules and the principles of organization accuracy, conciseness, and clarity in writing. Development of skills required to submit feature articles for publication and conduct peer critiques. A final portfolio will be required.

**INGL 4316. AMERICAN ROMANTICISM.** Three credit hours. Three hours of lecture per week. Prerequisite: One literature course at the level of INGL 33-- or higher, or authorization of the Director of the Department.

Exploration of the literary traditions of the Romantic Period in the United States through a study of its major authors: Emerson, Hawthorne, Poe, Thoreau, Melville, and Whitman.

**INGL 4317. AMERICAN REALISM AND NATURALISM.** Three credit hours. Three hours of lecture per week. Prerequisite: One literature course at the level of INGL 33-- or higher, or authorization of the Director of the Department.

Development of fictional techniques in the United States during the late nineteenth and early twentieth centuries with readings from the following authors: Mark Twain, Howells, James, Garland, Norris, Crane and Dreiser.

**INGL 4318. EARLY AMERICAN AUTHORS.** Three credit hours. Three hours of lecture per week. Prerequisite: one 3000 level course in literature.

The growth of an American tradition and consciousness in selected prose and poetry from the puritan period, the age of reason, and the pre-romantic movement in the literature of the United States.

**INGL 4998. SUPERVISED RESEARCH IN ENGLISH.** Three credit hours. Half hour of lecture, half hour of discussion and eight hours of research per week. Prerequisite: authorization of the Director of the Department.

Research in English supervised by a faculty member in the English Department.

### **Advanced Undergraduate and Graduate Courses**

**INGL 5007. ORAL COMMUNICATION.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Communication theory and speaking techniques, including enunciation, intonation, phrasing, projecting the voice, and holding audience attention. Varieties of formal oral interpretation are studied and practiced, including drama and poetry reading, public speaking, and debate.

**INGL 5009. CONTRASTIVE GRAMMAR.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Analysis of the descriptive grammars of English and Spanish to identify areas of divergences and to achieve an understanding of linguistic universals.

**INGL 5010. PERSPECTIVES OF TEACHING ENGLISH AS A SECOND LANGUAGE.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department. Co-requisite: EDPE 4245 or authorization of the Director of the Department.

Historical overview of language teaching methods from grammar-translation to the most recent approaches; students will develop applications for teaching English as a second language.

**INGL 5015. ENGLISH AND AMERICAN LITERARY CRITICISM.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Theory and practice of literary criticism within the tradition of English and American literature. A research paper will be required.

**INGL 5018. STUDY IN THE BRITISH ISLES.** Three credit hours. Twenty two point five (22.5) hours of lecture and twenty five hours of seminar per summer. Prerequisite: authorization of the Director of the Department.

Selected courses on various topics in English literature and culture, offered by international summer school programs in universities in the British Isles, such as the University of Cambridge, Oxford University, or University of Edinburgh. Includes plenary lectures on special topics in English literature and excursions to sites of historical and cultural interest.

**INGL 5025. CURRENT APPROACHES IN LINGUISTIC THEORY.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Recent developments in linguistic theory and their application to related issues.



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## DEPARTMENT OF GEOLOGY

### Mission

The Department of Geology offers a program leading to a degree of Bachelor of Science in Geology. The Department also offers a Master I Science and advanced undergraduate courses for qualified students in the graduate programs in Biology, Physics, Marine Sciences and Civil Engineering. The principal objectives of the Geology Program are: to prepare students for professional positions in industry, government, and for careers in academic research and teaching, to maintain the Department of Geology as a center for research in Caribbean Earth and Environmental Sciences, to develop a greater awareness of Earth Sciences in the general public through community outreach programs, and to conduct assessment of all facets of the Department. As part of degree requirements, majors have to conduct a supervised research project in their final year.

### Vision

The Department of Geology of the University of Puerto Rico at Mayaguez seeks to provide the highest levels of education through continuous revision and expansion of our educational, research, and outreach programs in order to produce well-trained, competent, academic and professional geoscientists capable of responding to societal needs.

### DEFINITION OF GENERAL EDUCATION

Each student will develop critical thinking, enthusiasm, initiative and the necessary skills to become lifelong students of Earth Sciences. Emphasis is placed on learning basic concepts and techniques through research, in an environment that promotes the development of professionals with social, cultural and humanistic sensibility as well as profound ethical values. In this way, the department will contribute to the enrichment of science and society through the creation and dissemination of new knowledge through scientific research.

### STUDENT LEARNING OUTCOMES

At graduation the students that meet the graduating student profile will have:

- Proficiency in a range of basic Earth Sciences concepts
- Ability to apply scientific technology and the scientific method to solve problems

- Computer literacy, problem solving, math reasoning skills, critical thinking, ability to judge scientific validity, able to write and speak effectively
- Up-to-date knowledge of scientific technology in Earth Sciences
- Ethical values
- Research experience and skills
- Interest in life-long learning

The Department of Geology also works to increase awareness of Earth and Environmental Sciences in the liberal arts, education, and other science majors. This is achieved by exposure through outreach activities such as Earth Sciences Week, our Internet pages, participation of faculty and students in national and international meetings, the Annual Geology Symposium, the Puerto Rico Seismic Network and the Caribbean Tsunami Warning System. The Department also educates engineers in the geological concepts integral to competent engineering practices.

The Department operates the Puerto Rico Seismic Network, laboratories with analytical instruments including an x-ray diffraction spectrometer and a mass spectrometer, as well as geochemical, remote sensing and geophysical laboratories.

## COURSES THAT FULFILL GENERAL EDUCATION REQUIREMENTS

### BACHELOR OF SCIENCE IN GEOLOGY

#### Summary of Credits in Program

|                           |            |
|---------------------------|------------|
| Faculty requirements      | 50         |
| Departmental requirements |            |
| Major area                | 46         |
| Non-major area            | 24         |
| Recommended electives     | 9          |
| Free electives            | <u>12</u>  |
| <b>Total</b>              | <b>141</b> |

**PROGRAM OF STUDY**  
**GEOLOGY CURRICULUM**

**FIRST YEAR**

**First Semester**

| Number     | Credits  | Course                          |
|------------|----------|---------------------------------|
| *INGL 3--- | 3        | First year course in English    |
| *MATE 3171 | 3        | Pre-Calculus I                  |
| GEOL 3025  | 3        | Earth Sciences                  |
| GEOL 3047  | 1        | Introductory Geology Laboratory |
| QUIM 3131  | 3        | General Chemistry I             |
| QUIM 3133  | 1        | General Chemistry Laboratory I  |
| *ESPA 3101 | <u>3</u> | Basic course in Spanish I       |
|            | 17       |                                 |

**Second Semester**

| Number     | Credits  | Course                          |
|------------|----------|---------------------------------|
| *INGL 3--- | 3        | First year course in English    |
| *MATE 3172 | 3        | Pre-Calculus II                 |
| GEOL 3026  | 3        | History of Life                 |
| QUIM 3132  | 3        | General Chemistry II            |
| QUIM 3134  | 1        | General Chemistry Laboratory II |
| *ESPA 3102 | <u>3</u> | Basic course in Spanish II      |
|            | 16       |                                 |

**SECOND YEAR**

**First Semester**

| Number    | Credits  | Course  |
|-----------|----------|---|
| MATE 3031 | 4        | Calculus I  |
| INGL 3--- | 3        | Second course in English                            |
| CIBI 3031 | 3        | Intro. to the Biological Sciences I                 |
| GEOL 4017 | 3        | Elementary Geomorphology                            |
| GEOL 3055 | <u>3</u> | Morphological Crystallography and Crystal Chemistry |
|           | 16       |   |

**Second Semester**

| Number     | Credits  | Course   |
|------------|----------|--|
| MATE 3032  | 4        | Calculus II  |
| *INGL 3--- | 3        | Second year course in English                          |
| CIBI 3032  | 3        | Intro. to the Biological Sciences II                   |
| GEOL 4006  | 3        | Structural Geology                                     |
| GEOL 3056  | <u>3</u> | Geochemistry of Mineral Systems and Optical Mineralogy |
|            | 16       |  |

**THIRD YEAR**

**First Semester**

| Number    | Credits  | Course                                    |
|-----------|----------|---|
| ESPA 3--- | 3        | Course above level of basic Spanish       |
| FISI 3151 | 3        | Modern College Physics I                  |
| FISI 3153 | 1        | Modern College Physics Lab. I             |
| COMP ---- | 3        | Elective in Computer Science              |
| GEOL 4045 | 3        | Petrogenesis of Crystalline Rocks         |
| GEOL 4046 | 3        | Sedimentary Environments and Lithogenesis |
| EDFI ---- | <u>1</u> | Course in Physical Education              |
|           | 17       |   |

**Second Semester**

| Number    | Credits  | Course                              |
|-----------|----------|-------------------------------------|
| ESPA 3--- | 3        | Course above level of basic Spanish |
| FISI 3152 | 3        | Modern College Physics II           |
| FISI 3154 | 1        | Modern College Physics Lab. II      |
| GEOL 4009 | 3        | Stratigraphy                        |
| EDFI ---- | 1        | Course in Physical Education        |
| ELECTIVES | <u>6</u> | Free Electives                      |
|           | 17       |                                     |

**SUMMER BETWEEN THIRD AND FOURTH YEAR**

| Number    | Credits | Course        |
|-----------|---------|---------------|
| GEOL 4018 | 6       | Field Geology |

**FOURTH YEAR**

**First Semester**

| Number     | Credits  | Course   |
|------------|----------|--|
| GEOL 4049  | 2        | Undergraduate Research I   |
| GEOL 4011  | 1        | Undergraduate Seminar  |
| GEOL ----  | 3        | Geology Electives  |
| HUMA 3111  | 3        | Intro. to Western Culture I  |
| **ELECTIVE |          | Recommended Elective in Science (not Geology), Mathematics, Engineering, Economics and/or Agronomy |
| ELECTIVE   | 3        | Free Elective  |
| +ELECTIVE  | <u>3</u> | Course in Social Sciences or Economics   |
|            | 18       |  |

**Second Semester**

| Number    | Credits | Course                       |
|-----------|---------|------------------------------|
| GEOL 4055 | 2       | Undergraduate Research II    |
| GEOL 4012 | 1       | Undergraduate Seminar        |
| GEOL ---- | 3       | Geology Electives            |
| HUMA 3112 | 3       | Intro. to Western Culture II |

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|            |  |
|------------|--|
| **ELECTIVE | Recommended Elective in Science (not Geology), Mathematics, Engineering, |
|            | 3 Economics and/or Agronomy  |
| ELECTIVE   | 3 Free Elective  |
| +ELECTIVE  | 3 Course in Social Sciences or Economics                                 |
|            | 18   |

**Total credits required: 141**

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*Recommended electives: AGRO 3005, AGRO 4015, AGRO 4016, AGRO 4018, AGRO 4035, AGRO 5008, ASTR 4005, ASTR 4006, ASTR 5005, ASTR 5007, BIOL 3125, BIOL 3417, BIOL 3425, BIOL 3435, BIOL 4015, BIOL 4025, BIOL 4335, BIOL 4465, BIOL 4467, COMP 3010, ECON 4028, ECON 4056, ESMA \*\*\*\*, FISI 4008, FISI 4105, FISI 4116, FISI 4125, FISI 5007, INCI 4001, INCI 4002, INCI 4008, INCI 4032, INCI 4039, INCI 4051, INCI 4052, INCI 4079, INCI 4085, INCI 4088, INCI 4135, INCI 4138, INCI 4139, INCI 5008, INGE 3015, INGE 3016, INGE 3025, INGE 3031, INGE 3032, INGE 4001, INGE 4010, INGE 4011, INGE 4015, MATE 3062, MATE 4009, MATE 4010, MATE 4020, MATE 4031, MATE 4061, MATE 4062, MATE 4071, MATE 4072, METE 4006, METE 4007, METE 4008, METE 4057, QUIM 3025, QUIM 3055, QUIM 3065, QUIM 3071, QUIM 3072, QUIM 3085, QUIM 3461, QUIM 3462, QUIM 3463, QUIM 3464, QUIM 4015, QUIM 4041, QUIM 4042, QUIM 4085, QUIM 4101, QUIM 4102.

+Choose any course in Social Sciences: ANTR \*\*\*\*, ANTR/CISO 4066, CIPO \*\*\*\*, CISO 3121-3122, CISO \*\*\*\*, GEOG \*\*\*\*, HIST \*\*\*\*, PSIC \*\*\*\*, SOCI \*\*\*\*, ECON 3021, ECON 3022, ECON 3091, ECON 3092, ECON 4037, or ECON 4056.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3202, INGL 3209, or INGL 3289.

## DEPARTMENTAL FACULTY

**LYSA CHIZMADIA**, *Associate Professor*, Ph.D., 2004, University of New Mexico at Albuquerque.

**FERNANDO GILBES**, *Professor*, Ph.D., 1996, University of South Florida.

**THOMAS HUDGINS**, *Assistant Professor*, Ph.D., 2015, University of Michigan.

**VÍCTOR A. HUERFANO**, *Researcher*, Ph.D., University of Puerto Rico.

**K. STEPHEN HUGHES**, *Associate Professor*, Ph.D., 2014, North Carolina State University.

**JAMES JOYCE**, *Professor*, Ph.D., 1985, Northwestern University, Illinois.

**ALBERTO M. LÓPEZ**, *Associate Professor*, Ph.D., 2006, Northwestern University, Illinois.

**WILSON RAMÍREZ**, *Professor*, Ph.D., 2000, Tulane University, Louisiana.

**LIZZETTE RODRÍGUEZ**, *Associate Professor*, Ph.D., 2007, Michigan Technological University.

**HERNÁN SANTOS**, *Professor*, Ph.D., 1999, University of Colorado.

**ELIZABETH VANACORE**, *Associate Researcher*, Ph.D., 2008, Rice University, Texas.

## COURSES OF INSTRUCTION

### DEPARTMENT OF GEOLOGY

#### Undergraduate Courses

**GEOL 3025. EARTH SCIENCES.** Three credit hours. Three hours of lecture per week. Co-requisite: GEOL 3047 (Only for Geology students).

Introduction to the study of the earth. The structure, composition, and tectonics of the lithosphere; the interaction of the hydrosphere and atmosphere with the lithosphere, the earth in relation to the solar system. Field trips are required.

**GEOL 3026. LIFE IN THE PAST.** Three credit hours. Three hours of lecture per week.

Introduction to the evolution and the ecological significance of life in the course of geological time. Field trips are required.

**GEOL 3027. GEOLOGICAL ASPECTS OF THE ENVIRONMENTAL SCIENCES.** Three credit hours. Three hours of lecture per week.

Human activities that degrade the earth and those terrestrial phenomena actually or potentially harmful to man.

**GEOL 3028. INTRODUCTION TO EARTHQUAKES.** Three credit hours. Three hours of lecture per week.

Description of earthquakes, from the conditions that cause them to their geographic distribution in relation to global plate tectonics. Identification of instrumentation and description of modern methods employed to determine earthquake locations and the parameters used to make estimates of seismic rupture process. Exploration of earthquake mitigation, secondary effects, and social impact and resilience.

**GEOL 3045. PLANETARY GEOLOGY.** Three credit hours. Three hours of lecture per week.

Introduction to earth and planetary sciences through the study of the composition, structure, and dynamic processes of the earth and other planets.

**GEOL 3047. INTRODUCTORY GEOLOGY LABORATORY.** One credit hour. One three-hour laboratory per week. Co-requisite: GEOL 3025.

Introduction to the use and interpretation of topographic and geologic maps, and aerial photographs; identification of common minerals, rocks, and fossils; interpretation of geologic structures. Field trips required.

**GEOL 3055. MORPHOLOGICAL CRYSTALLOGRAPHY AND CRYSTAL CHEMISTRY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: (MATE 3171 or MATE 3005) and (QUIM 3131 and QUIM 3133). Co-requisite: GEOL 3025.

Internal structure and morphological characteristics of the thirty two (32) different classes of crystals. Basic crystal structures of rock-forming minerals and crystal chemistry.

**GEOL 3056. GEOCHEMISTRY OF MINERAL SYSTEMS AND OPTICAL MINERALOGY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisite: GEOL 3055.

Occurrence, geochemistry, and physical properties of rock-forming and economic minerals. Macroscopic and microscopic identification of minerals.

**GEOL 3067. VOLCANOES.** Three credit hours. Three hours of lecture per week.

Volcanoes, their products, and their effects on the environment and human beings.

**GEOL 3070. INTRODUCTION TO MARINE GEOLOGY.** Three credit hours. Three hours of lecture per week.

Introduction to the morphology, structure, stratigraphy, and evolution of ocean basins and adjacent continental margins. Presentation of concepts of paleoceanography, including the paleoclimatic record in ocean sediments and measuring changes in sea level. Discussion of the objectives and limitations of research in marine oceanography. Study of the development of ocean basins based on the concept of plate tectonics; the rocks, minerals, and sediments that compose the ocean floor; and the environmental problems and management strategies associated with the marine setting.

**GEOL 3105. IMAGES OF PLANET EARTH.** Three credit hours. Three hours of lecture per week.

The use of images of our planet Earth for the study of earth systems science with emphasis on global change; the interactions among the lithosphere, asthenosphere, hydrosphere, cryosphere, atmosphere, and biosphere; the Earth as a planet within the solar system.

**GEOL 4001. TOPICS IN GEOLOGY.** One to three credit hours. One to three hours of lecture per week. Prerequisite: Senior standing in Geology.

Special topics in geology based on review of literature, and on field and/or laboratory experiences.

**GEOL 4002. TOPICS IN GEOLOGY.** One to three credit hours. One to three hours of lecture per week. Prerequisite: Senior standing in Geology.

Special topics in geology based on review of literature, and on field and/or laboratory experiences.

**GEOL 4005. ELEMENTARY PALEONTOLOGY.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: GEOL 3026.

Principles of stratigraphical paleontology; invertebrate, vertebrate and plant fossils; practical applications. Representative examples of each group will be studied in the laboratory.

**GEOL 4006. ELEMENTARY STRUCTURAL GEOLOGY.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: GEOL 3025.

The study of major and minor rock structures. The general structure of the Earth, and deformation of its crust. Practical interpretation of geological maps.

**GEOL 4009. STRATIGRAPHY.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: GEOL 4046.

Survey of fundamental stratigraphic principles applicable to the analysis and interpretation of stratified rocks, their contained fossils, and their relations in space and time. Systematic account of the stratigraphic systems in selected regions, and interpretation of their broader relations in the Earth's crust.

**GEOL 4011. SEMINAR IN GEOLOGY.** One credit hour. One hour of seminar per week. Prerequisite: Senior standing in Geology.

Class presentation and discussion of selected topics in geology.

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**GEOL 4012. SEMINAR IN GEOLOGY.** One credit hour. One hour of seminar per week. Prerequisite: GEOL 4011 and GEOL 4045 and GEOL 4046.

Class presentation and discussion of selected topics in geology.

**GEOL 4015. GEOLOGY FOR ENGINEERS.** Three credit hours. Two hours of lecture and one two-hour laboratory per week.

General principles of geology, with special emphasis on those aspects pertaining to engineering problems; study of common minerals and rocks; structural geology and geomorphology.

**GEOL 4016. ENGINEERING GEOLOGY.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: GEOL 4006 or GEOL 4015.

Study of the specific application of geological principles to engineering problems, such as foundations, road location, water supply, dam and reservoir sites, construction materials, and beach erosion.

**GEOL 4017. ELEMENTARY GEOMORPHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: (GEOL 3025 and GEOL 3047) or (GEOL 4015 or INCI 4001) or authorization of the Director of the Department.

Study of the development of landforms; interpretation of topography and topographic maps.

**GEOL 4018. FIELD GEOLOGY.** Six credit hours. Six weeks in field camp during the summer. Prerequisite: GEOL 4009 and GEOL 4045.

Introduction to geological field methods; preparation of geological maps using plane table, pace-and-compass and other techniques; construction of structural cross sections.

**GEOL 4019. ECONOMIC GEOLOGY.** Three credit hours. Two hours of lecture and one four-hour laboratory per week. Prerequisite: GEOL 4045.

The nature, occurrence, origin, and host rocks of commercially important mineral deposits. Identification, classification, and textural analysis of ore minerals. Field trips are required.

**GEOL 4028. FIELD METHODS IN GEOLOGY.** Two credit hours. One hour of lecture and three hours of laboratory per week. Prerequisite: authorization of the Director of the Department.

Principles of topographic and geologic mapping, and of the various instruments for field work and their use.

**GEOL 4037. VOLCANOES AND THEIR HAZARDS.** Three credit hours. Three hours of lecture per week. Co-requisite: GEOL 4017.

Hazards associated with volcanic activity; monitoring of volcanoes, and long and short term forecasting of eruptions; effects of volcanic eruptions on humans, infrastructure, and agriculture; impact of volcanic crises on society; analysis of case studies.

**GEOL 4045. PETROGENESIS OF CRYSTALLINE ROCKS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: GEOL 3056.

The study of igneous and metamorphic rocks, emphasizing field identification. Introduction to microscopic petrography of common rocks.

**GEOL 4046. SEDIMENTARY ENVIRONMENTS AND LITHOGENESIS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: GEOL 3056.

Introduction to the processes of sedimentary rock formation, including the weathering of rocks and the transportation, deposition, and lithification of sediments. Emphasis on the field study of diverse modern sedimentary environments and classification of sedimentary rocks based on petrographic analysis.

**GEOL 4047. INTRODUCTION TO GEOCHEMISTRY.** Three credit hours. Three hours of lecture per week. Prerequisites: (QUIM3002 and GEOL4045 and GEOL4046) or (QUIM3132 and QUIM3134 and GEOL4045 and GEOL4046).

Chemical principles applied to geological processes. Topics include: thermodynamic properties of geological materials; gaseous and ionic behavior in aqueous media under dynamic and equilibrium environmental conditions; geochemical methods to study changes in the earth's surface.

**GEOL 4048. GEOLOGICAL APPLICATIONS OF REMOTE SENSING.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: (MATE 3031 and FISI 3151) or authorization of the Director of the Department.

Theory and techniques of remote sensing applied to the geosciences, including interpretation of images of the surface of the earth and other planets.

**GEOL 4049. UNDERGRADUATE RESEARCH I.** Two credit hours. Six hours of practice and/or laboratory per week. Prerequisite: (GEOL 4045 and GEOL 4046) or authorization of the Director of the Department.

Research in geology, supervised by a faculty member.

**GEOL 4055. UNDERGRADUATE RESEARCH II.** Two credit hours. Six hours of practice and/or laboratory per week. Prerequisite: GEOL 4049.

Research in geology, supervised by a faculty member.

**GEOL 4057. ENVIRONMENTAL GEOPHYSICS.** Three credit hours. Two hours of lecture and one four-hour laboratory per week. Prerequisites: (GEOL 3025 or GEOL 4015) and (FISI 3151 or FISI 3161 or FISI 3171).

The application of geophysical methods such as: seismic reflection/refraction, gravity, electrical, magnetic ground penetrating radar especially to environmental problems in Puerto Rico. Field trips are required.

**GEOL 4059. PHYSICAL VOLCANOLOGY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: GEOL 4045.

Physical volcanology including properties of magmas, subaerial and submarine volcanic processes, effusive and explosive products, volcanic edifices, effects of volcanism on climate, and extraterrestrial volcanism. Analysis of case studies. Field trips required.

**GEOL 4060. GEOLOGICAL APPLICATIONS OF CARTOGRAPHY AND GEODESY.** Three credit hours. Two hours of conference and one three-hour laboratory per week.

Techniques of cartography and geodesy in map-making and surveying for the geosciences with an emphasis on EDM, laser-ranging, geodetic GPS surveying, and the generation of hypsometric data from airborne and satellite platforms. Examples of environmental, geological and natural hazard mitigation applications from the Caribbean.

**GEOL 4105. INTRODUCTION TO HYDROGEOLOGY.** Four credit hours. Three hours of lecture and two hours of laboratory per week. Prerequisites: GEOL 3047 and GEOL 4017.

Discussion of the effects of precipitation, evapotranspiration, and runoff in the Hydrologic Cycle, and their interaction with surface landforms and geologic strata. Study of flooding, groundwater, and hydrochemistry and water quality, particularly in Puerto Rico. Field trips required.

## **Advanced Undergraduate and Graduate Courses**

**GEOL 5005. MARINE GEOLOGY.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisite: GEOL 4046 or authorization of the Director of the Department.

Discussion of the broad morphotectonic features of the sea floor and of coastal zones. Sediments, their origin, mode of formation, methods of study and interpretation. Reefs. Sea bottom topography and geomorphology. Study of changes of the level of the sea. Emphasis on the Caribbean region.

**GEOL 5006. SEDIMENTATION.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: GEOL 4046 or authorization of the Director of the Department.

Erosion, transportation, and deposition of sediments; classification of sediments; sedimentary environment; sedimentary history of depositional sites; significance of grain size in the sedimentary environment.

**GEOL 5008. MICROPALAEONTOLOGY.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisite: GEOL 4003 or authorization of the Director of the Department.

Foraminifers, structure and morphology of the test, stratigraphy and paleoecology, fundamentals of classification, tintinnids, radiolarians, conodonts, ostracods, dicoasterids.

**GEOL 5009. SCANNING ELECTRON MICROSCOPY.** Three credit hours. Two hours of lecture and one four-hour laboratory per week. Prerequisite: GEOL 4005 or authorization of the Director of the Department.

Introduction to the basic principles of scanning electron microscopy, including sample preparation and interpretation of micrographs. Emphasis will be placed on the aspects with each student being assigned a problem according to his interest.

**GEOL 5011. PRINCIPLES OF PALEONTOLOGY I.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: authorization of the Director of the Department.

Morphology and classification of fossils with emphasis on the invertebrates. General stratigraphic distribution. The most significant fossil groups will be studied in the laboratory.

**GEOL 5015. OPTICAL MINERALOGY.** Three credit hours. Two hours of lecture and one three hour laboratory per week. Prerequisite: GEOL 3056 or authorization of the Director of the Department.

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Optical crystallography, detailed microscopic study of rock forming minerals.

**GEOL 5020. ADVANCED GEOPHYSICS.** Three credit hours. Three hours of lecture per week. Prerequisites: GEOL 4057 or authorization of the Director of the Department.

The principal physical processes related to the dynamics and evolution of the earth, including energetic activity, gravitational and magnetic fields, heat flow, tectonics, and convection.

**GEOL 5025. GEOLOGY OF THE CARIBBEAN.** Three credit hours. Three hours of lecture per week. Prerequisite: GEOL 4009 or authorization of the Director of the Department.

The geological and geophysical history and evolution of the Caribbean region, with special emphasis on Puerto Rico; mineral resources; geological hazards; relation of the region to global tectonics.

**GEOL 5026. TECTONICS.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Theory of global plate tectonics as a synthesis of diverse geological themes, with emphasis on the Caribbean region.

**GEOL 5027. METALLOGENESIS AND GLOBAL TECTONICS.** Three credit hours. Three hours of lecture per week.

The relationship of the genesis and distribution of ore deposits to the tectonic environments.

**GEOL 5565. EARTHQUAKE SEISMOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: (GEOL 4057 and MATE 3032 and FISI 3152) or authorization of the Director of the Department.

The use of local and global networks to determine the location, magnitude, and source parameters of earthquakes; global seismicity; theory of wave propagation; point sources; inversion of the Earth's structure; source properties.

**GEOL 5575. SEISMOTECTONICS.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Description of the relationship between seismology and plate tectonics. Recognize how earthquakes are used to identify the forces that act along active plate boundaries. Catalog earthquake types occurring at convergent, divergent and shear plate boundaries. Apply the concepts of Physics to explain the seismic processes occurring on the fault plane. Distinguish between slow-

slip and stick-slip fault movements. Relate the signal obtained from modern seismic and geodetic instruments with seismic processes to infer plate boundary kinematics.

**GEOL 5605. GEOLOGICAL HAZARDS.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: GEOL 3025 or GEOL 4015 or authorization of the Director of the Department.

Mechanisms, distribution, and mitigation of geological hazards, including earthquakes, surface fault ruptures, volcanoes, landslides, floods, and ground subsidence. Analysis of case histories. Field trips are required.

**GEOL 5985. SPECIAL TOPICS IN PALEONTOLOGY.** One to three credit hours. Prerequisite: authorization of the Director of the Department.

Recent developments in paleontologic principles. Field trips required.

**GEOL 5993. ADVANCED GEOCHEMISTRY.** One to three credit hours. One to three hours of lecture per week.

Advanced topics in geochemistry. Field trips required.

**GEOL 5994. SPECIAL TOPICS IN PALEONTOLOGY WITH LABORATORY.** One to three credit hours. Prerequisite: authorization of the Director of the Department.

Special topics in paleontology. Field trips required.

**GEOL 5998. ADVANCED PETROLOGY I.** One to three credit hours. One to three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Advanced topics on the origin of volcanic, plutonic, and metamorphic rocks. Course content will vary depending on the interests of the professor and students. Field trips required.

## DEPARTMENT OF HISPANIC STUDIES

The Department of Hispanic Studies, established in 1956 as the Spanish Department, offers a **Bachelor of Arts** in Hispanic Studies, and minors in both Linguistics and Gender & Women's Literary and Cultural Studies. Minors are available for non major students as well. The Department also collaborates with other Programs of the UPRM in order to offer students an opportunity to obtain certificates in Education and film. It provides courses of instruction for all students on campus, as well as courses, which are required by other academic programs.

The Department of Hispanic Studies offers a program, which emphasizes analytical study of both language and literature. It offers specialized courses in Spanish Language and Linguistics, as well as Spanish, Latin-American, and Puerto Rican literatures. The Department also offers a graduate program leading to the degree of **Master of Arts** in Hispanic Studies. (See the Graduate Catalogue.)

### Mission

The mission of the Department of Hispanic Studies is to prepare professionals in the areas of Puerto Rican, Latin American and Spanish literature, literary theory and criticism, Linguistic, theory, writing and other related fields of study. Graduates may perform or continue careers in teaching, editorial work, library science, journalism, law, and communications, among others. The Department will encourage analytical, critical and creative thinking, and communication skills, so that students may create and disseminate new knowledge in ways that contribute to democracy and solidarity and the enrichment of culture and society.

### Vision

The Department of Hispanic Studies at the University of Puerto Rico at Mayagüez educates professionals who research and study the language, literature and Hispanic cultures through a humanistic education that integrates the development of analytical, critical and creative thinking.

### Students Outcomes:

Upon graduation from the Department of Hispanic Studies at UPRM, the student will:

- Show a general knowledge of Hispanic literature, and Linguistics
- Relate texts to their cultural and historical contexts.
- Assess the aesthetic qualities of literature.
- Practice reading skills, critical thinking and analysis.
- Distinguish literary genres.
- Command the appropriate use of literary and linguistic terminology.
- Recognize representative authors and cultural characteristics of the major literary periods.
- Show a broad knowledge of linguistic theory, Spanish grammar, and language change and variation.
- Command the conventions in the formal use of oral and written language.
- Explain the interactions between culture, society, and literature.
- Write different kinds of texts according to the purposes and audiences.
- Recognize and assess the ethical issues raised in the literature and writing.
- Apply research skills.
- Value and pursue continuous learning.

### Courses:

|                     |           |
|---------------------|-----------|
| ESPA 3211-3212      | ESPA 3906 |
| ESPA 4221-4222      | ESPA 3216 |
| ESPA 4231-4232      | ESPA 3295 |
| ESPA 4905/LING 4015 | ESPA 4046 |
| LING 4010           |           |
| LING 4020           |           |



## BACHELOR OF ARTS IN HISPANIC STUDIES

### Summary of Credits in Program

|                           |            |
|---------------------------|------------|
| Faculty requirements      | 56         |
| Departmental requirements |            |
| Major area                | 32         |
| Non-major area            | 24         |
| Recommended electives     | 12         |
| Free electives            | <u>12</u>  |
| <b>Total</b>              | <b>136</b> |

### PROGRAM OF STUDY

#### HISPANIC STUDIES CURRICULUM

#### FIRST YEAR

##### First Semester

| Number                         | Credits  | Course  |
|--------------------------------|----------|---|
| *ESPA 3101                     | 3        | Basic course in Spanish I   |
| *INGL 3-<br>CIBI 3031          | 3        | First year course in English<br>Intro. to the Biological Sciences I |
| + Course in<br>Social Sciences | 3        |   |
| *MATE 3171                     | 3        | Pre-Calculus I  |
| or                             |          |   |
| MATE 3086                      | 3        | Mathematical Reasoning  |
| EDFI ----                      | <u>1</u> | Course in Physical Education  |
|                                | 16       |   |

##### Second Semester

| Number                        | Credits  | Course   |
|-------------------------------|----------|--|
| *ESPA 3102                    | 3        | Basic course in Spanish II   |
| *INGL 3-<br>CIBI 3032         | 3        | First year course in English<br>Intro. to the Biological Sciences II |
| +Course in<br>Social Sciences | 3        |  |
| MATE 3---                     | 3        | **Recommended course in<br>Mathematics                               |
| EDFI ----                     | <u>1</u> | Course in Physical Education   |
|                               | 16       |  |

#### SECOND YEAR

##### First Semester

| Number    | Credits | Course  |
|-----------|---------|---|
| ESPA 3211 | 3       | Intro. to Spanish Literature I                                |
| LING 4010 | 3       | Language in the Human Mind:<br>An Introduction to Linguistics |
| ESPA 3295 | 3       | Spanish Grammar   |
| INGL 3--- | 3       | Second year course in English                                 |
| HUMA 3111 | 3       | Intro. to Western Culture I                                   |

|           |          |                          |
|-----------|----------|--------------------------|
| HIST 3141 | 3        | History of Spain         |
| or        |          |                          |
| HIST 3211 | 3        | History of Latin America |
| or        |          |                          |
| HIST 3221 | <u>3</u> | History of the Antilles  |
|           | 18       |                          |

##### Second Semester

| Number     | Credits  | Course                          |
|------------|----------|---------------------------------|
| ESPA 3212  | 3        | Intro. to Spanish Literature II |
| LING 4020  | 3        | Linguistic Change and Variation |
| ESPA 3216  | 3        | Formal Expositive Writing       |
| ^INGL 3--- | 3        | Second year course in English   |
| HUMA 3112  | 3        | Intro. to Western Culture II    |
| HIST 3142  | 3        | History of Spain                |
| or         |          |                                 |
| HIST 3212  | 3        | History of Latin America        |
| or         |          |                                 |
| HIST 3222  | <u>3</u> | History of the Antilles         |
|            | 18       |                                 |

#### THIRD YEAR

##### First Semester

| Number         | Credits  | Course  |
|----------------|----------|---|
| LING 4XXX/5XXX | 3        | Linguistic Requirement                          |
| ESPA 4221      | 3        | Spanish-American Literature I                   |
| ESPA 3906      | 2        | Bibliographical Research in<br>Hispanic Studies |
| HIST 3241      | 3        | History of Puerto Rico                          |
| ELECTIVE       | 3        | Elective in Foreign Language                    |
| ESPA 4231      | <u>3</u> | Puerto Rican Literature I                       |
|                | 17       |   |

##### Second Semester

| Number         | Credits  | Course   |
|----------------|----------|--|
| LING 4XXX/5XXX | 3        | Linguistic Requirement                             |
| ESPA 4222      | 3        | Spanish-American Literature II                     |
| ESPA 4046      | 3        | Intro. To Critical Theory and<br>Literary Analysis |
| HIST 3242      | 3        | History of Puerto Rico                             |
| ELECTIVE       | 3        | Romance Language Elective                          |
| ESPA 4232      | <u>3</u> | Puerto Rican Literature II                         |
|                | 18       |  |

#### FOURTH YEAR

##### First Semester

| Number       | Credits | Course                              |
|--------------|---------|-------------------------------------|
| ESPA 4905    | 3       | Seminar in Literature               |
| or           |         |                                     |
| LING 4015    | 3       | Seminar in Linguistics              |
| ESPA or LING | 3       | Electives in Spanish or Linguistics |
| ESPA or LING | 3       | Electives in Spanish or Linguistics |

|                       |          |  |
|-----------------------|----------|--|
| FISI, QUIM<br>or GEOL | 3        | Elective in Physics, Chemistry<br>or Geology |
| ELECTIVE              | 3        | Free Elective                                |
| ELECTIVE              | <u>3</u> | Free Elective                                |
|                       | 18       |  |

## Second Semester

| Number                | Credits  | Course                                       |
|-----------------------|----------|--|
| ESPA or LING          | 3        | Electives in Spanish or Linguistics          |
| ESPA or LING          | 3        | Electives in Spanish or Linguistics          |
| FISI, QUIM<br>or GEOL | 3        | Elective in Physics, Chemistry<br>or Geology |
| ELECTIVE              | 3        | Free Elective                                |
| ELECTIVE              | <u>3</u> | Free Elective                                |
|                       | 15       |  |

## DEPARTMENTAL FACULTY

**MARIBEL ACOSTA-LUGO**, *Professor*, Ph.D., 2004, University of Connecticut. Research and Teaching Interests: Spanish American Literature with emphasis on Puerto Rico and the Hispanic Caribbean; Novel, Theater and Short Story.

**HILTON ALERS-VALENTÍN**, *Professor*, Ph.D., 2000, University of Massachusetts at Amherst. Research and Teaching Interests: Syntactic Theory, Phonological Theory, Generative Grammar, Formal Semantics.

**AIDA L. CARRERO-VÉLEZ**, *Associate Professor*, M.A., 1990, State University of New York at Albany. Research and Teaching Interests: Spanish American and Hispanic Caribbean Literatures. Short story, Poetry.

**CAMILE CRUZ-MARTES**, *Professor*, Ph.D., 2001, Brown University. Research and Teaching Interests: Hispanic Caribbean and Latin American Colonial Literature.

**KATZMÍN FELICIANO-CRUZ**, *Professor*, Ph.D., 2004, University of Puerto Rico. Research and Teaching Interests: Spanish Literature.

**MANUEL FIGUEROA-MELÉNDEZ**, *Professor*, Ph.D., 1997, University of Puerto Rico. Research and Teaching Interests: Spanish Literature, Novel, Poetry, Love in Literature, Theater. Poet, Essay and Short Story Writer.

**FRANCISCO GARCÍA-MORENO BARCO**, *Professor*, Ph.D., 1992, Michigan State University. Research and Teaching Interests: Spanish Literature, Narrative and Writing.

**LEILANI GARCÍA-TURULL**, *Associate Professor*, Ph.D., 2000, University of Wisconsin-Madison. Research and Teaching Interests: Latin American

Literature with emphasis on Contemporary Chronicle in Puerto Rico and Mexico, Cultural Studies, Studies on Performance and Afro-Hispanic Literature.

**JACQUELINE GIRÓN-ALVARADO**, *Professor*, Ph.D., 1993, Pennsylvania State University. Research and Teaching Interests: Spanish American Poetry and Theater (20th Century), Puerto Rican Literature, Feminist Literature Criticism. Short Story Writer, Poet, Critic.

**MELVIN GONZÁLEZ-RIVERA**, *Associate Professor*, Ph.D. 2011, Ohio State University. Research and Teaching Interests: Syntactic Theory, Semantics, Pragmatics, Caribbean Spanish Language.

**MAGDA GRANELA-RODRÍGUEZ**, *Professor*, Ph.D., 1987, University of Illinois, Urbana. Research and Teaching Interests: Spanish American, Mexican and Puerto Rican Literature, Novel, Theater, Poetry and Writing. Poet, Essayist and Critic.

**RAQUEL LLOREDA-DÍAZ**, *Associate Professor*, M.A., 1990, University of Puerto Rico. Research and Teaching Interests: Spanish American Literature.

**JAIME L. MARTELL-MORALES**, *Professor*, Ph.D., 2000, State University of New York-Stony Brook. Research and Teaching Interests: Puerto Rican and Spanish American Literature, Latin American Colonial Literature, Literary Theory, Novel and Poetry. Essayist and Critic.

**ALFREDO MORALES-NIEVES**, *Professor*, Ph.D., 1987, University of California at Irvine. Research and Teaching Interests: Spanish American and Hispanic Caribbean Literature; XIX Century, Essay, Philosophy and Studies of Nationhood, Race, Gender in Literature, Writing. Poet and Short Story Writer.

**ALEXANDRA MORALES REYES**, *Assistant Professor*, Ph.D., 2013, University of Illinois-Urbana. Research and Teaching Interests: First and Second Language acquisition, Psycholinguistics, Phonology, Morphosyntax.

**DAVID L. QUIÑONES-ROMÁN**, *Professor*, Ph.D., 1988, University of Massachusetts at Amherst. Research and Teaching Interests: Spanish Literature (17th Century-Golden Age, Fiction, Cervantes), Spanish Literature (Medieval Period), Spanish American Literature (from Colonial Period to Modernism), Poet.

**VÍCTOR J. RIVERA-DÍAZ**, *Professor*, Ph.D., 1997, University of Illinois-Urbana. Research and Teaching Interests: Knowledge Presentation and Advertising, Memory Processes and Media, Communication and Mass Communication Theory, Business Communication, Journalism Writing.

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**CARMEN M. RIVERA VILLEGAS**, *Professor*, Ph.D., 1997, Vanderbilt University. Research and Teaching Interests: Puerto Rican Poetry and Contemporary Mexican Literature.

**JOSÉ E. SANTOS-GUZMÁN**, *Professor*, Ph.D., 1999, Brown University. Research and Teaching Interests: Spanish Literatures of the 18<sup>th</sup> and 20<sup>th</sup> Centuries (Jovellanos, Olavide, Cadalso, Pérez Galdós, Generation of 1898, Spanish Novel from the Post-Civil War Era to the Present); Hispanic Linguistics (Language Variation).

**MARÍA M. SOLÁ-FERNÁNDEZ**, *Emeritus Professor*, Ph.D., 1977, University of Puerto Rico. Research and Teaching Interests: Spanish American Literature, Feminist Literature, Criticism, Puerto Rican Literature.

## **COURSES OF INSTRUCTION**

### **DEPARTMENT OF HISPANIC STUDIES**

#### **Undergraduate Courses**

**ESPA 0041.** SPANISH FOR BEGINNERS. No credit. Three hours of lecture per week.

A practical course in conversation for students whose native language is not Spanish, including the basic elements of the language, and the acquisition of a working vocabulary.

**ESPA 0042.** SPANISH FOR BEGINNERS. No credit. Three hours of lecture per week.

A practical course in conversation for students whose native language is not Spanish, including the basic elements of the language, and the acquisition of a working vocabulary.

**ESPA 3021.** MASTERPIECES OF LATIN AMERICAN LITERATURE. Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Study of masterpieces of Spanish American Literature from the sixteenth century to the nineteenth century, including examples of Puerto Rican literature.

**ESPA 3022.** MASTERPIECES OF LATIN AMERICAN LITERATURE. Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Study of some of the outstanding works of Spanish American literature from the nineteenth century to the present, including examples of Puerto Rican literature.

**ESPA 3101.** BASIC COURSE IN SPANISH I. Three credit hours. Three hours of lecture per week.

Practice in the critical reading of literary texts, the writing and editing of narrative texts; effective oral communication in Spanish.

**ESPA 3102.** BASIC COURSE IN SPANISH II. Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3101.

Practice in the critical reading of essays, poetry, and drama; the writing and editing of expository texts; effective oral communication in Spanish.

**ESPA 3126.** LATIN AMERICAN CINEMA. Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Study and critical analysis of the most relevant film movements in Latin America, both in documentary and fiction cinema. Evaluation of the aesthetic aspects of cinematographical creation unique to each country within the Latin American context.

**ESPA 3127.** INTRODUCTION TO CENTRAL AMERICAN LITERATURE. Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Reading and analysis of representative Central American literary works belonging to key periods in the region, from a literary, sociological, cultural, and historical perspective.

**ESPA 3170.** JOURNALISTIC WRITING. Three credit hours. Three hours of lecture and workshop per week. Prerequisite: ESPA 3102- Basic Course in Spanish II.

Application of the basic concepts of journalism and the writing styles and structures of different journalistic genres. Emphasis on writing specialized news, features, and editorials for the printed and digital media.

**ESPA 3175.** READING "RACE" IN PUERTO RICO. Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Discussion of the attitudes and representations regarding Black heritage by the academic and popular sectors of Puerto Rico throughout the reading of various texts. Exploration of the function of language as a medium that constructs and reflects racial and racist attitudes. Analysis of the diverse strategies of resistance, identification, and appropriation demonstrated by sectors of the black "race" in the discursive manifestations studied in class.

**ESPA 3208. COMPOSITION.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Theory of grammar applied to the written language; comparison among languages of diverse literary genres; elements of semantic and stylistics.

**ESPA 3211. INTRODUCTION TO SPANISH LITERATURE I.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ESPA 3102.

A study of literary movements, authors and representative works of Spanish literature from the Middle Ages to the Renaissance.

**ESPA 3212. INTRODUCTION TO SPANISH LITERATURE II.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Literature from the middle ages to the renaissance in the first semester, and from the goldenage to the present.

**ESPA 3215. COMMERCIAL EXPRESSION AND COMMUNICATION.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102 and students of Business Administration College.

Development of skills for efficient language use, both oral and written. Special attention will be given to written communication forms: letters, memoranda, summaries, reports, etc. The principles of logic and psychology basic to the efficient writing of these forms will be presented and intense practice in their preparation will be given.

**ESPA 3216. FORMAL EXPOSITIVE WRITING.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Writing of expositive formal texts through a planned process, with emphasis in argumentative exposition. Application of principles of theories of writing, natural languages, and academic literacy. Practice of the writing process by means of exercises, reading of model texts, and activities oriented towards the acquisition of new vocabulary.

**ESPA 3295. SPANISH GRAMMAR.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Approach to Spanish grammar as a theoretical-practical study of the linguistic competence. Description of the phonetic, phonological, morphological and syntactical components. Analysis of gramatical structures in contemporary Spanish.

**ESPA 3305. CINEMA AND HISPANIC LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

A comparative analysis of literary and cinematic codes in Hispanic texts and the films based on them.

**ESPA 3315. WOMEN AND WRITING IN HISPANIC AMERICA.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Identity, intimacy, and social struggle of Hispanic American women in representative texts written by women; diverse readings from a gender perspective.

**ESPA 3405. FEMININE DISCOURSE IN ART OF THE HISPANIC WORLD.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Reading and analysis of the 20<sup>th</sup> and 21<sup>st</sup> century Hispanic literary, artisan, pictorial, musical, and film texts dealing with the female figure as subject-creator. Interpretation of cultural texts applying discursive theoretical models. Particular attention is given to the marked divergence of the genders in artistic representations by problematizing the female subject-creator.

**ESPA 3406. CREATIVE WRITING: SHORT STORIES.** Three credit hours. One hour of lecture and two hours of workshop per week. Prerequisite: ESPA 3102.

Theory and practice of the short story. Discussion of theoretical aspects of the narrative. Analysis of model texts. Practice of the processes, and use of resources in the context of short stories. Revision and discussion of narrative exercises through conferences and workshops. Writing of original short stories is required.

**ESPA 3505. WOMEN AND FOLKLORE.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Study of folkloristic from the perspective of women. Analytic discussion concerning folkloric manifestations by and about women using cultural texts. Research and compilation of folkloric materials produced by women in Puerto Rico.

**ESPA 3906. BIBLIOGRAPHICAL RESEARCH IN HISPANIC STUDIES.** Two credit hours. Two hours of lecture and one hour of research per week. Prerequisite: ESPA 3102.

Introduction to the use of library resources and bibliographical sources related to research in Hispanic literature and linguistics. Identification, compilation, and search of bibliographic documentation in catalogs,

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indexes, databases, and other references. Preparation of a bibliography on a specific topic is required.

**ESPA 4007. FICTION IN PUERTO RICAN LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

History and appreciation of the novel and short story in the literature of Puerto Rico from the 19th Century to the present. Text analysis, reports and lectures.

**ESPA 4011. DIACHRONY OF THE SPANISH LANGUAGE.** Three credit hours. Three hours of lecture per week. Prerequisite: (ESPA 4201 and ESPA 4202) or INGL 3225.

Phonological, morpho-syntactic and lexico-semantic evolution of the Spanish language from Latin.

**ESPA 4012. THE SPANISH LANGUAGE IN HISPANIC AMERICA.** Three credit hours. Three hours of lecture per week. Prerequisite: (ESPA 4201 and ESPA 4202) or INGL 3225.

Analysis of Hispanic American Spanish from the perspectives of linguistic geography, dialectology, and sociolinguistics.

**ESPA 4021. CERVANTES.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ESPA 3212.

Lectures on the works of Cervantes accompanied by critical analysis. Study of this writer's poetry, "entremeses", novels, with special emphasis on the Novelas Ejemplares and Don Quijote, and consideration of the importance and significance of these writings in the field of Hispanic letters.

**ESPA 4022. CERVANTES.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ESPA 4021.

Lectures on the works of Cervantes accompanied by critical analysis. Study of this writer's poetry, "entremeses", novels, with special emphasis on the Novelas Ejemplares and Don Quijote, and consideration of the importance and significance of these writings in the field of Hispanic letters.

**ESPA 4045. SEMINAR IN LITERARY AND CULTURAL STUDIES ON WOMEN AND GENDER.** Three credit hours. Three hours of lecture per week. Prerequisites: ESPA 4505 or authorization of the Director of the Department.

Exploration within a field of study in women or gender studies. Reading and discussion of primary sources.

Selection of a topic, design, writing and presentation of a research project.

**ESPA 4046. INTRODUCTION TO CRITICAL THEORY AND LITERARY ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Survey of the theories of literary criticism since Russian formalism. Application of critical theory to the analysis of literary texts with a comprehensive view and understanding in the hermeneutic and epistemological fields. Study of the relationship between the development of critical theory and social and historical aspects.

**ESPA 4051. SPANISH LITERATURE OF THE NINETEENTH CENTURY.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ESPA 3212.

Study of the currents of Romanticism, Post-romanticism and Realism in Spanish literature.

**ESPA 4056. MODERNISM LITERATURE IN SPANISH AMERICA.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Lectures with textual analysis of the principal poets and prose writers produced by "modernismo" in the various countries of Spanish America: José Martí, Salvador Díaz Mirón, Julián del Casal, José Asunción Silva, Rubén Darío, Leopoldo Lugones, Julio Herrera Reissig, Guillermo Valencia, Enrique Gómez Carrillo, Amado Nervo, Enrique González Martínez, Quiroga, María Vaz Ferrerira, José Vaconcelos, etc.

**ESPA 4061. SPANISH POETRY.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

A study of Spanish poetry since the origins in the Middle Age up to the present time. The tendencies, authors, and poems of all periods are considered.

**ESPA 4062. SPANISH POETRY.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

A study of Spanish poetry since the origins in the Middle Age up to the present time. The tendencies, authors, and poems of all periods are considered.

**ESPA 4065. CONTEMPORARY SPANISH-AMERICAN POETRY.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Reading and textual analysis of Spanish American poetry after Modernism, with special emphasis on its relation to traditional modes of poetic discourse.

**ESPA 4071. THE SHORT STORY IN SPANISH-AMERICA.** Three credit hours per semester. Three hours of lecture per week. Prerequisite: ESPA 3102.

Lectures with textual analysis of the Spanish American short history, from its beginnings in the 19th century until the present. Consideration of tendencies, movements or schools, and authors.

**ESPA 4072. THE SHORT STORY IN SPANISH-AMERICA.** Three credit hours per semester. Three hours of lecture per week. Prerequisite: ESPA 3102.

Lectures with textual analysis of the Spanish American short history, from its beginnings in the 19th century until the present. Consideration of tendencies, movements or schools, and authors.

**ESPA 4105. PUERTO RICAN POETRY.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Critical study of poetic expression in Puerto Rico. Discussion and analysis of texts which exemplify diverse stages, aesthetic concerns, and movements in Puerto Rican Poetry, from its origins to the present.

**ESPA 4201. INTRODUCTION TO LINGUISTICS I.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Exploration into the nature of human language through the study of the most recent models proposed by linguistic theory. Description and analysis of linguistic universals in phonetics, phonology, morphology, and syntax. Application of linguistic theory to problems in natural languages, with special attention to Spanish.

**ESPA 4202. INTRODUCTION TO LINGUISTICS II.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 4201.

Exploration into the nature of human language through the study of the most recent models proposed by linguistic theory. Analysis of linguistic universals in syntax, semantics and language acquisition and processing. Description of linguistic variation by means of typology, historical linguistics, and sociolinguistics. Application of linguistic theory to problems in natural languages, with special attention to Spanish.

**ESPA 4215. SPANISH AMERICAN THEATER OF THE 20<sup>TH</sup> CENTURY.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Study of movements, tendencies, topics and techniques of 20<sup>th</sup> century Spanish American theater through reading and discussion of representative authors and works.

**ESPA 4216. SPANISH PHONETICS AND PHONOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 4201.

General scope of Spanish phonetics and phonology describing the principal phonetic and phonological contrasts of the regional and social varieties of Spanish in Spain, America and the Caribbean.

**ESPA 4221. SPANISH-AMERICAN LITERATURE I.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

A study of Spanish American Literature from its beginnings to the present.

**ESPA 4222. SPANISH-AMERICAN LITERATURE II.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

A study of Spanish American Literature from its beginnings to the present.

**ESPA 4227. WOMEN NARRATORS IN HISPANIC LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Study of narrative works produced by women writers in Spanish. Discussion of topics, value and merits within these works, with emphasis on gender perspective. Text analysis using contemporary theoretical frameworks, with particular attention to feminism, postmodernity, and postcolonialism.

**ESPA 4228. CENTRAL AMERICAN WOMEN WRITERS.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Analysis of literary works of representative Central American women writers. Contrast and comparison of feminine perspectives as they appear in their works taking into account social, historical and cultural issues.

**ESPA 4231. PUERTO RICAN LITERATURE.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ESPA 3102.

Lectures accompanied by the reading of selected works.

**ESPA 4232. PUERTO RICAN LITERATURE.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ESPA 3102.

Lectures accompanied by the reading of selected works.

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**ESPA 4251. THE GOLDEN AGE.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ESPA 3212.

The Spanish Renaissance, Humanism, Reformation and Counter Reformation, Mysticism and Asceticism; study of lyric and epic poetry, novel, prose, writings and the drama previous to Lope de Vega: Cervante's novel and Lope de Vega's dramas; Calderón, Tirso de Molina, etc. Lectures, reports, analysis of main works.

**ESPA 4252. THE GOLDEN AGE.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ESPA 4251.

The Spanish Renaissance, Humanism, Reformation and Counter Reformation, Mysticism and Asceticism; study of lyric and epic poetry, novel, prose, writings and the drama previous to Lope de Vega: Cervante's novel and Lope de Vega's dramas; Calderón, Tirso de Molina, etc. Lectures, reports, analysis of main works.

**ESPA 4405. TECHNICAL AND SCIENTIFIC WRITING.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102 and eighteen (18) credits in major specialty.

Strategies for the production of professional documents for referential objectives; practice in the writing of technical and scientific reports, letters, proposals, and papers.

**ESPA 4491. SEMINAR.** One hour credit. Two hours of lecture per week. Prerequisite: ESPA 3102.

This course will train the student in preparing and classifying a bibliography, and will give him an introduction to methods and problems of research and literary criticism. Required of all students majoring in Hispanic Studies.

**ESPA 4492. SEMINAR.** One hour credit. Two hours of lecture per week. Prerequisite: ESPA 4491.

This course will train the student in preparing and classifying a bibliography, and will give him an introduction to methods and problems of research and literary criticism. Required of all students majoring in Hispanic Studies.

**ESPA 4495. PROPOSAL WRITING.** Three credit hours. One hour of lecture, one hour of discussion and one hour of workshop per week. Prerequisite: ESPA 3208 or ESPA 3215.

Strategies and objectives in writing proposals in Spanish. Analysis of the structure of a proposal. Identification of different types of proposals. Evaluation of the requirements for different funding agencies. The writing of a proposal is required.

**ESPA 4505. FEMINIST CRITICAL THEORIES: READING GENDER AND SEXUALITY.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

Survey of feminist critical theory, its relationship to the global women's movement, with emphasis on Puerto Rico, and its links to critical theories of discourse and culture. Application of feminist theoretical literacy to the analysis of critical, literary and cultural texts, with emphasis on the 20<sup>th</sup> and 21<sup>st</sup> centuries. Practice in strategies of reading context with a perspective of gender supplemented with viewpoints from queer and diverse sexualities.

**ESPA 4905. SEMINAR IN LITERATURE.** Three credit hours. One hour of discussion and two hours of seminar per week. Prerequisites: (ESPA 3211-3212 and ESPA 4221-4222 and ESPA 4231-4232) or authorization of the Director of the Department.

Exploration within a field of study in Hispanic literature. Reading and discussion of primary sources. Selection of a topic, design, writing and presentation of a research project.

**ESPA 4995. SPECIAL TOPICS I.** One to three credit hours. One to three hours of lecture per week. Prerequisite: ESPA 3102 and authorization of the Director of the Department.

Specific aspects of language or literature not covered in the offerings of the Department. New research areas will be included.

**ESPA 4996. SPECIAL TOPICS II.** One to three credit hours. One to three hours of lecture per week. Prerequisite: ESPA 3102 and authorization of the Director of the Department.

Specific aspects of language or literature not covered in the offerings of the Department. New research areas will be included.

### **Advanced Undergraduate and Graduate Courses**

**ESPA 5005. POETIC GENERATION OF 1927.** Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3212 or authorization of the Director of Department.

A critical and stylistic study of the Poetic Generation of 1927, considering the influence of earlier Spanish writers, and the impact of European "isms".

**LING 4010. LANGUAGE IN THE HUMAN MIND: AN INTRODUCTION TO LINGUISTICS.** Three credit hours. Three hours of lecture per week.

Introduction to the study of language as a cognitive science and its relationship with certain controversies in other cognitive disciplines, such as reference and the mind-body dualism in philosophy, innate versus acquired and knowledge versus behavior in cognitive psychology and biology and natural language processing in systems of artificial intelligence. Characterization of levels of representation of linguistic structures, distinctive properties of the language faculty, and differences between human languages and other natural or artificial systems. Integrated exploration of the application of the scientific method to linguistic analysis, philosophical questions in the study of language, and specific problems in the development of linguistic theory.

**LING 4015. SEMINAR IN LINGUISTICS.** Three credit hours. One hour of discussion and two hours of seminar per week. Prerequisite: ESPA 4011 and ESPA 4012.

Exploration of a field of study in contemporary Hispanic linguistics. Primary sources from the chosen field will be read and discussed. Specification of a topic and design of an original research project. Writing and presentation of the research paper will be required.

**LING 4020. LINGUISTIC CHANGE AND VARIATION.** Three credit hours. Three hours of lecture per week. Prerequisite: LING 4010.

Study of typological, diachronic, dialectal, and social variations in natural languages, with special attention to Spanish. Formulation of linguistic universals and parametrical differences in the grammatical systems of languages across the world. Phylogenetic classification of languages and analysis of phonological, morphological, syntactic and lexical changes. Discussion of the relations between social variables in speakers and their surroundings and variables in linguistic performance. Description of dialectal variations in Spanish and linguistic phenomena and systems that emerge from language contact.

**LING 5030. INTRODUCTION TO GENERATIVE SYNTAX.** Three credit hours. Three hours of lecture per week. Prerequisites: LING 4010 or ESPA 4201 or INGL 3225 or authorization of the Director of the Department.

Study of syntactic structures in natural languages, with particular attention to Spanish. Description and classification of syntactic features, categories, functions and operations. Representation of subordinate clauses, clitics, negation, and sentence informational structure. Analysis of phrase and sentence constituents through the application of recent generative syntactic theoretical models.

**LING 5040. INTRODUCTION TO GENERATIVE PHONOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: LING 4010 or ESPA 4201 or INGL 3225 or authorization of the Director of the Department.

Study of phonological structures in natural languages, with particular attention to Spanish. Description and classification of articulate sounds and distinctive features of segments and suprasegments. Representation of phonological rules, feature geometry, intonation, and metrical stress. Analysis of phonological patterns and processes as well as prosodic structures through the application of recent generative phonological theories.

**LING 5050. MORPHOLOGICAL THEORY.** Three credit hours. Three hours of lecture per week. Prerequisites: LING 4010 or ESPA 4201 or INGL 3225 or authorization of the Director of the Department.

Representation of morphological structures, processes, and operations in natural languages through models proposed in generative morphology. Study of the nature of the lexicon, morphology as an autonomous module of grammar, and the interface of morphology with phonology and syntax. Revision of theories of Lexical Morphology, Prosodic Morphology, and Optimality. Application of linguistic theory to the analysis of morphological data in natural languages.

**LING 5060. COMPOSITIONAL SEMANTICS.** Three credit hours. Three hours of lecture per week. Prerequisites: LING 4010 or ESPA 4201 or INGL 3225 or authorization of the Director of the Department.

Introduction to the study of linguistic meaning and its relationship with syntactic structure according to the principles of compositional semantics. Application of formal methods and basic tools like set theory, propositional logic, and model theory to semantic analysis. Exploration of types and relations of meaning, predication, quantification, modification, temporal relations, modal contexts and possible world theories.

**LING 5075. LANGUAGE ACQUISITION AND DEVELOPMENT.** Three credit hours. One and a half hours of lectures and one and a half hours of seminar per week. Prerequisites: LING 4010 or ESPA 4201 or INGL 3225 or authorization of the Director of the Department.

Survey of research and theoretical perspectives in natural language acquisition and development in children. Discussion and examination of child language data from Spanish and other languages. Exploration of universal principles and biological aspects of language acquisition and development, the logical problem of language acquisition, infant speech perception and production, development of phonology, morphology, syntax, semantics and the lexicon, Universal Grammar and the



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language bioprogram, and child creation of creole languages.

**LING 5080. COMPUTATIONAL LINGUISTICS.** Three credit hours. One and a half hours of lectures and one and a half hours of seminar per week. Prerequisites: LING 4010 or ESPA 4201 or INGL 3225 or authorization of the Director of the Department.

Study of the computational properties of human language and models of natural language processing. Analysis and evaluation of deterministic and nondeterministic systems for computational models of language learning and processing. Representation of phonological, morphological, syntactic, and semantic structures by means of parsers based upon these computational models. Survey of on-line tools, such as tagged corpora, parsers and semantic webs. Discussion of computational models' applications in language processing technologies, such as orthographic and grammar checkers, computer translation, search engines, and information extraction.

**LING 5090. FORMAL FOUNDATIONS OF LINGUISTIC THEORY.** Three credit hours. Three hours of lecture per week. Prerequisites: LING 4010 or ESPA 4201 or INGL 3225 or MATE 3171 or authorization of the Director of the Department.

Study of the logical and mathematical foundations needed to formulate linguistic theory and formally describe properties of languages. Introduction to formal tools and basic concepts of set theory, relations and functions; infinities; propositional calculus and predicate logic; Model Theory; algebras, lattices, and automata. Application of formal methods to the analysis of the syntax and semantics of quantifiers, natural and formal languages, and types of grammars.

**LING 5100. PHILOSOPHICAL FOUNDATIONS OF LINGUISTIC THEORY.** Three credit hours. One and a half hours of lecture and one and a half hours of seminar per week. Prerequisites: (LING 4010 and (INGL 3225 or ESPA 4202 or ESHI 6027)) or authorization of the Director of the Department.

Critical-historic reconstruction of the fundamental concepts in linguistic theory, such as levels of adequacy in a theory of grammar; rules, representations and derivations; restrictions and locality; principles and parameters of Universal Grammar; hierarchy of formal languages and automata; the relation between thought, language and reality; I-language, meaning, truth, sense and reference, virtual conceptual necessity, dualism and methodological minimalism. Discussion of the development of linguistic theory from Cartesian rationalism to the biocognitive approach within modern and contemporary scientific thinking.

**LING 5110. FOUNDATIONAL ISSUES IN BIOLINGUISTICS.** Three credit hours. One and a half hours of lecture and one and a half hours of seminar per week. Prerequisites: ((LING 4010 and ESPA 4202) or ESHI 6027 or INGL 3225) or authorization of the Director of the Department.

Critical review and analysis of the canonical issues and debates in biolinguistics such as the biological factors in language design, the architecture of the language faculty, universal grammar, recursion and innatism in language acquisition and development, linguistic competence within a comparative ethological context, the nature of the genetic endowment and evolution of the language faculty, the neurological implementation and computational models of the language components and interfaces. Discussion of the contributions of anthropology, psychology, molecular and evolutionary biology, neuroscience, and computational sciences to problems in theoretical linguistics, as well as the implications of findings in biolinguistics for some controversies in these disciplines.

**LING 5120. PSYCHOLINGUISTICS.** Three credit hours. One and a half hours of lectures and one and a half hours of seminar per week. Prerequisites: LING 4010 or ESPA 4201 or INGL 3225 or authorization of the Director of the Department.

Introduction to the study of the mental representations and processes involved in language implementation, including the comprehension, production and storage of spoken and written linguistic information. Survey of sentential, discursive and conversational structure processing models. Exploration of the psychological reality of linguistic representations. Discussion of the contributions of psychology, computational sciences and Artificial Intelligence to problems in the design of models of natural language processing, as well as the implications of findings in psycholinguistics for some controversies in these disciplines.

**LING 5170. BILINGUALISM AND SECOND LANGUAGE ACQUISITION IN CHILDREN.** Three credit hours. Three hours of lecture per week. Prerequisites: LING 4010 and INGL 3225 or authorization of the Director of the Department.

Exploration of language development in bilingual and second language acquisition in children. Survey of research and theoretical perspectives in bilingualism, second language acquisition, heritage language, and foreign language learning. Analysis of children's language data in the different linguistic components: lexicon, phonology, morphology, syntax, and semantics. Discussion of existing myths about bilingual acquisition in children. Examination of the possible effects of bilingualism on a child's academic achievement, cognitive development, and first language development.

## DEPARTMENT OF HUMANITIES

The Department of Humanities offers five programs leading to the Bachelor of Arts degree: Plastic Arts, Theory of Art, Comparative Literature, Philosophy, and French Language and Literature. Also, it offers Curricular Sequences in Art, French and Francophone Literature, Italian, Comparative Literature, and Music; as well as a Minor Concentration in Practical and Professional Ethics. In addition to the courses related to these areas, the Department also offers the two-semester survey course in Western culture, which is a requirement for most students at UPRM and a variety of modern languages, drama, religion and Asian culture courses, among others.

Department facilities include an art gallery, a theatre, a lecture hall, a computer laboratory, a specialized library and a study room for our majors.

### Mission and Vision

The mission of the Department of Humanities is to cultivate an appreciation of the diversity of human culture by examining and analyzing the artistic and intellectual achievements of humanity. The Department endeavors to foster students to think critically across disciplines so as to stimulate the development of intellectual curiosity, to be able to form sound intellectual judgments and ethical values, and to be creative and innovative. The faculty of the Humanities Department emphasizes the study of multiple cultural expressions, especially those that open new avenues for research, and how these relate to the Puerto Rican cultural reality.

The integration of a liberal arts program with professional learning provides knowledge, skills, and values needed to be a responsible, successful, and creative citizen. The Department provides educational programs, public cultural events, and community services that enhance the quality of life for the people of Puerto Rico.

### STUDENT LEARNING OUTCOMES

#### Plastic Arts

Graduates of this program possess the skills necessary for the creative execution of ideas of a visual character in traditional and non-traditional media. Furthermore, they become professionals with a balanced technical and theoretical knowledge in aesthetics, art criticism, and history of art. This program is directed to prepare

and educate artists, art educators and illustrators. The graduate of this program might direct his or her employment search toward professions such as: art education, graphic design, medical illustration, graphic illustration, sculpture, painting, and graphic arts.

#### Theory of Art

Graduates of this program develop the perception and the sensibility for esthetic values. They succeed in the appreciation and evaluation of diverse works of art and apply their knowledge to the criticism of art. Graduates of this program can pursue doctoral studies in theory of art, art criticism, or philosophy. Some become teachers of the history of culture and of art, art critics, directors of museums and galleries, curators and restaurateurs.

#### Philosophy

Graduates of philosophy have an ample preparation in the history of philosophy. The program emphasizes on the formulation of problems and questions that emerge in the context of contemporary life. Students develop rigorous critical thinking skills and skills of argumentation and written and verbal expression. They develop a commitment to the search for truth that philosophical life requires. Graduates go on to become teachers, to pursue doctoral studies in philosophy, or to engage in post baccalaureate fields such as law, journalism, and public administration.

#### French Language and Literature

The graduate of French Language and Literature is capable of standing out in the professional worlds of tourism, travel, editing, publishing, and education, among others. Many graduates continue with graduate studies in French, linguistics, communications, law and international affairs. Students' knowledge of the language, culture, and history of France and francophone countries together with knowledge of other languages such as English, German and Italian prepare them to enter diverse fields in the professional world and to continue postgraduate studies in the disciplines of the humanities.

#### Comparative Literature

Graduates from the Program in Comparative Literature possess a variety of skills in reading, writing, oral expression, and literary analysis. In other words, they raise critical issues and propose hypotheses that enrich literary studies and cultural reflection in diverse contexts, eras, and languages. Our

graduates also exhibit an ability to articulate comparative connections with various disciplines such as: anthropology, cinema, philosophy, religion, history, and sociology. This multidisciplinary focus allows the students to choose from a range of graduate programs in areas such as law, library science, and publishing. They are also trained in a variety of critical theories and analytic interdisciplinary approaches. Our students are able to effectively take up positions in careers related to education and academic research. However, their flexibility and mastery of diverse theories and analytic strategies allow them to be desirable candidates in any professional career.

## BACHELOR OF ARTS IN COMPARATIVE LITERATURE

### Summary of Credits in Program

|                           |            |
|---------------------------|------------|
| Faculty requirements      | 56         |
| Departmental requirements |            |
| Major area                | 39         |
| Non-major area            | 18         |
| Recommended electives     | 12         |
| Free electives            | <u>12</u>  |
| <b>Total</b>              | <b>137</b> |

### PROGRAM OF STUDY

#### COMPARATIVE LITERATURE CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits  | Course                       |
|------------|----------|------------------------------|
| HUMA 3111  | 3        | Intro. to Western Culture I  |
| ITAL ____  | 3        | First year course            |
| or         |          |                              |
| FRAN ____  | 3        | First year course            |
| or         |          |                              |
| ALEM ____  | 3        | First year course            |
| *INGL 3__  | 3        | First year course in English |
| *ESPA 3101 | 3        | Basic course in Spanish I    |
| *MATE 3171 | 3        | Pre-Calculus I               |
| or         |          |                              |
| *MATE 3086 | 3        | Mathematical Reasoning       |
| EDFI ____  | <u>1</u> | Course in Physical Education |
|            | 16       |                              |

#### Second Semester

| Number      | Credits  | Course                       |
|-------------|----------|------------------------------|
| HUMA 3112   | 3        | Intro. to Western Culture II |
| ITAL ____   | 3        | First year course            |
| or          |          |                              |
| FRAN ____   | 3        | First year course            |
| or          |          |                              |
| ALEM ____   | 3        | First year course            |
| *INGL 3--   | 3        | First year course in English |
| *ESPA 3102  | 3        | Basic course in Spanish II   |
| **MATE ____ | 3        | Recommended course           |
| or          |          |                              |
| COMP ____   | 3        | Recommended course           |
| or          |          |                              |
| ESMA ____   | 3        | Recommended course           |
| EDFI ____   | <u>1</u> | Course in Physical Education |
|             | 16       |                              |

#### SECOND YEAR

##### First Semester

| Number    | Credits  | Course                              |
|-----------|----------|-------------------------------------|
| LITE 3025 | 3        | Literary Theory                     |
| LITE 3041 | 3        | Intro. to Comparative Literature    |
| ITAL ____ | 3        | Second year course                  |
| or        |          |                                     |
| FRAN ____ | 3        | Second year course                  |
| or        |          |                                     |
| ALEM ____ | 3        | Second year course                  |
| *INGL 3__ | 3        | Second year course in English       |
| *ESPA 3__ | 3        | Course above level of basic Spanish |
| ELECTIVE  | <u>3</u> | Free Electives                      |
|           | 18       |                                     |

##### Second Semester

| Number    | Credits  | Course                              |
|-----------|----------|-------------------------------------|
| LITE 3035 | 3        | Mythology in Western Literature     |
| LITE 3042 | 3        | Intro. to Comparative Literature    |
| ITAL ____ | 3        | Second year course                  |
| or        |          |                                     |
| FRAN ____ | 3        | Second year course                  |
| or        |          |                                     |
| ALEM ____ | 3        | First year course                   |
| *INGL 3__ | 3        | Second year course in English       |
| ESPA 3__  | 3        | Course above level of basic Spanish |
| ELECTIVE  | <u>3</u> | Free Electives                      |
|           | 18       |                                     |

### THIRD YEAR

#### First Semester

| Number    | Credits  | Course                                  |
|-----------|----------|---|
| LITE 4011 | 3        | Evolution of the Novel I                |
| LITE 4021 | 3        | Comparative Drama I                     |
| FILO 3001 | 3        | Intro. to Philosophy I: Major Questions |
| QUIM ____ | 3        | Electives                               |
| or        |          |   |
| FISI ____ | 3        | Electives                               |
| or        |          |   |
| GEOL ____ | 3        | Electives                               |
| + ____    | 3        | Social Sciences or Economics            |
| ELECTIVE  | <u>3</u> | Free Electives                          |
|           | 18       |   |

#### Second Semester

| Number    | Credits  | Course                                    |
|-----------|----------|---|
| LITE 4012 | 3        | Evolution of the Novel II                 |
| LITE 4022 | 3        | Comparative Drama II                      |
| FILO 3002 | 3        | Intro. to Philosophy: Historical Approach |
| QUIM ____ | 3        | Electives                                 |
| or        |          |   |
| FISI ____ | 3        | Electives                                 |
| or        |          |   |
| GEOL ____ | 3        | Electives                                 |
| + ____    | 3        | Social Sciences or Economics              |
| ELECTIVE  | <u>3</u> | Free Electives                            |
|           | 18       |   |

### FOURTH YEAR

#### First Semester

| Number    | Credits  | Course                              |
|-----------|----------|-------------------------------------|
| LITE 4051 | 3        | Comparative Poetry I                |
| LITE 4991 | 1        | Undergraduate Research I            |
| LITE ____ | 3        | Elective in Comparative Literature  |
| CIBI 3031 | 3        | Intro. to the Biological Sciences I |
| HIST ____ | 3        | Elective in History                 |
| ELECTIVE  | <u>3</u> | Elective in a National Literature   |
|           | 16       |                                     |

#### Second Semester

| Number    | Credits  | Course                               |
|-----------|----------|--------------------------------------|
| LITE 4052 | 3        | Comparative Poetry II                |
| LITE 4992 | 2        | Undergraduate Research II            |
| LITE ____ | 3        | Elective in Comparative Literature   |
| CIBI 3032 | 3        | Intro. to the Biological Sciences II |
| HIST ____ | 3        | Elective in History                  |
| ELECTIVE  | <u>3</u> | Elective in a National Literature    |
|           | 17       |                                      |

### Total credits required: 137

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*MATE 3000, MATE 3172, COMP 3010, COMP 3057, ESMA 3015 or ESMA 3101.

+ Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI 3261-3262, SOCI 3315, or ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

### BACHELOR OF ARTS IN FRENCH LANGUAGE AND LITERATURE

#### Summary of Credits in Program

|   |            |
|---|------------|
| Faculty requirements                                    | 56         |
| Departmental requirements                               |            |
| Major area  | 44         |
| Non-major area  | 12         |
| Recommended electives                                   | 6          |
| Recommended electives in another language or literature | 6          |
| Free electives  | <u>13</u>  |
| <b>Total</b>  | <b>137</b> |

### PROGRAM OF STUDY

#### FRENCH LANGUAGE AND LITERATURE CURRICULUM

#### FIRST YEAR

##### First Semester

| Number       | Credits  | Course                       |
|--------------|----------|------------------------------|
| FRAN 3141    | 3        | French I                     |
| HUMA 3111    | 3        | Intro. to Western Culture I  |
| *INGL 3 ____ | 3        | First year course in English |
| *ESPA 3101   | 3        | Basic course in Spanish I    |
| *MATE 3171   | 3        | Pre-Calculus I               |
| ____ or      |          |                              |
| MATE 3086    | 3        | Mathematical Reasoning       |
| EDFI ____    | <u>1</u> | Course in Physical Education |
|              | 16       |                              |

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**Second Semester**

| Number       | Credits | Course                       |
|--------------|---------|------------------------------|
| FRAN 3142    | 3       | French II                    |
| HUMA 3112    | 3       | Intro. to Western Culture II |
| *INGL 3 ____ | 3       | First year course in English |
| *ESPA 3102   | 3       | Basic course in Spanish II   |
| **MATE ____  | 3       | Recommended course           |
| or           |         |                              |
| COMP ____    | 3       | Recommended course           |
| or           |         |                              |
| ESMA 3171    | 3       | Recommended course           |
| EDFI ____    | 1       | Course in Physical Education |
|              | 16      |                              |

**SECOND YEAR****First Semester**

| Number      | Credits | Course                              |
|-------------|---------|-------------------------------------|
| FRAN 3143   | 3       | French III                          |
| FRAN 3060   | 3       | French Phonetics                    |
| LATI 3011   | 3       | Elementary Latin                    |
| INGL 3 ____ | 3       | Second year course in English       |
| ESPA 3 ____ | 3       | Course above level of basic Spanish |
| ELECTIVE    | 3       | Free elective                       |
|             | 18      |                                     |

**Second Semester**

| Number       | Credits | Course                              |
|--------------|---------|-------------------------------------|
| FRAN 3144    | 3       | French IV                           |
| FRAN 3155    | 3       | Conversation I                      |
| LATI 3012    | 3       | Elementary Latin                    |
| ^INGL 3 ____ | 3       | Second year course in English       |
| ESPA 3 ____  | 3       | Course above level of basic Spanish |
| ELECTIVE     | 3       | Free elective                       |
|              | 18      |                                     |

**THIRD YEAR****First Semester**

| Number    | Credits | Course                                      |
|-----------|---------|---|
| FRAN 4181 | 3       | French Literature to the Revolution         |
| FRAN 4115 | 3       | French Composition                          |
| FRAN 4151 | 3       | French Culture & Civilization               |
| FILO 3001 | 3       | Introduction to Philosophy: Major Questions |
| FISI ____ | 3       | Elective                                    |
| or        |         |   |
| QUIM ____ | 3       | Elective                                    |
| or        |         |   |
| GEOL ____ | 3       | Elective                                    |
| ELECTIVE  | 3       | Free elective                               |
|           | 18      |   |

**Second Semester**

| Number    | Credits | Course  |
|-----------|---------|---|
| FRAN 4182 | 3       | French Literature to the Revolution             |
| FRAN 4116 | 3       | Conversation II                                 |
| FRAN 4152 | 3       | French Culture & Civilization                   |
| FILO 3002 | 3       | Introduction to Philosophy: Historical Approach |
| FISI ____ | 3       | Elective  |
| or        |         |   |
| QUIM ____ | 3       | Elective  |
| or        |         |   |
| GEOL ____ | 3       | Elective  |
| ELECTIVE  | 3       | Free elective                                   |
|           | 18      |   |

**FOURTH YEAR****First Semester**

| Number    | Credits | Course                                     |
|-----------|---------|--|
| FRAN 4191 | 3       | French Literature since the Revolution     |
| FRAN 4236 | 1       | Undergraduate Research I                   |
| CIBI 3031 | 3       | Intro. to the Biological Sciences          |
| + ____    | 3       | Social Sciences or Economics               |
| ELECTIVE  | 3       | Recommended elective                       |
| ELECTIVE  | 3       | Elective in another language or literature |
| ELECTIVE  | 1       | Free elective                              |
|           | 17      |  |

**Second Semester**

| Number    | Credits | Course                                     |
|-----------|---------|--|
| FRAN 4192 | 3       | French Literature since the Revolution     |
| FRAN 4237 | 1       | Undergraduate Research II                  |
| CIBI 3032 | 3       | Intro. to the Biological Sciences II       |
| + ____    | 3       | Social Sciences or Economics               |
| ELECTIVE  | 3       | Recommended elective                       |
| ELECTIVE  | 3       | Elective in another language or literature |
|           | 16      |  |

**Total credits required: 137**

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*MATE 3000, MATE 3172, COMP 3010, COMP 3057, ESMA 3015, or ESMA 3101.

+ Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI 3261-3262, SOCI 3315, or ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## BACHELOR OF ARTS IN PHILOSOPHY

### Summary of Credits in Program

|                           |            |
|---------------------------|------------|
| Faculty requirements      | 56         |
| Departmental requirements |            |
| Major area                | 38         |
| Non-major area            | 18         |
| Recommended electives     | 9          |
| Free electives            | <u>19</u>  |
| <b>Total</b>              | <b>140</b> |

### PROGRAM OF STUDY

#### PHILOSOPHY CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits  | Course                                |
|------------|----------|---------------------------------------|
| FILO 3001  | 3        | Intro. to Philosophy: Major Questions |
| HUMA 3111  | 3        | Intro. to Western Culture I           |
| *ING 3____ | 3        | First year course in English          |
| *ESPA 3101 | 3        | Basic course in Spanish I             |
| *MATE 3171 | 3        | Pre-Calculus I                        |
| + _____    | <u>3</u> | Social Sciences or Economics          |
|            | 18       |                                       |

##### Second Semester

| Number     | Credits  | Course                                    |
|------------|----------|---|
| FILO 3002  | 3        | Intro. to Philosophy: Historical Approach |
| HUMA 3112  | 3        | Intro. to Western Culture II              |
| *ING 3____ | 3        | First year course in English              |
| *ESPA 3102 | 3        | Basic course in Spanish II                |
| *MATE 3172 | 3        | Pre-Calculus II                           |
| + _____    | <u>3</u> | Social Sciences or Economics              |
|            | 18       |   |

#### SECOND YEAR

##### First Semester

| Number     | Credits  | Course                              |
|------------|----------|-------------------------------------|
| FILO 3157  | 3        | Intro. to Logic                     |
| FILO 3158  | 3        | Ancient Philosophy                  |
| FRAN 3141  | 3        | French I                            |
| or         |          |                                     |
| ALEM 3041  | 3        | German I                            |
| INGL 3____ | 3        | Second year course in English       |
| ESPA 3____ | 3        | Course above level of basic Spanish |
| FISI_____  | 3        | Elective                            |
| or         |          |                                     |
| QUIM_____  | 3        | Elective                            |
| or         |          |                                     |
| GEOL _____ | <u>3</u> | Elective                            |
|            | 18       |                                     |

#### Second Semester

| Number      | Credits  | Course                              |
|-------------|----------|-------------------------------------|
| FILO 3159   | 3        | Medieval Philosophy                 |
| FRAN 3142   | 3        | French II                           |
| or          |          |                                     |
| ALEM 3042   | 3        | German II                           |
| ^INGL 3____ | 3        | Second year course in English       |
| ESPA 3____  | 3        | Course above level of basic Spanish |
| HIST 3202   | 3        | Modern World History II             |
| or          |          |                                     |
| HIST 3195   | 3        | History of the Ancient World        |
| FISI_____   | 3        | Elective                            |
| or          |          |                                     |
| QUIM_____   | 3        | Elective                            |
| or          |          |                                     |
| GEOL _____  | <u>3</u> | Elective                            |
|             | 18       |                                     |

#### THIRD YEAR

##### First Semester

| Number    | Credits  | Course                              |
|-----------|----------|-------------------------------------|
| FILO 3155 | 3        | Intro. to Ethics                    |
| FILO 3165 | 3        | Modern Philosophy                   |
| FRAN 3143 | 3        | French III                          |
| or        |          |                                     |
| ALEM 3043 | 3        | German III                          |
| or        |          |                                     |
| GRIE 3011 | 3        | Elementary Greek                    |
| or        |          |                                     |
| LATI 3011 | 3        | Elementary Latin                    |
| PSIC 3001 | 3        | Principles of Psychology I          |
| CIBI 3031 | 3        | Intro. to the Biological Sciences I |
| ELECTIVE  | <u>3</u> | Free elective                       |
|           | 18       |                                     |

##### Second Semester

| Number    | Credits  | Course                               |
|-----------|----------|--------------------------------------|
| FILO 3166 | 3        | Contemporary Philosophy              |
| FILO 4041 | 3        | Metaphysics I                        |
| or        |          |                                      |
| FILO 4146 | 3        | Contemporary Epistemology            |
| FRAN 3144 | 3        | French IV                            |
| or        |          |                                      |
| ALEM 3044 | 3        | German IV                            |
| or        |          |                                      |
| GRIE 3012 | 3        | Elementary Greek                     |
| or        |          |                                      |
| LATI 3012 | 3        | Elementary Latin                     |
| PSIC 3002 | 3        | Principles of Psychology II          |
| CIBI 3032 | 3        | Intro. to the Biological Sciences II |
| ELECTIVE  | <u>3</u> | Free elective                        |
|           | 18       |                                      |

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**FOURTH YEAR****First Semester**

| Number    | Credits | Course                               |
|-----------|---------|--------------------------------------|
| FILO 3167 | 3       | Symbolic Logic I                     |
| FILO 4146 | 3       | Contemporary Epistemology            |
| or        |         |                                      |
| FILO 4041 | 3       | Metaphysics I                        |
| FILO 4991 | 1       | Undergraduate Research I             |
| FILO ____ | 3       | Third or fourth level course in FILO |
| EDFI ____ | 1       | Basic course in Physical Education   |
| ELECTIVE  | 6       | Free elective                        |
|           | 17      |                                      |

**Second Semester**

|           |    |                                      |
|-----------|----|--------------------------------------|
| FILO 4992 | 1  | Undergraduate Research II            |
| FILO ____ | 3  | Third or fourth level course in FILO |
| FILO ____ | 3  | Elective in Philosophy               |
| EDFI ____ | 1  | Basic course in Physical Education   |
| ELECTIVE  | 7  | Free elective                        |
|           | 15 |                                      |

**Total credits required: 140**

\*Refer to the Academic Regulations section for information on Advanced Placement.

+ Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI 3261-3262, SOCI 3315, or ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

**BACHELOR OF ARTS IN PLASTIC ARTS****Summary of Credits in Programs**

|                           |            |
|---------------------------|------------|
| Faculty requirements      | 56         |
| Departmental requirements |            |
| Major area                | 46         |
| Non-major area            | 18         |
| Recommended electives     | 6          |
| Free electives            | 14         |
| <b>Total</b>              | <b>140</b> |

**PROGRAM OF STUDY****PLASTIC ARTS CURRICULUM****FIRST YEAR****First Semester**

| Number      | Credits | Course                       |
|-------------|---------|------------------------------|
| HUMA 3111   | 3       | Intro. to Western Culture I  |
| *ING 3 ____ | 3       | First year course in English |
| *ESPA 3101  | 3       | Basic course in Spanish I    |
| ARTE 3121   | 3       | Drawing                      |
| *MATE 3171  | 3       | Pre-Calculus I               |
| or          |         |                              |
| MATE 3086   | 3       | Mathematical Reasoning       |
| EDFI ____   | 1       | Course in Physical Education |
| ELECTIVE    | 2       | Free elective                |
|             | 18      |                              |

**Second Semester**

| Number      | Credits | Course                       |
|-------------|---------|------------------------------|
| HUMA 3112   | 3       | Intro. to Western Culture II |
| *ING 3 ____ | 3       | First year course in English |
| *ESPA 3102  | 3       | Basic course in Spanish II   |
| ARTE 3132   | 3       | Color                        |
| **MATE ____ | 3       | Recommended course           |
| or          |         |                              |
| **COMP ____ | 3       | Recommended course           |
| or          |         |                              |
| **ESMA ____ | 3       | Recommended course           |
| **MATE 3086 | 3       | Mathematical Reasoning       |
| EDFI ____   | 1       | Course in Physical Education |
| ELECTIVE    | 2       | Free elective                |
|             | 18      |                              |

**SECOND YEAR****First Semester**

| Number      | Credits | Course                              |
|-------------|---------|-------------------------------------|
| ARTE 3141   | 3       | Design Workshop                     |
| ARTE 3151   | 3       | Fundamentals of Art Theory          |
| FRAN 3141   | 3       | French I                            |
| or          |         |                                     |
| ITAL 3071   | 3       | Italian I                           |
| or          |         |                                     |
| ALEM ____   | 3       | First year course                   |
| INGL 3 ____ | 3       | Second year course in English       |
| ESPA 3 ____ | 3       | Course above level of basic Spanish |
| CIBI 3031   | 3       | Intro. to the Biological Sciences   |
|             | 18      |                                     |

## Second Semester

| Number       | Credits  | Course                              |
|--------------|----------|-------------------------------------|
| ARTE 3122    | 3        | Painting                            |
| ARTE 3152    | 3        | Theoretical Bases of Modern Art     |
| FRAN 3142    | 3        | French II                           |
| or           |          |                                     |
| ITAL 3072    | 3        | Italian II                          |
| ^INGL 3 ____ | 3        | Second year course in English       |
| ESPA 3 ____  | 3        | Course above level of basic Spanish |
| CIBI 3032    | <u>3</u> | Intro. to the Biological Sciences   |
|              | 18       |                                     |

## THIRD YEAR

### First Semester

| Number    | Credits  | Course                                |
|-----------|----------|---------------------------------------|
| ARTE 4251 | 3        | Printmaking I                         |
| ARTE 4271 | 3        | History of Art: Paleolithic to Roman  |
| + ____    | 3        | Social Sciences or Economics          |
| FRAN 3143 | 3        | French III                            |
| or        |          |                                       |
| ITAL 3073 | 3        | Italian III                           |
| FILO 3001 | 3        | Intro. to Philosophy: Major Questions |
| FISI ____ | 3        | Elective                              |
| or        |          |                                       |
| QUIM ____ | 3        | Elective                              |
| or        |          |                                       |
| GEOL ____ | <u>3</u> | Elective                              |
|           | 18       |                                       |

### Second Semester

| Number    | Credits  | Course                                     |
|-----------|----------|--|
| ARTE 4291 | 3        | Elementary Sculpture                       |
| ARTE 4272 | 3        | History of Art: Early Christian to Baroque |
| + ____    | 3        | Social Sciences or Economics               |
| FRAN 3144 | 3        | French IV                                  |
| or        |          |  |
| ITAL 3074 | 3        | Italian IV                                 |
| FILO 3002 | 3        | Intro. to Philosophy: Historical Approach  |
| FISI ____ | 3        | Elective                                   |
| or        |          |  |
| QUIM ____ | 3        | Elective                                   |
| or        |          |  |
| GEOL ____ | <u>3</u> | Elective                                   |
|           | 18       |  |

## FOURTH YEAR

### First Semester

| Number       | Credits  | Course                |
|--------------|----------|-----------------------|
| ***ARTE ____ | 3        | Elective in Art       |
| ARTE 4259    | 3        | History of Modern Art |
| ARTE 4321    | 2        | Art Seminar I         |
| HIST ____    | 3        | Elective in History   |
| ELECTIVE     | <u>5</u> | Electives             |
|              | 16       |                       |

## Second Semester

| Number       | Credits  | Course                      |
|--------------|----------|-----------------------------|
| ***ARTE ____ | 3        | Elective in Art             |
| ARTE 4335    | 3        | History of Contemporary Art |
| ARTE 4322    | 2        | Art Seminar II              |
| HIST ____    | 3        | Elective in History         |
| ELECTIVE     | <u>5</u> | Electives                   |
|              | 16       |                             |

### Total credits required: 140

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*MATE 3000, MATE 3172, COMP 3010, COMP 3057, ESMA 3015 or ESMA 3101.

\*\*\*Suggested courses: ARTE 4252, ARTE 4292.

+ Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI 3261-3262, SOCI 3315, or ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## BACHELOR OF ARTS IN THEORY OF ART

### Summary of Credits in Program

|                           |            |
|---------------------------|------------|
| Faculty requirements      | 56         |
| Departmental requirements |            |
| Major area                | 34         |
| Non-major area            | 24         |
| Recommended electives     | 12         |
| Free electives            | <u>14</u>  |
| <b>Total</b>              | <b>140</b> |

## PROGRAM OF STUDY

### THEORY OF ART CURRICULUM

#### FIRST YEAR

##### First Semester

| Number       | Credits | Course                       |
|--------------|---------|------------------------------|
| HUMA 3111    | 3       | Intro. to Western Culture I  |
| *INGL 3 ____ | 3       | First year course in English |
| *ESPA 3101   | 3       | Basic course in Spanish I    |
| + ____       | 3       | Social Sciences or Economics |
| *MATE 3171   | 3       | Pre-Calculus I               |
| or           |         |                              |



MATE 3086 3 Mathematical Reasoning  
EDFI \_\_\_\_ 1 Course in Physical Education  
16

### Second Semester

Number Credits Course

HUMA 3112 3 Intro. to Western Culture II  
\*INGL 3 \_\_\_\_ 3 First year course in English  
\*ESPA 3102 3 Basic course in Spanish II  
+ \_\_\_\_ 3 Social Sciences or Economics  
\*\*MATE \_\_\_\_ 3 Recommended course  
or  
\*\*COMP \_\_\_\_ 3 Recommended course  
or  
\*\*ESMA \_\_\_\_ 3 Recommended course  
EDFI \_\_\_\_ 1 Course in Physical Education  
16

### SECOND YEAR

#### First Semester

Number Credits Course

ARTE 3151 3 Fundamentals of Art Theory  
FRAN 3141 3 French I  
or  
ITAL 3071 3 Italian I  
FILO 3001 3 Intro. To Philosophy: Major Questions  
INGL 3 \_\_\_\_ 3 Second year course in English  
ESPA 3 \_\_\_\_ 3 Course above level of basic Spanish  
CIBI 3031 3 Intro. to the Biological Sciences I  
18

#### Second Semester

Number Credits Course

ARTE 3152 3 Theoretical Bases of Modern Art  
FRAN 3142 3 French II  
or  
ITAL 3072 3 Italian II  
FILO 3002 3 Intro. to Philosophy: Historical Approach  
\*INGL 3 \_\_\_\_ 3 Second year course in English  
ESPA 3 \_\_\_\_ 3 Course above level of basic Spanish  
CIBI 3032 3 Intro. to the Biological Sciences II  
18

### THIRD YEAR

#### First Semester

Number Credits Course

ARTE 4271 3 History of Art: Paleolithic to Roman  
FILO 4051 3 Principles of Aesthetics  
FRAN 3143 3 French III  
or  
ITAL 3073 3 Italian III  
ARTE 3226 3 History of Art in Puerto Rico

HIST \_\_\_\_ 3 Elective in History  
FISI \_\_\_\_ 3 Elective

or

QUIM \_\_\_\_ 3 Elective

or

GEOL \_\_\_\_ 3 Elective  
18

### Second Semester

Number Credits Course

ARTE 4272 3 History of Art: Early Christian to Baroque  
FILO 4052 3 Contemporary Aesthetics  
FRAN 3144 3 French IV  
or  
ITAL 3074 3 Italian IV  
ARTE \_\_\_\_ 3 Elective in Art  
HIST \_\_\_\_ 3 Elective in History  
FISI \_\_\_\_ 3 Elective  
or  
QUIM \_\_\_\_ 3 Elective  
or  
GEOL \_\_\_\_ 3 Elective  
18

### FOURTH YEAR

#### First Semester

Number Credits Course

ARTE 4259 3 History of Modern Art  
ARTE 4311 3 Art Criticism  
ARTE 4321 2 Art Seminar I  
ARTE \_\_\_\_ 3 Electives in Art  
ELECTIVES 7 Free Electives  
18

#### Second Semester

Number Credits Course

ARTE 4335 3 History of Contemporary Art  
ARTE \_\_\_\_ 3 Electives in Art  
ARTE 4322 2 Art Seminar II  
ARTE \_\_\_\_ 3 Electives in Art  
ELECTIVES 7 Free Electives  
18

### Total credits required: 140

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*MATE 3000, MATE 3172, COMP 3010, COMP 3057, ESMA 3015 or ESMA 3101.

+ Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI

3261-3262, SOCI 3315, or ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

<sup>^</sup> Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

### Curricular Sequence in Art

The Curricular Sequence in Art will provide students with a reasonable knowledge and skills in a selected area of the Visual Arts. The students will start taking basic courses that include history, theory, and the basic skill of drawing. Afterward, they have the option to follow different tracks, according to their own interests and the availability of courses in this Campus. The already established prerequisites in each course will guide the students through the different alternatives.

### Objectives

Upon completion of the sequence, students will be able to:

- Identify methods and techniques in the visual arts.
- Identify the artistic heritage and value the importance of preserving it.
- Recognize differences in the art of different cultures.
- Develop basic skills in drawing.
- Learn to use the elements of visual composition applied to the technique of drawing.
- Through the elective courses, students can develop their creative skills or expand their theoretical knowledge in the art.

### Requirements:

- Enrolled in any program, except Plastic Arts or Theory of Art.
- Satisfactory academic progress, according to standards established by the institution.
- Grade point average equal or greater than required retention index.
- Not in probation.
- No more than one grade of "W" in the same course of ART.
- No failed courses of ART prior to application.
- Favorable recommendation from the Coordinator of the Curricular Sequence in Art, or the Director of the Department.

It is recommended to submit application during the second year of the study program.

### Required courses:

Students may take up to 3 credits in each of the rows in the following table:

| Course    | Title                                      | Crs. |
|-----------|--|------|
| ARTE 3276 | ART APPRECIATION                           | 3    |
| ARTE 3121 | DRAWING                                    | 3    |
| ARTE 3151 | FUNDAMENTALS OF ART THEORY                 | 3    |
| ARTE 3152 | THEORETICAL BASES OF MODERN ART            |      |
| ARTE 3226 | HISTORY OF ART IN PUERTO RICO              |      |
| ARTE 3122 | PAINTING                                   | 6    |
| ARTE 3131 | PERSPECTIVE IN ART                         |      |
| ARTE 3141 | DESIGN WORKSHOP                            |      |
| ARTE 3161 | STAINED GLASS                              |      |
| ARTE 3200 | STUDY OF THE HUMAN FIGURE                  |      |
| ARTE 3235 | WATERCOLOR                                 |      |
| ARTE 3531 | COMPUTERS IN THE VISUAL ARTS I             |      |
| ARTE 4021 | CERAMICS                                   |      |
| ARTE 4022 | POTTERY                                    |      |
| ARTE 4123 | ILLUSTRATION I                             |      |
| ARTE 4251 | PRINTMAKING I                              |      |
| ARTE 4271 | HISTORY OF ART: PALEOLITHIC TO ROMAN       |      |
| ARTE 4281 | SPANISH AMERICAN I                         |      |
| ARTE 4291 | ELEMENTARY SCULPTURE                       |      |
| ARTE 4301 | INDUSTRIAL DESIGN                          |      |
| ARTE 4995 | SPECIAL TOPICS <sup>1</sup>                |      |
| ARTE 3007 | ARTISTIC PHOTOGRAPHY                       | 3    |
| ARTE 3055 | CALIGRAPHY                                 |      |
| ARTE 3132 | COLOR                                      |      |
| ARTE 3142 | DESIGN WORKSHOP                            |      |
| ARTE 3162 | STAINED GLASS                              |      |
| ARTE 3210 | PORTRAIT STUDY                             |      |
| ARTE 3279 | EXPERIMENTATION WITH ART MATERIALS         |      |
| ARTE 3532 | COMPUTERS IN THE VISUAL ARTS II            |      |
| ARTE 4124 | ILLUSTRATION II                            |      |
| ARTE 4252 | PRINTMAKING II                             |      |
| ARTE 4272 | HISTORY OF ART: EARLY CHRISTIAN TO BAROQUE |      |
| ARTE 4282 | HISTORY OF THE FINE ARTS IN LATIN AMERICA  |      |
| ARTE 4292 | INTERMEDIATE SCULPTURE                     |      |
| ARTE 4302 | INDUSTRIAL DESIGN                          |      |
| ARTE 4311 | ART CRITICISM I                            |      |
| ARTE 4535 | ADVANCE PAINTING                           |      |
| ARTE 4996 | SPECIAL TOPICS <sup>2</sup>                |      |
| TOTAL     |  | 15   |

<sup>1</sup>Variable credit course. Can take up to 9 credits.

<sup>2</sup>Variable credit course. Can take up to 9 credits.

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## **Curricular Sequence in French and Francophone Literature and Culture**

### **Description**

The purpose of the Curricular Sequence in French and Francophone Literature and Culture is to enable students to attain an advanced level of competency in speaking, listening, reading, and writing French. It will provide them with a comprehensive knowledge of the history, contemporary culture, and institutions of France and the francophone world. This program stresses both practical and humanistic goals, introducing the student to the rich cultural and literary tapestry of the French-speaking world. The curricular sequence in French and Francophone literature and culture is not considered as an end in itself, but as a vehicle for students' broader and more informed participation in their chosen fields.

### **Objectives**

- To develop advanced-high proficiency in French in all four language skills: listening, reading, speaking, and writing.
- To better understand the French and Francophone world and its cultural, economic, political, and social issues.
- To acquire a critical appreciation of literature written in French.
- To develop an appreciation of the diversity of French and Francophone cultures.
- To acquire the tools necessary for learning, understanding, and appreciating the culture, arts, and institutions of French and Francophone countries.

### **Minimum Student Requirements**

Students who wish to enter into the Curricular Sequence in French and Francophone Literature and Culture should be active students in the University of Puerto Rico, Mayagüez Campus with a minimum GPA of 2.5 at the moment of requesting entrance to the program.

- Submit the application for the Curricular Sequence in the Registrar's Office.

The Director of the Humanities Department, in conjunction with the French Coordinator, will evaluate the requests for admission. Students should obtain advisement from the Coordinator of the French Program so as to understand the sequence requirements.

The students should complete the "Request for the Certificate in French and Francophone Literature and Culture," which will be available Registrar's Office. The Director of the Humanities Department, in conjunction with the French Coordinator, will evaluate the requests for admission. Students should obtain advisement from the Coordinator of the French Program so as to understand the sequence requirements.

The final dates of submissions for admission to the program are subject to the dates for Readmission and Internal Transfer established every year by the administrative board.

The sequence consists of 24 credits, 12 of which are common to all interested students:

- FRAN 3141- FRENCH I
- FRAN 3142- FRENCH II
- FRAN 3143- FRENCH III
- FRAN 3144- FRENCH IV

The remaining 12 credits needed to complete the sequence are to be chosen among these courses:

The courses of French and Francophone literature, history and culture can only be taken after the students have acquire a sufficient level of French. These courses are indispensable to meet the objectives previously described. Therefore, the French program decided unanimously in its regular meeting on the 5<sup>th</sup> of October, 2006, that the said requisite is absolutely essential. It must be noted that the sequence has been organized to be completed in four years or less.

- FRAN 3135 Summer study program in Paris
- FRAN 3151 Business French I
- FRAN 4115 French composition
- FRAN 4116 French conversation II
- FRAN 4151-4152 French culture and civilization
- FRAN 4181-4182 French literature to the Revolution
- FRAN 4191-4192 French literature since the Revolution

### **Curricular Sequence in Italian**

With the Curricular Sequence in Italian, students acquire linguistic and cultural skills that allow them to communicate in written and oral Italian at an intermediate level. Such skills can be applied to different professional and academic contexts, such as the artistic and archaeological, the fields of fashion and cooking. The study of Italian can be particularly advantageous for Puerto Rican students because, as a

Romance language, Italian shares lexicon and structures with Spanish. A Sequence in Italian fosters analytical skills as it widens the students' cultural horizon through the practice of cultural difference.

### **Student Learning Outcomes:**

Upon completing the Sequence, the students should

- Have intermediate oral/aural and writing communication skills
- Recognize fundamental aspects of the culture and civilization of Italy
- Show appreciation for cultural diversity

### **Requirements:**

- Be an active student at UPRM
- Submit the application for the Curricular Sequence in the Registrar's Office
- Minimum grade point average of 2.00
- Pass 9 credits of required courses and 6 of elective courses in Italian with a minimum grade of "C" in each course
- The Certificate will be granted once the student completes graduation requirements

### **Required Courses:**

ITAL 3071 Basic Italian I  
ITAL 3072 Basic Italian II  
ITAL3073 Intermediate Italian I

### **Elective Courses (2 courses):**

ITAL 3074 Intermediate Italian II  
ITAL 3085 Italian Cinema  
ITAL 3086 Conversation in Italian  
ITAL 3087 Italian Culture  
ITAL 3090 Summer Study to Italy  
ITAL 4007 Special Topics  
ITAL4011 Italian Literature I  
ITAL 4012 Italian Literature II

### **Curricular Sequence in Comparative Literature**

The Sequence in Comparative Literature is an opportunity to acquire and develop skills in reading, research, writing, oral performance, and critical thinking that complement skills associated with any other area of knowledge. Likewise, the Sequence provides students with a solid understanding of literary and cultural studies, literary and cultural

history, and critical theory. In particular, it offers students in other areas the opportunity to complement their preparation through a planned series of courses, which allow them to strengthen necessary communication and analytical skills, as well as to deepen their understanding of various areas in the humanities that are vital for their professional performance and cultural awareness. For students majoring in other literary, linguistic and audiovisual arts the Sequence provides the opportunity to widen and diversify their field of study, and to complement their study and application of criticism with both well established and current theoretical approaches.

### **Requirements:**

- Be an active student at UPRM.
- Submit the application for the Curricular Sequence in the Office of the Registrar.
- Pass the curricular sequence courses with a minimum grade point average of 2.50.

### **Required Courses:**

LITE 3025: Literary Theory  
LITE 3041: Introduction to Comparative Literature  
LITE 3042: Introduction to Comparative Literature

### **Option A: (6 credits)**

3 credits of a course of literary genre:

LITE 4011: Evolution of the Novel I.  
LITE 4021: Comparative Drama I.  
LITE 4051: Comparative Poetry.

3 credits to continue with the same genre:

LITE 4012: Evolution of the Novel II.  
LITE 4022: Comparative Drama II.  
LITE 4052: Comparative Poetry.

### **Option B (6 credits)**

3 credits of a course of literary genre:

LITE 4011: Evolution of the Novel I.  
LITE 4021: Comparative Drama I.  
LITE 4051: Comparative Poetry.

3 credits in elective courses

LITE 3035: Mythology in Western Literature.  
LITE 4035: Medieval European Literature.  
LITE 4045: Renaissance Literature.

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LITE 4081: Romanticism in Literature.  
LITE 4118: The Modern Short Story.  
LITE 4990: Special Topics in Comparative Literature I.

### **Curricular Sequence in Music**

The Sequence in Music provides students with an opportunity to acquire and develop an appreciation of music and a panoramic understanding of Music History, Theory, and applied Piano and Voice.

#### **Learning Goals:**

Upon completing the Sequence, the students should:

- Understand the role of Music in society.
- Be able to apply their analytical and critical thinking skills to the study of Music.
- Recognize the various types of compositional styles used throughout history.
- Develop their own personal aesthetic and critical skills and be able to apply them in interdisciplinary contexts.
- Develop an appreciation of the diversity of musical styles.

#### **Requirements:**

- Be an active student or in a professional improvement program at UPRM
- Submit the application for the Curricular Sequence in the Registrar's Office
- Minimum grade point average of 2.00
- Pass the 9 credits of required courses and 6 credits of elective courses in Music with a minimum grade of "C" in each course.

The Certificate will be granted once the student completes graduation requirements

#### **Required Courses:**

MUSI 3135: Music Appreciation  
MUSI 3171: Fundamentals of Music I<sup>2</sup>  
MUSI 3172: Fundamentals of Music II

#### **Elective Courses (6 credits):**

MUSI 3005: Puerto Rican Musical Culture  
MUSI 3006: Latin American Music  
MUSI 3161: Music History I

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<sup>2</sup> Passing the competency exam will prove equivalence in the course and can exempt the student from this requirement, which will have to be replaced with 3 additional credits in elective courses. The Department offers the competency exam, which is worth a total of

MUSI 3162: Music History II  
MUSI 3167: Introduction to the Opera  
MUSI 4995: Special Topics  
FILO 4051: Principles of Aesthetics or  
FILO 4052: Contemporary Aesthetics

### **Minor in Practical and Professional Ethics**

The Minor in Practical and Professional Ethics is an opportunity for students to deeply examine their ethical obligations as citizens and future professionals.

Upon completing the minor, students will be able to:

- Distinguish between morality, ethics, and professional ethics.
- Distinguish between ethics and law and ethics and religion.
- Construct and elaborate ethical arguments.
- Identify and articulate rational arguments for and against moral absolutism and relativism.
- Analyze the ethical ramifications of current events and paradigmatic cases in professional ethics.
- Critically analyze professional codes of ethics.
- Develop the critical skills necessary to live responsibly in a multi-cultural and democratic society.
- Identify issues in social justice in the practice of their professions.

#### **Requirements**

- Be an active student or enrolled in a professional improvement program at UPRM.
- Active UPRM students should have a minimum GPA of 2.0 at the moment of requesting entrance to the Program.
- The students should complete and submit to the Registrar the "Request for Admission to the Minor in Practical and Professional Ethics" which will be available in the Humanities Department. The Director of the Humanities Department, in conjunction with the Coordinator of the Philosophy Program, will evaluate the requests for admission.
- The final dates of submission for admission to the program are established in the Academic Calendar.

100 points, and requires a grade of 80% or higher to pass and be exempted from the MUSI 3171 requirement.

To graduate with the Minor in Practical and Professional Ethics:

- Active UPRM students must have the minimum GPA required by their college.
- All students, including those enrolled in professional improvement programs, must have a Minor GPA of 2.0 or higher.
- Complete an exit interview with the Coordinator of the minor.
- Upon graduation and successful fulfillment of the requirements, student transcripts will indicate the completion of the Minor in Practical and Professional Ethics (Concentración Menor en Ética Práctica y Profesional).

### Minor Course Requirements

The minor consists of 15 credits to be completed in the following manner:

1. FILO 3155: *Introduction to Ethics* (3 credits). This is a basic course required for all students in the Minor.
2. At least 6 and at most 9 credits are to be taken from Group A.
3. At least 3 credits are to be taken from Group B.
4. The remaining credits, if any, can be taken from Group B or Group C.
5. Up to 3 credits in Group A and up to 3 credits in Group B (for a total of 6 credits) can be taken as special topics courses in philosophy (FILO 4995 and FILO 4996) if the subject matter is Ethics. For each course, the philosophy professors decide if the course belongs in the practical and professional ethics cluster of courses (Group A) or if it belongs in the cluster of courses in theoretical and social ethics that enrich the candidate's general background in ethics (Group B).
6. Students **from the Bachelor of Arts in Philosophy Program:**
  - a. Have to replace FILO 3155 for another course within group A, B or C.
  - b. Cannot use FILO 3001, FILO 3002, FILO 3157 or FILO 3167 for the Minor.

### Group A, B and C:

- **Group A** includes topics in applied ethics.
- **Group B** includes topics in theoretical and social ethics that enrich the candidate's general background in Ethics.
- **Group C** includes courses on other philosophical issues that broaden the student's general education.

The courses have no pre-requisites, except for FILO 4155 which has the pre-requisite FILO 3155, and FILO 3168 which has the following pre-requisite: FISI 3171 or FISI 3161 or FISI 3151 or FISI 3091 or CIFI 3012.

### Group A

FILO 3178: Business Ethics  
FILO 3185: Computer Ethics  
FILO 4025: Medical Ethics  
FILO 4027: Bioethics  
FILO 4045: Ethics in Engineering  
FILO 4995/4996: Special Topics in Philosophy

### Group B

FILO 3156: Modern and Contemporary Ethics  
FILO 3195: Global Ethics  
FILO 4155: Advanced Ethics  
FILO 4160: Philosophy of Technology  
FILO 4125: Philosophy of Law  
FILO 4995/4996: Special Topics in Philosophy

### Group C

FILO 3001: Intro. to Philosophy: Major Questions  
FILO 3002: Intro. to Philosophy: Historical Approach  
FILO 3157: Introduction to Logic  
FILO 3167: Symbolic Logic  
FILO 3168: Philosophy of Science

## DEPARTMENTAL FACULTY

**SANDRA APONTE-ORTIZ**, *Professor*, M.A., 1984, Rosary College.

**ANDERSON BROWN**, *Associate Professor*, Ph.D., 1996, University of Colorado at Boulder.

**YVETTE CABRERA-VEGA**, *Professor*, M.F.A., 1987, Pratt Institute.

**DANA L. COLLINS**, *Professor*, Ph.D., 1998, University of Arizona, Tucson, Arizona.

**MARIAM COLÓN PIZARRO**, *Associate Professor*, Ph.D., 2011, University of Michigan, Ann Arbor.

**LYDIA M. GONZÁLEZ-QUEVEDO**, *Professor*, Ph.D., 1996, University of Texas at Austin.

**SARA GAVRELL**, *Associate Professor*, Ph.D., 2007, University of Wisconsin-Madison

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**JEFFREY HERLIHY**, *Associate Professor*, Ph.D. 2008, Universitat Pompeu Fabra.

**MICHAEL HUFFMASTER**, *Associate Professor*, Ph.D. 2010, University of California, Berkeley.

**HÉCTOR JOSÉ HUYKE**, *Professor*, Ph.D., 1987, Columbia University.

**ANTHONY IZQUIERDO**, *Professor*, M.A., 1975, Middlebury College.

**ANA KOTHE**, *Professor*, Ph.D., 1996, University of Maryland, College Park.

**JOSÉ A. LÓPEZ**, *Professor*, Ph.D., 2003, Indiana University.

**RAMÓN LÓPEZ COLÓN**, *Associate Professor*, MFA, 1997, Tyler School of Art at Temple University.

**NOEMÍ MALDONADO-CARDENALES**, *Professor*, Ph.D., 2008, State University of New York at Buffalo.

**LESTER MCGRATH-ANDINO**, *Associate Professor*, Th.D., 1995, Boston University.

**CORA A. MONROE-GONZÁLEZ**, *Associate Professor*, Ph.D., 1998, Yale University.

**ALFREDO ORTIZ**, *Professor*, M.F.A., 1985, Pratt Institute.

**STEPHANE PILLET**, *Professor*, Ph.D. 2001, University of Illinois, Urbana Champaign.

**ROSA PLÁ-CORTÉS**, *Professor*, Ph.D., 2005, Universidad de Puerto Rico.

**CHRISTOPHER POWERS**, *Professor*, Ph.D. 2003, Johns Hopkins University.

**JANET RENOU**, *Professor*, Ph.D., 1998, University of Ottawa.

**LISSETTE ROLÓN-COLLAZO**, *Professor*, Ph.D., 1997, University of Iowa.

**JUAN J. SÁNCHEZ**, *Professor*, Ph.D., 1989, Universidad de Murcia.

**FRANCES J. SANTIAGO-TORRES**, *Professor*, Ph.D., 1998, The City University of New York-Graduate Center.

**CLAUDIA TORRES-GUILLEMARD**, *Assistant Professor*, MFA. 2010, University of Delaware.

**JERRY TORRES-SANTIAGO**, *Professor*, Ph.D. 1998, Universidad de Puerto Rico.

**BARUCH VERGARA**, *Assistant Professor*, MFA., 2004, Benemérita Universidad Autónoma de Puebla.

## **COURSES THAT FULLFILL THE GENERAL EDUCATION REQUIREMENTS**

### **DEPARTMENT OF HUMANITIES**

#### **Undergraduate Courses**

#### **ART**

**ARTE 3007. ARTISTIC PHOTOGRAPHY.** Three credit hours. Six hours of workshop per week.

Introduction to photographic equipment, materials and processes, with emphasis on the theory and practice of artistic photography.

**ARTE 3016. HISTORY AND LANGUAGE OF COMICS.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week.

Study of the language of comics and major authors, works, series, characters and magazines of the history of European, American and Japanese comics from the perspective of Art History.

**ARTE 3055. CALIGRAPHY.** Three credit hours. Six hours of workshop per week.

Theory and practice of ancient and modern calligraphy.

**ARTE 3121. DRAWING.** Three credit hours. Six hours of workshop per week.

Introduction to materials, concepts, and techniques of artistic drawing.

**ARTE 3122. PAINTING.** Three credit hours. Six hours of workshop per week.

Introduction to materials, concepts, and techniques of painting.

**ARTE 3131. PERSPECTIVE IN ART.** Three credit hours. Six hours of workshop per week. Prerequisite: ARTE 3121.

A historical, theoretical, and practical introduction to the study of perspective in art.

**ARTE 3132. COLOR.** Three credit hours. Six hours of art workshop per week.

A historical, theoretical and practical introduction to the study of color in art.

**ARTE 3141. DESIGN WORKSHOP.** Three credit hours per semester. Six hours workshop per week each semester.

A study of the fundamental principles and elements of design in the structure and composition of the several plastic arts.

**ARTE 3142. DESIGN WORKSHOP.** Three credit hours per semester. Six hours workshop per week each semester. Prerequisite: ARTE 3141.

A study of the fundamental principles and elements of design in the structure and composition of the several plastic arts.

**ARTE 3151. FUNDAMENTALS OF ART THEORY.** Three credit hours. Three hours of lecture per week.

Study of the basic structures of works of the fine arts and of the correspondences among them, with emphasis on the plastic arts.

**ARTE 3152. THEORETICAL BASES OF MODERN ART.** Three credit hours. Three hours of lecture per week.

Theoretical bases of the principal schools and modes of modern plastic arts.

**ARTE 3161. STAINED GLASS WORKSHOP.** Three credit hours per semester. Six hours of workshop per week per semester.

Theory and practice in the artistic use of glass panels.

**ARTE 3162. STAINED GLASS WORKSHOP.** Three credit hours per semester. Six hours of workshop per week per semester. Prerequisite: ARTE 3161.

Theory and practice in the artistic use of glass panels.

**ARTE 3200. STUDY OF THE HUMAN FIGURE.** Three credit hours. Six hours of workshop per week. Prerequisites: ARTE 3121 or ARTE 3122.

Artistic study of the human figure including anatomy, proportion and movement.

**ARTE 3210. PORTRAIT STUDY.** Three credit hours. Six hours of workshop per week. Prerequisites: ARTE 3121 and ARTE 3122.

Introduction to the techniques of portraiture using several media such as charcoal, pencil and oils.

**ARTE 3226. HISTORY OF ART IN PUERTO RICO.** Three credit hours. Three hours of lecture per week.

History of art in Puerto Rico since the period of colonization to the present.

**ARTE 3235. WATERCOLOR.** Three credit hours. Six hours of workshop per week. Prerequisite: ARTE 3121.

Methods, materials, and techniques of watercolor.

**ARTE 3276. ART APPRECIATION.** Three credit hours. Three lectures per week.

A comparative study of the arts in modern times, with reference to the historic styles of major importance; analysis, evaluation, and personal interpretation of great works of art in architecture, painting, sculpture, the lesser arts and the graphic arts. Includes also a study of artistic development in Puerto Rican culture, and the valuable contributions of our artists to all phases of the island life.

**ARTE 3279. EXPERIMENTATION WITH ART MATERIALS.** Three credit hours. Six hours of workshop per week.

The exploration of techniques and materials in painting, sculpture, and the graphic arts.

**ARTE 3531. COMPUTERS IN THE VISUAL ARTS I.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: ADMI 3007 or COMP 3010 or COMP 3057 or ECAG 3007 or INGE 3011 or authorization of the Director of the Department.

Introduction to the use of the microcomputer both as a medium and as a tool in the visual arts.

**ARTE 3532. COMPUTERS IN THE VISUAL ARTS II.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: ARTE 3531.

Creation of digitized three-dimensional images; computer animation.

**ARTE 4021. CERAMIC.** Three credit hours. Six hours of workshop per week.

An introduction to the materials and techniques used in the art of ceramics.

**ARTE 4022. POTTERY.** Three credit hours. Six hours of workshop per week.

Basic techniques in pottery emphasizing the use of the potter's wheel.

**ARTE 4025. ADVANCED CERAMICS.** Three credit hours. Six hours of workshop per week. Prerequisite: ARTE 4021 and ARTE 4022.

Advanced study of modeling in clay, with emphasis on the commercial as well as the artistic aspects of ceramics.



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**ARTE 4123. ILLUSTRATION I.** Three credit hours. Six hours of workshop per week. Prerequisites: ARTE 3121.

Illustration in sciences, education, and commercial and industrial promotion.

**ARTE 4124. ILLUSTRATION II.** Three credit hours. Six hours of workshop per week. Prerequisites: ARTE 4123 or authorization of the Director of the Department.

Advanced study of illustration in the sciences, education, and commercial and industrial publicity.

**ARTE 4206. ARCHITECTURE IN PUERTO RICO.** Three credit hours. Three hours of lecture per week. One and a half hour of lecture and one and a half hour of discussion per week.

Study of the most influential architectural works in Puerto Rico, situated in their historical background, in order to promote their appreciation, study their creators and relate them to social, economic and political aspects of Puerto Rico. Development of the capacity for analysis of the contemporary architectural environment and awareness of the relations between buildings and people.

**ARTE 4251. PRINTMAKING I.** Three credit hours. Six hours of workshop per week. Prerequisite: ARTE 3121.

Creative experimentation in two printmaking techniques: relief and lithography. Analysis and interpretation of masterworks in the history of printmaking.

**ARTE 4252. PRINTMAKING II.** Three credit hours. Six hours of workshop per week. Prerequisite: ARTE 4251.

Creative experimentation in two printmaking techniques: intaglio and screen-printing. Analysis and interpretation of masterworks in the history of printmaking.

**ARTE 4259. HISTORY OF MODERN ART.** Three credit hours. Three hours of lecture per week. Prerequisite: ARTE 4272 or authorization of the Director of the Department.

History of modern art from Neoclassicism to Impressionism.

**ARTE 4260. METAL ENGRAVING.** Three credit hours. Six hours of workshop per week. Prerequisite: ARTE 4252.

Knowledge and practice of the techniques of metal engraving: etching, aquatint, mezzotint, burin, drypoint, and others.

**ARTE 4271. HISTORY OF ART: PALEOLITHIC TO ROMAN.** Three credit hours. Three hours of lecture per week. Prerequisite: HUMA 3112.

History of art from the Paleolithic age to the Roman period with emphasis on the cultures that flourished around the Mediterranean Sea.

**ARTE 4272. HISTORY OF ART: EARLY CHRISTIAN TO BAROQUE.** Three credit hours. Three hours of lecture per week. Prerequisite: ARTE 4271.

History of art from the Early Christian period to the Baroque with emphasis on the cultures of Europe.

**ARTE 4281. SPANISH AMERICAN I.** Three credit hours. Three hours of lecture per week.

Art in Hispanic America from the Pre-Hispanic times to the 18<sup>th</sup> century.

**ARTE 4282. INTRODUCTION TO THE FINE ARTS IN LATIN AMERICA.** Three credit hours per semester. Three lectures per week each semester. Prerequisite: ARTE 4281.

An examination of selected examples of painting, architecture, and sculpture from the pre-Colonial period to the present day.

**ARTE 4291. ELEMENTARY SCULPTURE.** Three credit hours. Six hours of workshop per week. Prerequisite: ARTE 3121.

Introduction to methods, materials, and tools of sculpture.

**ARTE 4292. INTERMEDIATE SCULPTURE.** Three credit hours. Six hours of workshop per week. Prerequisite: ARTE 4291.

Materials and forms in sculpture emphasizing the conceptual aspects of tridimensional art.

**ARTE 4293. ADVANCED SCULPTURE.** Three credit hours. Six hours of workshop per week. Prerequisite: ARTE 4292.

Advanced techniques and methods in sculpture emphasizing the development of artistic expression.

**ARTE 4301. INDUSTRIAL DESIGN.** Three credit hours per semester. Six hours workshop per week each semester.

Introduction to the theory of the design and elaboration, esthetic as well as functional and structural, of prototypes of possible industrial products in both two and three dimensions.

**ARTE 4302. INDUSTRIAL DESIGN.** Three credit hours per semester. Six hours workshop per week each semester. Prerequisite: ARTE 4301.

Introduction to the theory of the design and elaboration, esthetic as well as functional and structural, of prototypes of possible industrial products in both two and three dimensions.

**ARTE 4311. ART CRITICISM I.** Three credit hours. Three hours of lecture per week. Prerequisite: twelve credits in Arts.

Art criticism with emphasis on basic concepts and methodology.

**ARTE 4312. ART CRITICISM II.** Three credit hours. Three hours of lecture per week. Prerequisite: ARTE 4311.

Art criticism with emphasis on the history of criticism in architecture, sculpture, and painting from the time of the ancient Greeks to present.

**ARTE 4321. ART SEMINAR I.** Two credit hours. Two hours of seminar per week. Prerequisites: 18 credits in Art courses.

Preparation of a research proposal under the supervision of a professor.

**ARTE 4322. ART SEMINAR II.** Two credit hours. Two hours of seminar per week. Prerequisites: ARTE 4321.

Preparation of a bachelor's thesis under the supervision of a professor.

**ARTE 4331. COMPARATIVE ARTS.** Three credit hours per semester. Three hours of lecture per week each semester.

Detailed explanation of given trends in the different art forms. The course will center around the question: to what extent is it possible to find common denominators of a particular movement in different media?

**ARTE 4332. COMPARATIVE ARTS.** Three credit hours per semester. Three hours of lecture per week each semester.

Detailed explanation of given trends in the different art forms. The course will center around the question: to what extent is it possible to find common denominators of a particular movement in different media.

**ARTE 4335. HISTORY OF CONTEMPORARY ART.** Three credit hours. Three hours of lecture per week.

Prerequisite: ARTE 4259 or authorization of the Director of the Department.

History of contemporary art from "Art Nouveau" to present.

**ARTE 4525. NORTHERN EUROPEAN PAINTING OF THE RENAISSANCE.** Three credit hours. Three hours of lecture per week. Prerequisite: ARTE 4272.

The paintings of the Primitive Flemish, as well as the Dutch, French and German masters of the Renaissance.

**ARTE 4535. ADVANCED PAINTING.** Three credit hours. Six hours of workshop per week. Prerequisite: ARTE 3122.

Advanced techniques and methods in painting with emphasis on the development of individual expression.

**ARTE 4995. SPECIAL TOPICS.** One to nine credit hours. One to nine hours of seminar or two to eighteen hours of workshop per week. Prerequisite: authorization of the Director of the Department.

Special seminars on a chosen theme in the fine arts, or in the history and theory of art.

**ARTE 4996. SPECIAL TOPICS.** One to nine credit hours. One to nine hours of lecture per week or two to six hours of workshop per week. Prerequisite: authorization of the Director of the Department.

Selected topics in fine arts, plastic arts, art history or art theory.

## CHINESE

**CHIN 3051. MANDARIN CHINESE I.** Three credit hours. Three hours of lecture per week.

Introduction to the Mandarin Chinese language with emphasis on comprehension, speaking, reading, and writing skills. Development of basic sociocultural knowledge of contemporary China.

**CHIN 3052. MANDARIN II.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week. Prerequisite: CHIN 3051.

Development of basic Mandarin communication skills in listening, speaking, reading and writing, with a focus on listening and speaking. Introduction to Chinese culture to further the acquisition of basic social, cultural knowledge of contemporary China to promote cross-cultural awareness and understanding.

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## FRENCH

**FRAN 3060. FRENCH PHONETICS.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3141.

A study of the sounds, intonation and rhythm of the French language, with intensive laboratory practice.

**FRAN 3135. SUMMER STUDY PROGRAM IN PARIS.** Three credit hours. Forty hours of lecture and ten hours of practice.

A 50-hour program of summer study at the University of Paris (Sorbonne). Intensive study of French language and culture.

**FRAN 3141. FRENCH I.** Three credit hours per semester. Three hours of lecture per week each semester.

Thorough training in the fundamentals of French grammar and phonetics; exercises in composition. The direct method is used as much as possible.

**FRAN 3142. FRENCH II.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3141 or authorization of the Director of the Department.

Thorough training in the fundamentals of French grammar and phonetics; exercises in composition. The direct method is used as much as possible.

**FRAN 3143. FRENCH III.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3142 or authorization of the Director of the Department.

Review of French grammar; study of French idioms and word groups; composition; intensive readings.

**FRAN 3144. FRENCH IV.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: FRAN 3143.

Review of French grammar; study of French idioms and word groups; composition; intensive and extensive readings.

**FRAN 3151. BUSINESS FRENCH I.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3143.

Basic French vocabulary and style used in business and commerce.

**FRAN 3155. CONVERSATION I.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3141 or authorization of the Director of the Department.

Intensive oral practice in the French language. The emphasis will be on contemporary colloquial French.

**FRAN 4007. ADVANCED GRAMMAR.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3144.

An advanced study of French grammar by means of translations from Spanish to French.

**FRAN 4008. ADVANCED COMPOSITION.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 4115.

Intensive study of the techniques of composition, with emphasis on style and editing.

**FRAN 4036. BUSINESS FRENCH II.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3144 or FRAN 3151.

Advanced French vocabulary and style used in business and commerce. Emphasis on written and oral reports. Offered in French.

**FRAN 4115. FRENCH COMPOSITION.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3144.

A study of the techniques of composition, and of the most common French idiomatic expressions. Intensive grammar review.

**FRAN 4116. CONVERSATION II.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3155.

A course in advanced French conversation, with emphasis on idiomatic expressions and common phrases, and applied grammar. Translations from Spanish to French.

**FRAN 4141. FRENCH POETRY.** Three credit hours per semester. Three lectures per week each semester. Prerequisite: FRAN 3144.

Readings and interpretations of works of the most important French poets from the Middle Ages to the present; structural elements, versification, and styles. Given in French.

**FRAN 4142. FRENCH POETRY.** Three credit hours per semester. Three lectures per week each semester. Prerequisite: FRAN 3144.

Readings and interpretations of works of the most important French poets from the Middle Ages to the present; structural elements, versification, and styles. Given in French.

**FRAN 4145. THE FRENCH NOVEL.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3144.

Study of five to eight outstanding novels in French Literature from the Seventeenth to the Twentieth Century, with emphasis on narrative, structural, intertextual, and socio-cultural questions. Offered in French.

**FRAN 4147. MODERN FRENCH LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3144.

A survey of the French novel, the poetry, and the theatre of the Twentieth Century, focusing on outstanding works and major literary movements.

**FRAN 4149. FRENCH POETRY.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3144.

French poetry from its origins to the present, with emphasis on the Nineteenth and Twentieth Centuries; analysis of the poem as a verbal construct and as expression of the individual and a culture. Offered in French.

**FRAN 4151. FRENCH CULTURE AND CIVILIZATION.** Three credit hours per semester. Three hours of lecture per week per semester. Prerequisite: FRAN 3144.

Panoramic view of the development of French culture and civilization; its contribution to all aspects of European culture. Given in French.

**FRAN 4152. FRENCH CULTURE AND CIVILIZATION.** Three credit hours per semester. Three hours of lecture per week per semester. Prerequisite: FRAN 4151.

Panoramic view of the development of French culture and civilization; its contribution to all aspects of European culture. Given in French.

**FRAN 4181. FRENCH LITERATURE TO THE REVOLUTION.** Three credit hours per semester. Three lectures per week each semester. Prerequisite: FRAN 3144.

A study of selected works representative of the chief periods of French literature from the Middle Ages to the Revolution.

**FRAN 4182. FRENCH LITERATURE TO THE REVOLUTION.** Three credit hours per semester. Three lectures per week each semester. Prerequisite: FRAN 4181.

A study of selected works representative of the chief periods of French literature from the Middle Ages to the Revolution.

**FRAN 4185. HISTORY OF THE FRENCH LANGUAGE.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3144 and FRAN 3060.

A study of the development of the French language from its origins to the 18th Century by means of medieval and Renaissance literary works. Emphasis on philology.

**FRAN 4191. FRENCH LITERATURE SINCE THE REVOLUTION.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3144.

A study of selected works representatives of the chief periods of French literature from the Revolution to the present.

**FRAN 4192. FRENCH LITERATURE SINCE THE REVOLUTION.** Three credit hours. Three hours of lecture per week. Prerequisite: FRAN 3144.

A study of selected works representative of the chief periods of French literature from the Revolution to the present.

**FRAN 4236. UNDERGRADUATE RESEARCH I.** One credit hour. Three hours of research per week. Prerequisite: twenty four (24) credits in French.

Techniques for research in French language, literature, and culture. All work will be in French.

**FRAN 4237. UNDERGRADUATE RESEARCH II.** One credit hour. Three hours of research per week. Prerequisite: FRAN 4236.

Writing and presentation of a research paper in French on a topic related to French language, literature, or culture.

**FRAN 4995. SPECIAL TOPICS.** One to nine credit hours. One to nine hours of lecture per week. Prerequisite: FRAN 3144 or authorization of the Director of the Department.

Special topics in French language or culture. Course given in French.

**FRAN 4996. SPECIAL TOPICS.** One to nine credit hours. One to nine hours of lecture per week. Prerequisite: FRAN 3144 or authorization of the Director of the Department.

Special topics in French language or culture. Course given in French.

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## GERMAN

**ALEM 3041.** GERMAN I. Three credit hours per semester. Three hours of lecture per week each semester.

The principal grammatical elements of the German language, practice in its oral use, exercises in composition, vocabulary drill.

**ALEM 3042.** GERMAN II. Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ALEM 3041.

The principal grammatical elements of the German language, practice in its oral use, exercises in composition, vocabulary drill.

**ALEM 3043.** GERMAN III. Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ALEM 3042.

Thorough review of grammar, advanced composition, readings from German authors.

**ALEM 3044.** GERMAN IV. Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ALEM 3043.

Thorough review of grammar, advanced composition, readings from German authors.

**ALEM 4001.** GERMAN LITERATURE. Three credit hours per semester. Three hours of lecture per week per semester. Prerequisite: ALEM 3044.

A study of selected readings in the prose and poetry of the Nineteenth Century from Novalis to Storm and Hauptmann.

**ALEM 4002.** GERMAN LITERATURE. Three credit hours per semester. Three hours of lecture per week per semester. Prerequisite: ALEM 4001.

A study of selected readings in the prose and poetry of the Nineteenth Century from Novalis to Storm and Hauptmann.

## GREEK

**GRIE 3011.** ELEMENTARY GREEK. Three credit hours per semester. Three hours of lecture per week each semester.

Studies in the fundamentals of classical Greek; phonetics, grammar, and vocabulary. Readings in elementary texts.

**GRIE 3012.** ELEMENTARY GREEK. Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: GRIE 3011.

Studies in the fundamentals of classical Greek; phonetics, grammar, and vocabulary. Readings in elementary texts.

## HUMANITIES

**HUMA 3087.** CLASSICS OF ITALIAN LITERATURE IN TRANSLATION. Three credit hours. Three hours of lecture per week.

Study of some of the major works of Italian literature using Spanish translations. The class will be held in Spanish.

**HUMA 3111.** INTRODUCTION TO WESTERN CULTURE I. Three credit hours. Three hours of lecture per week.

Critical reflection on the foundational aspects of Western culture from the diverse perspectives of humanistic disciplines such as art, history, literature, philosophy, and religious thought. Analysis of the most significant original works and texts from the Greek, Roman, Hebrew and Medieval cultures and their relation to the present.

**HUMA 3112.** INTRODUCTION TO WESTERN CULTURE II. Three credit hours. Three hours of lecture per week. Prerequisite: HUMA 3111.

Critical reflection on the foundational aspects of Western culture from the diverse perspectives of humanistic disciplines such as art, history, literature, philosophy, and religious thought. Analysis of the most significant original works and texts from the Renaissance to the present.

**HUMA 3115.** EUROPEAN STUDY TOUR. Three credit hours. Fifteen hours of lecture and one trip of one month duration.

A study of several aspects of European culture including visits to museums, monuments, and other places of cultural interest. Formal written work required.

**HUMA 3271.** THE BIBLE AS A LITERARY AND HISTORICAL DOCUMENT: THE OLD TESTAMENT. Three credit hours. Three hours of lecture per week.

A comparative study of the Old Testament, considering the fields of history, literature, and philosophy.

**HUMA 3272.** THE BIBLE AS A LITERARY AND HISTORICAL DOCUMENT; THE NEW TESTAMENT. Three credit hours. Three hours of lecture per week.

A comparative study of the New Testament, considering the fields of history, literature and philosophy.

**HUMA 3401.** LATIN AMERICAN CIVILIZATION AND CULTURE. Three credit hours per semester. Three hours of lecture per week each semester.

A panoramic view of the life and culture of the Latin American people from pre-Colombian times to the present day, with special emphasis on achievements in art, literature, and philosophy, as well as inter-American cultural relations.

**HUMA 3402.** LATIN AMERICAN CIVILIZATION AND CULTURE. Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: HUMA 3401.

A panoramic view of the life and culture of the Latin American people from pre-Colombian times to the present day, with special emphasis on achievements in art, literature, and philosophy, as well as inter-American cultural relations.

**HUMA 3411.** INTRODUCTION TO THE CULTURE OF SOUTH ASIA. Three credit hours. Three hours of lecture per week.

Study of the culture of South Asia, especially that of India with emphasis on its philosophy, religion, literature and art.

**HUMA 3412.** INTRODUCTION TO THE CULTURE OF EAST ASIA. Three credit hours. Three hours of lecture per week.

Study of the culture of East Asia, especially those of China and Japan with emphasis on their respective philosophies, religions, literature and arts.

**HUMA 3425.** PUERTO RICAN THOUGHT. Three credit hours. Three hours of conference per week.

Comparative and interdisciplinary analysis of Puerto Rican cultural manifestations from the nineteenth century to the present in order to examine Puerto Rican identity and thought from the perspective of the humanities.

**HUMA 4995.** SPECIAL TOPICS. Three credit hours. Three hours of lecture per week. Prerequisite: HUMA 3111 or authorization of the Director of the Department.

Selected topics in Humanities.

**HUMA 4996.** SPECIAL TOPICS IN THE HUMANITIES. One to nine credit hours. One to nine hours of lecture per week. Prerequisite: HUMA 3111 or authorization of the Director of the Department.

Selected topics in the Humanities.

### Advanced Undergraduate and Graduate Courses

**HUMA 5991.** SPECIAL TOPICS. One to nine credit hours. One to nine hours of lecture per week. Prerequisites: HUMA 3112 or authorization of the Director of the Department.

Selected topics in the area of the Humanities.

**HUMA 5992.** SPECIAL TOPICS. One to nine credit hours. One to nine hours of lecture per week. Prerequisite: HUMA 3112 or authorization of the Director of the Department.

Selected topics in the area of the Humanities.

## ITALIAN

**ITAL 3031.** CONVERSATION AND CULTURE. Three credit hours. Three hours of lecture per week. Prerequisite: ITAL 3072.

The study of Italian culture and civilization from its beginnings to our time. By means of prepared oral discussion, the contributions of Italy towards the development of western thought and science will be considered. Given in Italian.

**ITAL 3032.** CONVERSATION AND CULTURE. Three credit hours per semester. Three hours of lecture per week. Prerequisite: ITAL 3031.

The study of Italian culture and civilization from its beginnings to our time. By means of prepared oral discussion, the contributions of Italy towards the development of western thought and science will be considered. Given in Italian.

**ITAL 3071-3072.** ITALIAN I-II. Three credit hours per semester. Three hours of lecture per week each semester.

The fundamentals of the Italian language; both oral and written; readings in elementary texts, and conversation stressing the most common expressions.

**ITAL 3073.** ITALIAN III. Three credit hours per semester. Three hours of lecture per week. Prerequisite: ITAL 3072 or its equivalent.

Review of grammar; composition, readings, and oral practice.

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**ITAL 3074. ITALIAN IV.** Three credit hours per semester. Three hours of lecture per week. Prerequisite: ITAL 3073 or its equivalent.

Review of grammar; composition, readings, and oral practice.

**ITAL 3085. THE ITALIAN CINEMA.** Three credit hours. Three hours of lecture per week.

Post-war Italian cinema as a form of art and as a medium for conveying human, social and political messages. Offered in Spanish.

**ITAL 3086. CONVERSATION IN ITALIAN.** Three credit hours. One hour of conference and one two-hour of discussion per week. Prerequisite: ITAL 3072.

Conversations in Italian about current topics with emphasis on strategies of expression and argumentation. Articles and news reports in Italian from different media will be used to stimulate and develop oral communication skills.

**ITAL 3087. ITALIAN CULTURE.** Three credit hours. Three hours of lecture per week. Prerequisite: ITAL 3072.

A course designed to develop knowledge of contemporary Italian culture through the study of literature, music, and film and the analysis of diverse social topics such as education, migration, and multiculturalism.

**ITAL 3090. SUMMER STUDY PROGRAM IN ITALY.** Three credit hours. Ten hours of lecture per week, five practice periods per week, and one one-month trip to Italy.

Intensive study of Italian language and culture in Italy.

**ITAL 4007. SPECIAL TOPICS.** One to three credit hours. One hour of lecture per week per credit. Prerequisite: ITAL 3074 or authorization of the Director of the Department.

Special topics in Italian language, literature, and culture. Taught in Italian.

**ITAL 4011-4012. ITALIAN LITERATURE I-II.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: ITAL 3074.

Great works of Italian writers of the Nineteenth Century: Manzoni, Leopardi, Carducci, Foscolo, and others.

## JAPANESE

**JAPO 3111. JAPANESE I.** Three credit hours. Three hours of lecture per week.

Fundamentals of Japanese language and culture with an emphasis on spoken language.

**JAPO 3112. JAPANESE II.** Three credit hours. Three hours of lecture per week. Prerequisite: JAPO 3111 or JAPO 3101.

Fundamentals of Japanese language and culture with an emphasis on spoken language; introduction to the written language.

**JAPO 3211. JAPANESE III.** Three credit hours. Three hours of lecture per week. Prerequisite: JAPO 3112 or JAPO 3102.

Intermediate study of Japanese language and culture. Practice of katakana, hiragana, and Chinese characters.

**JAPO 3212. JAPANESE IV.** Three credit hours. Three hours of lecture per week. Prerequisite: JAPO 3211 or JAPO 3201.

Intermediate study of Japanese language and culture with an emphasis on reading and writing.

## LATIN

**LATI 3011-3012. ELEMENTARY LATIN.** Three credit hours per semester. Three hours of lecture per week each semester.

Fundamentals of Latin grammar; elementary readings.

**LATI 3013-3014. INTERMEDIATE LATIN.** Three credit hours per semester. Three hours of lecture per week per semester. Prerequisite: LATI 3012.

Latin grammar and syntax; selected readings.

## COMPARATIVE LITERATURE

**LITE 3005. LITERATURE APPRECIATION.** Three credit hours. Three hours of lecture per week.

Literature as a means of communication and aesthetic expression with particular attention to the formal elements which differentiate literary from ordinary language. Literary analysis of texts through readings from Western and non-Western societies.

**LITE 3025. LITERARY THEORY.** Three credit hours. Three hours of lecture per week.

A study of the principal theories of literary genres from Aristotle to the present.

**LITE 3035. MYTHOLOGY IN WESTERN LITERATURE.** Three credit hours. Three hours of lecture per week.

A study of the fundamental mythological themes from the Greek, Roman, German and Celtic cultures, and their manifestations in Western literature.

**LITE 3041-3042. INTRODUCTION TO COMPARATIVE LITERATURE.** Three credit hours per semester. Three hours of lecture per week each semester.

A comparative study of the fundamental themes of Western literature expressed in the classical, romantic and realistic terms.

**LITE 4011. EVOLUTION OF THE NOVEL I.** Three credit hours. Three hours of lecture per week. Prerequisite: LITE 3042. Co-requisite: LITE 3025.

Characteristics, main authors, and development of the genre of the novel from its beginnings to the 18<sup>th</sup> century.

**LITE 4012. EVOLUTION OF THE NOVEL II.** Three credit hours. Three hours of lecture per week. Prerequisite: LITE 4011.

Characteristics, main authors, and development of the novel of Romanticism, Realism, and Naturalism and its transformation into the 20<sup>th</sup> century novel.

**LITE 4021. COMPARATIVE DRAMA I.** Three credit hours. Three hours of lecture per week. Prerequisite: LITE 3042. Co-requisite: LITE 3025.

Representative forms of Western drama and its major authors, from the Classical era to the Middle Ages.

**LITE 4022. COMPARATIVE DRAMA II.** Three credit hours. Three hours of lecture per week. Prerequisite: LITE 4021.

Representative forms of Western drama and its major authors, from the Renaissance to the present.

**LITE 4035. MEDIEVAL EUROPEAN LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisite: 3 credits in LITE.

A study of the literary genres cultivated in medieval Europe: the epic, the lyric, miracle plays and morality plays.

**LITE 4045. RENAISSANCE LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisite: 3 credits in LITE.

Consideration of the historical and cultural significance of the Renaissance as seen in representative works of Erasmus, Montaigne, Rabelais and the Italian neo-Platonists and neo-Aristotelian.

**LITE 4051. COMPARATIVE POETRY.** Three credit hours. Three hours of lecture per week. Prerequisite: LITE 3042. Corequisite: LITE 3025.

A study of the Western lyric in its most important phases and manifestations. Original texts in Spanish and English, and translations of Provençal, French, German, Italian and Portuguese will be used.

**LITE 4052. COMPARATIVE POETRY.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: LITE 4051.

A study of the Western lyric in its most important phases and manifestations. Original texts in Spanish and English, and translations of Provençal, French, German, Italian and Portuguese will be used.

**LITE 4075. LITERARY CRITICISM.** Three credit hours. Three hours of lecture per week. Prerequisites: LITE 3041 or ESPA 3212 or ESPA 3022.

A study of literary criticism and its influence on the development of Western literature from the ancients to our time.

**LITE 4076. POSTCOLONIAL STUDIES.** Three credit hours. Three hours of lecture per week. Prerequisite: 3 credits in LITE.

Studies of the colonial experience examined in light of postcolonial theories. Investigation of the cultural implications of colonialism and decolonization as seen in the theoretical work of various authors. The application of theoretical concepts to the interpretation of literary and cinematographic texts.

**LITE 4081. ROMANTICISM IN LITERATURE I.** Three credit hours. Three hours of lecture per week. Prerequisite: 3 credits in LITE.

Analysis of the European romantic movement by means of a comparative study of its various sources and literary expressions, from its roots in the 18<sup>th</sup> century to the development in the 19<sup>th</sup> century.

**LITE 4082. ROMANTICISM IN LITERATURE II.** Three credit hours. Three hours of lecture per week. Prerequisite: 3 credits in LITE.



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Analysis of the European romantic movement by means of a comparative study of its various sources and literary expressions, from its development in the 19<sup>th</sup> century to late romanticism.

**LITE 4115. CULTURAL STUDIES AND COMPARATIVE LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisite: 3 credits in LITE.

Cultural theory as manifested in the literary text interrelationships among the social sciences, history, and literature.

**LITE 4118. THE MODERN SHORT STORY.** Three credit hours. Three hours of lecture per week. Prerequisites: 3 credits in LITE.

Comparative study of the theories, themes, and formal characteristics of the short story as a modern narrative genre from its origins in the 19<sup>th</sup> century to the present in Europe and the Americas.

**LITE 4990. SPECIAL TOPICS IN COMPARATIVE LITERATURE I.** One to nine credit hours. One to twenty-seven hours of lecture per week. Prerequisite: six credits in LITE or ESPA.

Selected topics, authors, genres, or literary movements.

**LITE 4991. UNDERGRADUATE RESEARCH I.** One credit hour. Three hours of research per week. Prerequisite: 24 credits in Comparative Literature.

Selection of a research topic in comparative literature and preparation of a proposal under the supervision of a professor.

**LITE 4992. UNDERGRADUATE RESEARCH II.** Two to three credit hours. Six to nine hours of research per week. Prerequisite: 24 credits in Comparative Literature.

Application of research techniques to the writing of an undergraduate thesis on a topic previously selected in LITE 4991.

**LITE 4996. WORKSHOP IN COMPARATIVE LITERATURE I.** One to nine credit hours. One to nine hours of workshop per week.

Workshop on topics related to comparative literature.

## **Advanced Undergraduate and Graduate Courses**

**LITE /FILO 5001. LITERATURE AND PHILOSOPHY I.** Three credit hours. Three hours of lecture per week.

Critical examination of the major philosophical theories of literary genres; analysis of the epistemological, metaphysical, and ethical meaning of literary texts from the ancient Greeks to the early Spanish Golden Age.

**LITE/ FILO 5002. LITERATURE AND PHILOSOPHY II.** Three credit hours. Three hours of lecture per week.

Critical examination of the major philosophical theories of literary genres; analysis of the epistemological, metaphysical, and ethical meaning of literary texts from the end of the Spanish Golden Age to the present.

**LITE 5035. THEORY OF THE NOVEL.** Three credit hours. Three hours of lecture per week. Prerequisite: 9 credits in LITE, ESPA or INGL or authorization of the Director of the Department.

The development of the novel as a literary genre, emphasizing texts from the baroque to the present; a comparative analysis of narratology theories and representative novels.

**LITE 5050. CONTEMPORARY LITERARY CRITICISM.** Three credit hours. Three hours of lecture per week. Prerequisite: 9 credits in LITE, ESPA or INGL or authorization of the Director of the Department.

Principles and methodologies of contemporary schools of criticism; analysis of critics and texts from various literatures.

**LITE 5057. MAGICAL REALISM.** Three credit hours. Three hours of lecture per week. Prerequisites: Nine credits in LITE or ESPA or INGL or authorization of the Director of the Department.

Magical realism in the context of world literature. Analysis of its distinguishing characteristics in the genre of fantasy through readings of its main authors, texts, and critics.

**LITE 5336. WORLD LITERATURE BY WOMEN.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week. Prerequisites: Nine credits in LITE or ESPA or INGL or authorization of the Director of the Department.

The study of the themes, problems, and theories of the female gender as represented in the poetry, prose, and drama of world literature by women. Analysis of gender theory and its relation to contexts both local and global.

Discussion of the relationship between gender and themes such as race, class, community, stereotypes, representation, myth and the abject in women's literature from diverse cultures.

**LITE 5615. THE SYMBOLIST MOVEMENT IN LITERATURE.** Three credit hours. Three hours of lecture per week. Prerequisites: Nine credits in LITE or ESPA or INGL or INGL or authorization of the Director of the Department.

The development of the symbolist movement and its influence in Europe and in America, with special emphasis on poetry and the theater.

**LITE 5715. METHODS IN THE STUDY OF LITERARY TEXTS.** Three credit hours. Three hours of lecture per week. Prerequisites: Nine credits in LITE or ESPA or INGL or authorization of the Director of the Department.

Analysis of the most important methods used in the study of literary texts, from rhetoric's, to structuralism, with emphasis on the techniques used in comparative literature.

**LITE 5995. SPECIAL TOPICS IN COMPARATIVE LITERATURE I.** One to nine credit hours. Prerequisites: Nine credits in LITE or ESPA or INGL or authorization of the Director of the Department.

Critical analysis of authors, movements, genres, or interdisciplinary topics in comparative literature.

**LITE 5996. SPECIAL TOPICS IN COMPARATIVE LITERATURE II.** One to nine credit hours. Prerequisites: Nine credits in LITE or ESPA or INGL or authorization of the Director of the Department.

Critical analysis of authors, movements, genres, or interdisciplinary topics in comparative literature.

## MUSIC

**MUSI 3005. PUERTO RICAN MUSICAL CULTURE.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week.

Course designed to cultivate appreciation for Puerto Rican musical tradition. Development of a concept of the aesthetics of the music that frames the profile of Puerto Rican culture. Formation of the capacity to listen objectively and critically to Puerto Rican music with different levels of complexity, epochs and styles. Review of the most important works of the Puerto Rican repertoire, in the fields of both popular music and concert music. Study of the function of music in the formation of

Puerto Rican identity, our society and our history through the diverse cultural currents.

**MUSI 3006. LATIN AMERICAN MUSIC.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week.

Course designed to cultivate the appreciation of the musical traditions of Latin America. Study of the musical genres, composers and interpreters in Latin America, by way of a didactic tour of the following countries and regions Argentina, Uruguay, Chile, Brazil, Peru, Ecuador, Venezuela, Colombia, Central America, Mexico, Cuba, Haiti, Dominican Republic, and Puerto Rico. Includes an ample diversity of auditory examples, videos and demonstrations on musical instruments.

**MUSI 3135. MUSIC APPRECIATION.** Three credit hours. Three hours of lecture per week.

Music as a source of aesthetic pleasure, with particular emphasis on its human, philosophical and historical aspects; formal elements and their constitutions; study of the musical forms of the fugue, sonata, concerto and symphony, and of the principal tendencies in music.

**MUSI 3161. HISTORY OF MUSIC.** Three credit hours per semester. Three hours of lecture per week each semester.

The study of musical systems as a characteristic of great cultures; Western music from its beginning to the present; formal stylistic and technical development of music and its relation to other forms of thought and culture.

**MUSI 3162. MUSIC HISTORY II.** Three credit hours. Three hours of lecture per week.

The study of musical systems as a characteristic of great cultures; Western music from its beginning to the present; formal, stylistic, and technical development of music and its relation to other forms of thought and culture.

**MUSI 3167. INTRODUCTION TO OPERA.** Three credit hours. Three hours of lecture per week.

Study of the most significant operatic works of different periods, especially those which are in repertory.

**MUSI 3171. FUNDAMENTALS OF MUSIC I.** Three credit hours. Three hours of lecture per week.

An introduction to basic musical theory including; musical notation, basic harmony, auditory exercises, rhythmic and melodic dictation, analysis of minor forms, and melodic composition.

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**MUSI 3172. FUNDAMENTALS OF MUSIC II.** Three credit hours. Three hours of lecture per week. Prerequisite: MUSI 3171 or authorization of the Director of the Department.

A study of notation and reading in various keys; rhythms, intervals, and the construction of major and minor scales; auditory exercises, rhythmic and melodic dictation, analysis of minor forms, and melodic composition.

**MUSI 4995. SPECIAL TOPICS.** One to nine credit hours. One to nine hours of lecture per week.

Selected topics related to the study of music.

## PHILOSOPHY

**FILO 3001. INTRODUCTION TO PHILOSOPHY: MAJOR QUESTIONS.** Three credit hours. Three hours of lecture per week.

An introduction to the major questions dealt with in philosophy, such as the nature of reality, the nature of knowledge, the nature of moral and ethical behavior, the nature and purpose of government.

**FILO 3002. INTRODUCTION TO PHILOSOPHY: HISTORICAL APPROACH.** Three credit hours. Three hours of lecture per week.

An introduction to the major figures in the history of philosophy: Plato, Aristotle, Aquinas, Descartes, Locke, Kant, Hegel, and others.

**FILO 3155. INTRODUCTION TO ETHICS.** Three credit hours. Three hours of lecture per week.

Fundamentals of moral evaluation in human conduct.

**FILO 3156. MODERN AND CONTEMPORARY ETHICS.** Three credit hours. Three hours of lecture per week.

Modern and contemporary ethical systems, with special emphasis on Puerto Rican moral thinkers.

**FILO 3157. INTRODUCTION TO LOGIC.** Three credit hours. Three hours of lecture per week.

Introduction to logical thinking. Syllogisms and elementary truth functions, methods such as Venn diagrams and truth tables used to solve elementary arguments, and the nature of induction.

**FILO 3158. ANCIENT PHILOSOPHY.** Three credit hours. Three hours of lecture per week.

History of philosophy from the Presocratics to Plotinus.

**FILO 3159. MEDIEVAL PHILOSOPHY.** Three credit hours. Three hours of lecture per week. Prerequisite: FILO 3001 or FILO 3002 or FILO 3158.

History of philosophy from Saint Augustine to Francisco Suárez.

**FILO 3165. MODERN PHILOSOPHY.** Three credit hours. Three hours of lecture per week. Prerequisite: FILO 3001 or FILO 3002 or FILO 3158 or FILO 3159.

History of philosophy from the Renaissance to Immanuel Kant.

**FILO 3166. CONTEMPORARY PHILOSOPHY.** Three credit hours. Three hours of lecture per week. Prerequisite: FILO 3001 or FILO 3002 or FILO 3165.

History of philosophy of the nineteenth and twentieth centuries.

**FILO 3167. SYMBOLIC LOGIC I.** Three credit hours. Three hours of lecture per week.

The method of deduction for solving truth functions; quantification; laws of deduction extended to quantified propositions.

**FILO 3168. PHILOSOPHY OF SCIENCE.** Three credit hours. Three hours of lecture per week. Prerequisite: FISI 3171 or FISI 3161 or FISI 3151 or FISI 3091 or CIFI 3012.

Introductory philosophical exposition of the development and the fundamental assumptions of the principal concepts and theories of science, particularly of modern physics.

**FILO 3169. EXISTENTIALISM.** Three credit hours. Three hours of lecture per week.

Fundamental categories of human existence according to Martin Heidegger, Jean-Paul Sartre, and others.

**FILO 3175. PHILOSOPHY OF HISTORY.** Three credit hours. Three hours of lecture per week.

Philosophical consideration of history as a human process; principal theories.

**FILO 3178. BUSINESS ETHICS.** Three credit hours. Three hours of lecture per week.

Introduction to business ethics, morality in production, marketing, advertising and labor relations. Analysis of these topics in national and multinational organizations from the perspective of the Western Philosophical ethical tradition.

**FILO 3185. COMPUTER ETHICS.** Three credit hours. Three hours of lecture per week.

Ethical issues related to computer use, such as privacy, intellectual property, collective and individual responsibility for computer-wrought harm and computer crime.

**FILO 4025. MEDICAL ETHICS.** Three credit hours. Three hours of lecture per week.

Moral values involved in medical decisions, using as a basis the fundamental ethical theories of the history of philosophy.

**FILO 4026. FEMINIST ETHICS.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week. Prerequisites: Three credits in philosophy or authorization of the Director of the Department.

Study of feminist theory in ethics and analysis of feminist rethinking of traditional ethics. Discussion of values and ways of thinking that are considered “feminine” and “masculine” in traditional ethics. Philosophical analysis of the capacity of gestation and birth, and its relationship with autonomy, dignity, and human flourishing; of definitions of sex and gender; of the moral experience of women in the “public sphere” and in the “private sphere”, of the formation and development of moral character under oppressive systems; of practices and institutions that perpetuate oppression; and of proposals for resistance and change.

**FILO 4027. BIOETHICS.** Three credit hours. Three hours of lecture per week.

Moral problems related to biological research and technology.

**FILO 4041. METAPHYSICS I.** Three credit hours. Three hours of lecture per week. Prerequisite: FILO 3001 or FILO 3002 or FILO 3158.

The concepts of being, becoming, causality, essence, form and matter, quality, quantity, relation, time and space, as they emerge in ancient Greece and are integrated into Arabic and Christian thought.

**FILO 4042. METAPHYSICS II.** Three credit hours. Three hours of lecture per week. Prerequisite: FILO 4041.

Metaphysical thought after the Renaissance: rationalism, critical and absolute idealism, and Heideggerian existentialism.

**FILO 4045. ETHICS IN ENGINEERING.** Three credit hours. Three hours of lecture per week.

Ethical responsibilities of the professional engineer in relation to colleagues, employers, and society.

**FILO 4046. ENVIRONMENTAL ETHICS.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week.

A study of the most urgent environmental problems from the perspective of the philosophical principles given by different environmental ethics proposals.

**FILO 4051. PRINCIPLES OF AESTHETICS.** Three credit hours. Three hours of lecture per week.

The aesthetic experience of nature and the work of art from the point of view of both the beholder and the artist.

**FILO 4052. CONTEMPORARY AESTHETICS.** Three credit hours. Three hours of lecture per week.

Contemporary aesthetic school: experimental, hedonistic, psychological, psychoanalytical, sociological, phenomenological, existentialist, and others.

**FILO 4105. PHILOSOPHICAL TRENDS IN LATIN AMERICA.** Three credit hours. Three hours of lecture per week.

An historical and thematic examination of the basic texts of representative Latin American philosophers, such as Korn, Romero, Vasconcelos, Caso, Agremonete, Hostos, etc.

**FILO 4115. PHILOSOPHY OF RELIGION.** Three credit hours. Three hours of lecture per week.

Critical reflection on the nature, function and value of religious experience in its cognitive and moral dimensions.

**FILO 4125. PHILOSOPHY OF LAW.** Three credit hours. Three hours of lecture per week.

Philosophical analysis of the main classical and contemporary theories of the nature and function of law.

**FILO 4145. SYMBOLIC LOGIC II.** Three credit hours. Three hours of lecture per week. Prerequisite: FILO 3167.

The logic of relations; deductive systems; theory of classes; philosophical bases of symbolic logic.

**FILO 4146. CONTEMPORARY EPISTEMOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: FILO 3165. Corequisite: FILO 3166.

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Current issues in epistemology; such as foundationalism versus coherence and internalism versus externalism. Recent writings of representative figures in the field.

**FILO 4147. PHILOSOPHY OF PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Philosophical presuppositions of scientific inquiry in psychology.

**FILO 4148. PHILOSOPHY OF MARXISM.** Three credit hours. Three hours of lecture per week.

Philosophical foundations of Marxism emphasizing the thought of Marx and his followers, and the relation of dialectical materialism to mechanistic materialism, empiricism, and positivism.

**FILO 4149. SPECIAL TOPICS.** Three credit hours. Three hours of lecture per week. Prerequisite: third or fourth year student of philosophy.

Monographic study of a specific theme in philosophy or of a major philosopher.

**FILO 4155. ADVANCED ETHICS.** Three credit hours. Three hours of lecture per week. Prerequisite: FILO 3155.

Comparative study of selected ethical theories.

**FILO 4156. EPISTEMOLOGY AND SCIENCE.** Three credit hours. Three hours of lecture per week. Prerequisite: FILO 3165.

Epistemological analysis of the nature, structure, and ontological implications of scientific theories, including their roles in the scientific enterprise.

**FILO 4157. PHENOMENOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: FILO 3166.

Theory and practice of phenomenology as a system and as a philosophical method, especially through the writings of Edmond Husserl.

**FILO 4158. ANALYTIC PHILOSOPHY.** Three credit hours. Three hours of lecture per week. Prerequisites: FILO 3165 and FILO 3166.

Analytic and linguistic philosophy of the Twentieth Century, including logical atomism, neopositivism, and linguistic analysis.

**FILO 4159. PRAGMATISM.** Three credit hours. Three hours of lecture per week. Prerequisites: FILO 3165 and FILO 3166.

Pragmatism as a method, a theory of knowledge, and a theory of values.

**FILO 4160. PHILOSOPHY OF TECHNOLOGY.** Three credit hours. Three hours of lecture per week.

Critical study of the nature and meaning of technology. Conceptual distinctions between science, technology, technique, engineering, and art, and the metaphysical, epistemological, and ethical presuppositions that inspire the diverse cultural interpretations of technology will be considered.

**FILO 4991. UNDERGRADUATE RESEARCH IN PHILOSOPHY I.** One to three credit hours. Three to nine hours of research per week. Prerequisite: 21 approved credits in philosophy.

Preparation of a research proposal under the supervision of a philosophy professor.

**FILO 4992. UNDERGRADUATE RESEARCH IN PHILOSOPHY II.** One to three credit hours. Three to nine hours of research per week. Prerequisite: 21 approved credits in philosophy.

Preparation of a senior thesis based on research conducted under the supervision of a philosophy professor.

**FILO 4995. SPECIAL TOPICS IN PHILOSOPHY I.** One to nine credit hours. One to nine hours of lecture per week.

Selected topics in philosophy.

**FILO 4996. SPECIAL TOPICS IN PHILOSOPHY II.** One to nine credit hours. One to nine hours of lecture per week.

Selected topics in philosophy.

**FILO/LITE 5001. LITERATURE AND PHILOSOPHY I.** Three credit hours. Three hours of lecture per week.

Critical examination of the major philosophical theories of literary genres; analysis of the epistemological, metaphysical, and ethical meaning of literary texts from the ancient Greeks to the early Spanish Golden Age.

## RUSSIAN

**RUSO 3011. ELEMENTARY RUSSIAN.** Three credit hours per semester. Three hours of lecture per week per semester.

The principal grammatical elements of the Russian language, practice in its oral use, exercises in composition and vocabulary drill.

## THEATER

**TEAT 3051. INTRODUCTION TO THEATER ART.** Three credit hours per semester. Three hours of lecture per week each semester.

A general course in the history, theory and techniques of the drama.

**TEAT 3052. INTRODUCTION TO THEATER ART.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: TEAT 3051.

A general course in the history, theory and techniques of the drama.

**TEAT 3081. ACTING I.** Three credit hours per semester. One hour of lecture and four hours workshop per week each semester.

A study of acting through a historical background of works about famous actors. The workshop emphasizes vocal exercise, body movement, memorization and reader's theater.

**TEAT 3082. ACTING II.** Three credit hours per semester. One hour of lecture and four hours workshop per week each semester. Prerequisite: TEAT 3081.

A study of acting through a historical background of works about famous actors. The workshop emphasizes vocal exercise, body movement, memorization and reader's theater.

**TEAT 3091. THEATER PRODUCTION I.** Three credit hours per semester. One hour of lecture and four hours workshop per week each semester.

A workshop to acquaint the student with the principles of theater production. Procedures of production from the reading of the play to its performance, with emphasis on props, makeup, costuming and publicity.

**TEAT 3092. THEATER PRODUCTION II.** Three credit hours per semester. One hour of lecture and four hours workshop per week each semester. Prerequisite: TEAT 3091.

A workshop to acquaint the student with the principles of theater production. Procedures of production from the reading of the play to its performance, with emphasis on props, makeup, costuming and publicity.

**TEAT 4011. DIRECTING I.** Three credit hours. Two hours of lecture and two hours of workshop per week. Prerequisite: TEAT 3052 or nine credits in TEAT.

History and principles of stage directing.

**TEAT 4012. DIRECTING II.** Three credit hours per semester. Two hours of lecture and two hours of workshops per week each semester. Prerequisite: TEAT 3052 or 9 credits in Theater.

History and principles of stage directing.

**TEAT 4271. PLAYWRITING I: SHORT PLAYS.** Three credit hours. Two hours of lecture and one two-hour workshop per week. Prerequisite: six credits in TEAT or authorization of the Director of the Department.

Theory and practice of playwriting. Analysis of text structure. Creation of characters, dialogue, and scenes in short plays. Drafting and revision of short plays written by the students.

**TEAT 4272. PLAYWRITING II: FULL-LENGTH PLAYS.** Three credit hours. Two hours of lecture and one two-hour workshop per week. Prerequisite: TEAT 4271.

Theory and practice of full-length playwriting. Description of different dramatical writing techniques. Study of related formats: radio drama, television, and cinema. Drafting and revision of a full-length play written by each student.

**TEAT 4995. SPECIAL TOPICS IN THEATER.** One to nine credit hours. One to nine hours of lecture and workshop per week.

Exploration of various practices and diverse topics in theater such as lighting, make-up and costume design, pantomime, dramatic games, puppet theater and musical theater, among others.

## TRANSLATION

**TRAD 4995. TRANSLATION: THEORY AND PRACTICE.** One to three credit hours. One hour of lecture, one hour of discussion and one hour of seminar per week.

History, theory, and practice of translation of texts. Interlinguistic translation will focus on different areas: literature, jurisprudence, and business, among others. The languages and the areas of translation may vary.

## DEPARTMENT OF KINESIOLOGY

### *Mission*

To serve our society by creating and investigating Kinesiology in order to develop educators and coaches that promotes learning and healthy lifestyles.

### *Vision*

The kinesiology Department strives to attain the best Higher Education center for physical education and research in Kinesiology in Puerto Rico. Continuous learning and knowledge dissemination is our society.

### *Program Educational Objectives*

**Our department graduates will be able to:**

1. Address the challenges that they will face in their careers.
2. Pursue life-long learning.
3. Engage in physical activities.
4. Continue to develop problem-solving skills.
5. Exhibit leadership and team building skills.
6. Provide service to the profession, to our government, and our society.
7. Function as effective members of interdisciplinary teams.
8. Apply current technologies in physical education, sports, fitness, and recreation.

### *Definition of General Education for Physical Education*

General Education for Physical Education is defined as the courses that provide a solid academic preparation and enable students to improve their communication skills, humanistic and scientific knowledge applied to Kinesiology professions with a sense of responsibility as highly educated members of society and as good citizens.

### *Physical Education and General Education Student Outcomes*

| Physical Education Student Learning outcomes  | General Education Student Outcomes  |
|---|---|
| 1. Ability to understand and apply scientific and theoretical knowledge of kinesiology in | b. Identify and solve problems, think critically, and synthesize knowledge appropriate to their discipline. |

|   |   |
|---|---|
| physical education, sports, and fitness.  |   |
| 2. Proficiency in personal and professional skills in diverse physical education, fitness, and sport education settings.                      | b. Identify and solve problems, think critically, and synthesize knowledge appropriate to their discipline.   |
| 3. Ability to conduct research and to critically analyze and interpret data in at least one of the mayor areas of kinesiology.                | c. Apply mathematical reasoning skills, scientific inquiry methods, and tools of information technology.  |
| 4. Ability to solve problems in physical education, sports, and fitness, using scientific methods, research designs, and technological tools. | b. Identify and solve problems, think critically, and synthesize knowledge appropriate to their discipline.<br>c. Apply mathematical reasoning skills, scientific inquiry methods, and tools of information technology. |
| 5. Play an effective professional role in multidisciplinary groups, related to physical education, sports, fitness, issues.                   | b. Identify and solve problems, think critically, and synthesize knowledge appropriate to their discipline.   |
| 6. Ability to communicate effectively.  | a. Communicate effectively.   |
| 7. Understand the importance of compliance with professional practice and legal and ethical issues.   | d. Apply ethical standards.   |
| 8. Understand the impact of respect for nature and for diversity in local and global physical education, fitness and sport practices.         | g. Operate in a global context, relate to a societal context, and demonstrate respect for other cultures.   |
| 9. Commitment to engage in lifelong learning and physical activity.   | i. Recognize the need to engage in life-long learning.  |

|   |   |
|---|---|
| 10. Awareness of contemporary sociocultural, environmental issues in physical education, fitness, and sports. | e. Recognize the Puerto Rican heritage and interpret contemporary issues.<br>f. Appraise the essential values of a democratic society.<br>h. Develop an appreciation for the arts and humanities. |
|---|---|

### **Academic Offerings**

The Kinesiology Department offers three academic programs: (a) Physical Education in Teaching; (b) Coaching and Officiating, and (c) Sequence and/or minor concentration in Adapted Physical Education. The bachelor's degree in Teaching Physical Education includes all updated requirements for the Puerto Rico Teaching license in Physical Education K-12, including the general and professional minimum GPA required for certification. The approval of 21 credits in adapted physical education courses permit candidates with the Physical Education K-12 teaching license, to qualify for another license: the Adapted Physical Education teaching license.

The Kinesiology Department established an internal monitoring system of transition points for the Teaching Physical Education Program (TPEP):

#### *Entrance:*

Candidates enrolled in the TPEP will receive orientation on the need to follow the curricular sequence and the importance of maintaining a minimum of 3.0 GPA in order to comply with the Puerto Rico Department of Education Teacher Certification requirement. The Kinesiology Department Academic Counselor will monitor student progress throughout the first two academic years.

#### *Transition Point One:*

At the beginning of the first semester of the third year, candidates will complete a teacher disposition questionnaire in the EDFI 4205 course.

#### *Transition Point Two:*

In EDPE 4215 (Theory and Methodology in Teaching Physical Education in Secondary School) and EDPE 4218(Theory and Methodology in Teaching Elementary Physical Education) students will start to work on the electronic portfolio which will include artifacts related to their teaching experiences such as: unit or lesson plans, classroom management strategies, student learning analysis through assessment and reflections.

#### *Transition Point Three:*

Student teaching practicum: The candidate should have a minimum GPA of 3.0 in order to eventually become a certified teacher by the Puerto Rico Department of Education. Students will present a Teacher Candidate Work Sample (TCWS). In the TCWS the candidate has to include artifacts such as lesson or unit plans, exams with their analysis, and classroom management techniques.

#### *Transition Point Four:*

Program Completion, in the student teaching course the candidate has developed an approved electronic portfolio which includes the TCWS that demonstrates the candidate's content knowledge, applied knowledge of human development and learning, sensibility to diversity, pedagogical content knowledge skills and reflective habits on the effectiveness of their practice. A group interview and a satisfaction survey will be administered to candidates.

## **BACHELOR OF ARTS IN PHYSICAL EDUCATION**

### **A) PHYSICAL EDUCATION IN TEACHING PROGRAM**

#### **Summary of Credits in Program**

|                              |                |
|------------------------------|----------------|
| Faculty General requirements | 54-56          |
| Departmental requirements    |                |
| Major area                   | 39             |
| Non-major area               | 30             |
| Free electives               | <u>12</u>      |
| <b>Total</b>                 | <b>135-137</b> |

#### **PROGRAM OF STUDY**

#### **TEACHING CURRICULUM**

#### **FIRST YEAR**

##### **First Semester**

|  |   |
|--|---|
| <b>INGL 3101</b> General Education Requirement |   |
| Basic course in English                        | 3 |
| or   |   |
| <b>INGL 3103</b> General Education Requirement |   |
| Intermediate English I                         | 3 |
| <b>ESPA 3101</b> General Education Requirement |   |
| Basic course in Spanish I                      | 3 |
| <b>CIBI 3031</b> General Education Requirement |   |
| Intro. to the Biological Sciences I            | 3 |
| <b>HUMA 3111</b> General Education Requirement |   |
| Intro. to Western Culture I                    | 3 |
| <b>*EDFI 3555</b>                              |   |
| History and Principles of Physical Education   | 3 |



**EDFI 3305** General Education Requirement

Folk Dances 1

or

**EDFI 3245** General Education RequirementElementary Swimming  $\frac{1}{16}$ **Second Semester****INGL 3102** General Education Requirement

Basic course in English 3

or

**INGL 3104** General Education Requirement

Intermediate English II 3

**ESPA 3102** General Education Requirement

Basic course in Spanish II 3

**CIBI 3032** General Education Requirement

Intro. to the Biological Sciences II 3

**HUMA 3112** General Education Requirement

Intro. to Western Culture II 3

**+MATE 3171** General Education Requirement

Pre-Calculus I 3

or

**+MATE 3086** General Education Requirement

Mathematical Reasoning 3

**EDFI 3245** General Education Requirement

Elementary Swimming 1

or

**EDFI 3305** General Education Requirement

Folk Dances 1

**\*EDFI ---**Fundamental A or B  $\frac{1}{17}$ **SECOND YEAR****First Semester****INGL 3---** General Education Requirement

Second year course in English 3

**ESPA 3---** General Education Requirement

Course above level of basic Spanish 3

**\*EDFI 4005** General Education Requirement

Fundamental of Motor Learning 3

**EDFU 3011**

Foundations of Human Development 3

**+ESMA 3015** General Education Requirement

Elementary Statistics 3

or

**+ESMA 3101**

Applied Statistics 3

**\*EDFI 3395** General Education RequirementAdapted Physical Education: Exceptionality and Disabilities  $\frac{3}{18}$ **Second Semester****^INGL 3---** General Education Requirement

Second year course in English 3

**ESPA 3---** General Education Requirement

Course above level of basic Spanish 3

**\*EDFI 4026**

Measurement &amp; Evaluation in Elementary and

Secondary Physical Education 3

**EDFU 3012**

Foundations of Educational Psychology 3

**\*EDFI 4179**

Introduction to Motor Development with Laboratory 3

**\*EDFI ---**Fundamental A or B  $\frac{1}{16}$ **THIRD YEAR****First Semester****\*EDFI 4167**

Gymnastics, Dance and Fitness in Elementary Physical Education 3

**HIST 3111-3112** General Education Requirement

History of the United States of America 3

**\*EDFI 4205**

Teaching Methods &amp; Techniques in Physical Education 3

**EDFU 3007**

Social Foundation of Education 3

**\*EDFI 4106**

Biomechanics of Human Movement 3

**\*EDFI 3645**First Aid and Security  $\frac{2}{17}$ **Second Semester****EDFI 3106**

Low Organization and Sports Lead-Up Games 3

**HIST 3241 or 3242** General Education Requirement

History of Puerto Rico I or II 3

**\*EDPE 4218**

Theory and Methodology in Teaching Elementary Physical Education 3

**EDFU 4019**

Philosophical Foundation of Education 3

**\*EDFI 4177**

Exercise Physiology with Lab 3

**ELECTIVE**Free Elective  $\frac{3}{18}$ **FOURTH YEAR****First Semester****\*EDFI 3465**

Personal and Community Health 3

**\*EDPE 3129**

The Use of Microcomputers in the Classroom 3

**CIFI-QUIM** General Education Requirement

Elective in Physics (3)

or

Chemistry (4) 3-4

**\*EDFI 4125**

Organization, Adm. &amp; Supervision of Physical Education 3

**\*EDPE 4215**

Theory and Methodology in the Teaching of Physical Education in Secondary School 3

**ELECTIVE**Free Elective  $\frac{3}{18-19}$

## Second Semester

### EDPE 4216

|  |          |
|--|----------|
| Practicum in Teaching Physical Education       | 6        |
| <b>CIFI-QUIM</b> General Education Requirement |          |
| Elective in Physics (3)                        |          |
| or   |          |
| Chemistry (4)                                  | 3-4      |
| <b>ELECTIVE</b>                                |          |
| Free Elective                                  | 3        |
| <b>ELECTIVE</b>                                |          |
| Free Elective                                  | <u>3</u> |
|  | 15-16    |

**Total credits required: 135-137**

**One Fundamental in Physical Education must be taken in each letter group.**

A-Team Sports: EDFI 3077(1), EDFI 3215(1), EDFI 3596(1)  
B-Individual Sports: EDFI 3058(2), EDFI 3205(1), EDFI 3295(1), EDFI 3685(1)  
C-Aquatics: EDFI 3245(1)  
D-Rhythms: EDFI 3305(1)

RECOMMENDED ELECTIVE IN EDFU: EDFU 3008, EDFU 3055, EDFU 3115, EDFU 4218, EDPE 3129, EDES 4006.

Note: The courses EDPE 3129 and EDES 4006 are required if the student wants to obtain a Teacher's license from the Puerto Rico Department of Education. Students are advised to follow any changes in the required courses by the Department of Education of Puerto Rico.

+ MATE 3171 or MATE 3086 are prerequisite of ESMA 3015.  
+ MATE 3171 is prerequisite of ESMA 3101 and other Math courses.

++Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR 4006, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 4036, CIPO 4236, CISO 3121, CISO 3122, CISO 4066, ECON 3021, ECON 3022, ECON 3091, ECON 3092, ECON 4037, ECON 4056, GEOG 3155, GEOG 3185, HIST 3091, HIST 3092, HIST 3111, HIST 3112, HIST 3121, HIST 3122, HIST 3141, HIST 3142, HIST 3155, HIST 3158, HIST 3165, HIST 3185, HIST 3195, HIST 3201, HIST 3202, HIST 3211, HIST 3212, HIST 3221, HIST 3222, HIST 3241, HIST 3242, HIST 4005, HIST 4111, HIST 4112, HIST 4117, HIST 4165, HIST 4171, HIST 4172, HIST 4220, HIST 4235, HIST 4345, PSIC 3001, PSIC 3002, SOCI 3016, SOCI 3047, SOCI 3261, SOCI 3262, SOCI 3315.

+++Recommended electives in Physical Sciences-Chemistry: QUIM 3001, QUIM 3002, QUIM 3141, QUIM 3142, QUIM 3131, QUIM 3133, QUIM 3132, QUIM 3134, CIFI 3011, CIFI 3012, FISI 3091, FISI 3092, FISI 3151, FISI 3152, FISI 3153, FISI 3154, FISI 3161, FISI 3162, FISI 3163, FISI 3164, FISI 3172, FISI 3173, FISI 3174.

\*Specialization courses must be approved with grade of (C) or better.

\*\*Must be approved with grade of (B) or better.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## B) COACHING AND OFFICIATING PROGRAM

### Summary of Credits in Program

|                           |                |
|---------------------------|----------------|
| Faculty requirements      | 54-56          |
| Departmental requirements |                |
| Major area                | 47             |
| Non-major area            | 17             |
| Recommended electives     | 3              |
| Free electives            | <u>12</u>      |
| <b>Total</b>              | <b>133-135</b> |

## PROGRAM OF STUDY

### COACHING AND OFFICIATING CURRICULUM

#### FIRST YEAR

##### First Semester

|   |          |
|---|----------|
| <b>INGL 3101</b> General Education Requirement          |          |
| Basic course in English                                 | 3        |
| or  |          |
| <b>INGL 3103</b> General Education Requirement          |          |
| Intermediate English I                                  | 3        |
| <b>ESPA 3101</b> General Education Requirement          |          |
| Basic course in Spanish I                               | 3        |
| <b>CIBI 3031</b> General Education Requirement          |          |
| Intro. to the Biological Sciences I                     | 3        |
| <b>HUMA 3111</b> General Education Requirement          |          |
| Intro. to Western Culture I                             | 3        |
| <b>*EDFI 3555</b>                                       |          |
| History and Principles of Physical Education            | 3        |
| <b>*EDFI 3265</b>                                       |          |
| Weight Lifting and Weight Training for Different Sports | 1        |
| <b>EDFI ----</b> General Education Requirement          |          |
| Physical Education Elective                             | <u>1</u> |
|   | 17       |

##### Second Semester

|   |   |
|---|---|
| <b>INGL 3102</b> General Education Requirement  |   |
| Basic course in English                         | 3 |
| or  |   |
| <b>INGL 3104</b> General Education Requirement  |   |
| Intermediate English II                         | 3 |
| <b>ESPA 3102</b> General Education Requirement  |   |
| Basic course in Spanish II                      | 3 |
| <b>CIBI 3032</b> General Education Requirement  |   |
| Intro. to the Biological Sciences II            | 3 |
| <b>HUMA 3112</b> General Education Requirement  |   |
| Intro. to Western Culture II                    | 3 |
| <b>+MATE 3171</b> General Education Requirement |   |
| Pre-Calculus I                                  | 3 |
| or  |   |
| <b>+MATE 3086</b> General Education Requirement |   |
| Mathematical Reasoning                          | 3 |

|  |          |
|--|----------|
| <b>*EDFI ----</b>                              |          |
| Fundamentals                                   | 1        |
| <b>EDFI ----</b> General Education Requirement |          |
| Physical Education Elective                    | <u>1</u> |
|  | 17       |

## SECOND YEAR

### First Semester

|   |          |
|---|----------|
| <b>INGL 3---</b> General Education Requirement  |          |
| Second year course in English                   | 3        |
| <b>ESPA 3---</b> General Education Requirement  |          |
| Course above level of basic Spanish             | 3        |
| <b>++ELECTIVE</b> General Education Requirement |          |
| in Social Sciences                              | 3        |
| <b>EDFU 3011</b>                                |          |
| Foundations of Human Development                | 3        |
| <b>+ESMA 3015</b> General Education Requirement |          |
| Elementary Statistics                           | 3        |
| or  |          |
| <b>+ESMA 3101</b> General Education Requirement |          |
| Applied Statistics I                            | 3        |
| <b>*EDFI ----</b>                               |          |
| Fundamentals                                    | <u>1</u> |
|   | 16       |

### Second Semester

|   |          |
|---|----------|
| <b>^INGL 3---</b> General Education Requirement |          |
| Second year course in English                   | 3        |
| <b>ESPA 3---</b> General Education Requirement  |          |
| Course above level of basic Spanish             | 3        |
| <b>ELECTIVE</b> General Education Requirement   |          |
| in Social Sciences                              | 3        |
| <b>EDFU 3012</b>                                |          |
| Foundations of Educational Psychology           | 3        |
| <b>*EDFI 3465</b>                               |          |
| Personal and Community Health                   | 3        |
| <b>*EDFI ----</b>                               |          |
| Fundamentals                                    | 1        |
| <b>*EDFI ----</b>                               |          |
| Fundamentals                                    | <u>1</u> |
|   | 17       |

## THIRD YEAR

### First Semester

|   |     |
|---|-----|
| <b>CIFI-QUIM</b> General Education Requirement              |     |
| Elective in Physics   | (3) |
| or  |     |
| Chemistry (4)   | 3-4 |
| <b>*EDFI 4005</b>   |     |
| Fundamental of Motor Learning                               | 3   |
| <b>EDFU 3007</b>  |     |
| Social Foundation of Education                              | 3   |
| <b>*EDFI 3395</b>   |     |
| Adapted Physical Education: Exceptionality and Disabilities | 3   |
| <b>*EDFI 3645</b>   |     |
| First Aid and Security                                      | 2   |

|                          |          |
|--------------------------|----------|
| <b>*EDFI ----</b>        |          |
| Coaching and Officiating | <u>2</u> |
|                          | 16-17    |

### Second Semester

|   |          |
|---|----------|
| <b>CIFI-QUIM</b> General Education Requirement      |          |
| Elective in Physics                                 | (3)      |
| or  |          |
| Chemistry (4)                                       | 3-4      |
| <b>*EDFI 4205</b>                                   |          |
| Teaching Methods & Techniques in Physical Education | 3        |
| <b>EDFU 4019</b>                                    |          |
| Philosophical Foundation of Education               | 3        |
| <b>*EDFI 4045</b>                                   |          |
| Evaluation & Research in Physical Education         | 3        |
| <b>*EDFI 4106</b>                                   |          |
| Biomechanics of Human Movement                      | 3        |
| <b>*EDFI ----</b>                                   |          |
| Coaching and Officiating                            | <u>2</u> |
|   | 17-18    |

## FOURTH YEAR

### First Semester

|  |          |
|--|----------|
| <b>PSIC 3001</b> General Education Requirement                     |          |
| Principles of Psychology I   | 3        |
| <b>*EDFI 4230</b>  |          |
| Athletic Training  | 3        |
| <b>*EDFI ----</b>  |          |
| Coaching and Officiating   | 2        |
| <b>*EDFI ----</b>  |          |
| Coaching and Officiating   | 2        |
| <b>*EDFI 4177</b>  |          |
| Physiology of Exercise w Laboratory                                | 3        |
| <b>*EDFI 4125</b>  |          |
| Organization, Administration and Supervision of Physical Education | <u>3</u> |
|  | 16       |

### Second Semester

|                                     |          |
|-------------------------------------|----------|
| <b>*EDFI 4250</b>                   |          |
| Seminar in Coaching and Officiating | 2        |
| <b>ELECTIVE</b>                     |          |
| Free Elective                       | 3        |
| <b>ELECTIVE</b>                     |          |
| Free Elective                       | 3        |
| <b>ELECTIVE</b>                     |          |
| Free Elective                       | 3        |
| <b>ELECTIVE</b>                     |          |
| Free Elective                       | 3        |
| <b>ELECTIVE</b>                     |          |
| Recommended Elective                | <u>3</u> |
|                                     | 17       |

**Total credits required: 133-135**

\*Specialization courses must be approved with a grade of "C" or better.

Fundamental Courses- Choose four (4) of the following:  
EDFI 3058, EDFI 3077, EDFI 3215, EDFI 3225, EDFI 3245, EDFI 3295, EDFI 3596.

Coaching and Officiating- Choose four (4) of the following: EDFI 3075, EDFI 3095, EDFI 3615, EDFI 4055, EDFI 4065, EDFI 4075, EDFI 4195.EDFI 3620 (The pre-requisite in each is the fundamental course in that sport.)

+MATE 3171 or MATE 3086 are prerequisites of ESMA 3015.

+MATE 3171 is a prerequisite of ESMA 3101 and other Math courses.

++Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 4036, CIPO 4236, CISO 3121, CISO 3122, CISO 4066, ECON 3021, ECON 3022, ECON 3091, ECON 3092, ECON 4037, ECON 4056, GEOG 3155, GEOG 3185, HIST 3091, HIST 3092, HIST 3111, HIST 3112, HIST 3121, HIST 3122, HIST 3141, HIST 3142, HIST 3155, HIST 3158, HIST 3165, HIST 3185, HIST 3195, HIST 3201, HIST 3202, HIST 3211, HIST 3212, HIST 3221, HIST 3222, HIST 3241, HIST 3242, HIST 4005, HIST 4111, HIST 4112, HIST 4117, HIST 4165, HIST 4171, HIST 4172, HIST 4220, HIST 4235, HIST 4345, PSIC 3002, SOCI 3016, SOCI 3047, SOCI 3261, SOCI 3262, SOCI 3315.

Recommended Elective in Coaching and Officiating: ARTE 3121, ARTE 3276, CIMI\*\*\*\*, CIPO 3011, CONT 3005, ECON 3021, EDES 4006, EDFI 3038, EDFI 3245, EDFI 3246, EDFI 3305, EDFI 4000, EDFI 4010, EDFU 3055, EDFU 4006, EDFU 4025, EDPE 3129, ESAE \*\*\*\*, FILO 3157, FRAN 3141, FRAN 3142, GEOL 3027, GERH 4006, HIST 3111, HIST 3112, HIST 3241, HIST 3242, INGL 3238, ITAL 3071, ITAL 3072, MERC 3117, MUSI 3135, PSIC 3002, SOCI 3262, TEAT 3051, TEAT 3081, TEAT 3091, EDFI 4176, EDFI 4179, EDFI 3380, EDFI 3408, EDFI 4016, EDFI 3106, EDFI 4190, EDFI 3205, EDFI 3296.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

### C) ADAPTED PHYSICAL EDUCATION COURSES:

#### EDFI 3395

Adapted Physical Education:  
Exceptionality and Disabilities

3

#### EDFI 3098

Methods and Techniques in Adapted  
Physical Education 3

#### EDFI 3408

Adapted Aquatics 2

#### EDFI 3649

Summer Practice in Adapted  
Physical Education 4

#### EDFI 3696

Laboratory in Methods and  
Techniques in Adapted Physical Education 1

#### EDFI 4016

Inclusion in Physical Education 3

#### EDFI 4017

Adapted Sports 2

#### EDFI 4029

Adapted Physical Education and  
Assistive Technology 2  
21

### DEPARTMENTAL FACULTY

**RAMON L. ALVAREZ-FELICIANO**, *Assistant Professor*, E.Ed., 2015, University of Puerto Rico-Rio Piedras.

**IBRAHIM M. CORDERO-MORALES**, *Professor*, Ph.D., 2002, Florida State University.

**LUIS O. DEL RÍO-PÉREZ**, *Professor*, Ph.D., 1989, University of Pittsburgh.

**MARGARITA FERNÁNDEZ-VIVÓ**, *Professor*, Ph.D., 2002, Florida State University.

**IRIS A. FIGUEROA-ROBLES**, *Assistant Professor*, Ph.D. 2010, Florida State University.

**FERNANDO GAZTAMBIDE-BARBOSA**, *Associate Professor*, M.A., 1974, Interamerican University of Puerto Rico.

**HECTOR HEREDIA-VARGAS**, *Assistant Professor*, Ph.D.; 2015, University of Miami.

**EFRANK MENDOZA-MARTÍNEZ**, *Professor*, Ph.D., 1990, The University of New Mexico.

**CARLOS QUIÑONES-PADOVANI**, *Associate Professor*, Ph.D. 2009, Florida State University.

**DIANA RODRÍGUEZ-VEGA**, *Professor*, Ed.D., 1995, University of Columbia.

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**ENID RODRÍGUEZ-NOGUERAS,** *Assistant Professor*, Ph.D., 2010, University of North Carolina.

**MANUEL SILVA,** *Assistant Professor*, Ph.D., 2014, Claremont Graduate University.

**EDUARDO SOLTERO-FLORES,** *Professor*, Ed.D., 1988, University of Houston.

## **COURSES OF INSTRUCTION**

### **DEPARTMENT OF PHYSICAL EDUCATION**

#### **Undergraduate Courses**

**EDFI 3038. RECREATIONAL SWIMMING.** One credit hour. One hour of lecture and one hour of practice per week. Prerequisite: EDFI 3245.

Skills and techniques of recreational aquatic games.

**EDFI 3058. FUNDAMENTALS OF TRACK AND FIELD.** Two credit hours. One hour of lecture and two hours of practice per week.

Theory and practice of the basic skills in track and field events.

**EDFI 3075. DEVELOPMENT, TRAINING AND TECHNIQUE OF SPORTS.** Two credit hours. One hour of lecture and two hours of practice per week. Prerequisite: EDFI 3058.

Theory, strategy and mechanics of coaching various interscholastic and intercollegiate track and field events.

**EDFI 3076. PERSONAL TRAINING.** One credit hour. One hour of conference and one hour of practice per week.

Basic programs of physical fitness designed for the individual's needs using scientific knowledge and the practice of physical activities.

**EDFI 3077. FUNDAMENTALS OF SOFTBALL AND BASEBALL.** One credit hour. One hour of lecture and one hour of practice per week.

Theory and practice of basic skills of softball and baseball.

**EDFI 3078. TEACHING OF ULTIMATE.** One credit hour. One hour of lecture and one hour of supervised practice per week.

Study of the concepts and methods of teaching Ultimate Frisbee. Effective execution of the skills necessary to practice this sport in a competitive and recreational way. Discussion of techniques for teaching these skills to foment the creation of Ultimate Frisbee programs in schools and in the community with the purpose of offering an entertaining and economical way of promoting a healthier and more physically active lifestyle.

**EDFI 3090. PHYSICAL EDUCATION FOR THE PRESCHOOL LEVEL.** Three credit hours. Two hours of lecture and one two-hour workshop per week.

Study of the fundamental aspects of psychomotor, cognitive, and affective development of the pre-schooler and their relation and application to physical education. Methods and techniques for the effective teaching of physical education with emphasis on the selection, organization, and evaluation of activities of movement at this level.

**EDFI 3095. COACHING AND OFFICIATING BASKETBALL.** Two credit hours. One hour of lecture and two hours of practice per week. Prerequisite: EDFI 3215.

Theory and practice in coaching and officiating basketball.

**EDFI 3098. METHODS AND TECHNIQUES IN ADAPTED PHYSICAL EDUCATION.** Three credit hours. Three hours of lecture per week. Prerequisites: EDFI 3395. Co-requisite: EDFI 3696.

Methodology in assessment, programming, service delivery and evaluation of physical education programs for individuals with disabilities since infancy. Emphasis in the administration and interpretation of tests, writing of individualized plans in physical education within an individualized education plan (IEP) or the individualized family service plan (IFSP). Further in-dept coverage of techniques for individualizing teaching and intervention from diverse perspectives of models: developmental, functional family-centered and ecological foci.

**EDFI 3106. LOW ORGANIZATION AND SPORTS LEAD-UP GAMES.** Three credit hours. Two hours of lecture and two hours of practice per week. Prerequisites: EDFI 4179 and EDFI 4205.

Teaching and practice of low organization games, modified activities and introductory games to sports, in the elementary physical education curriculum. Emphasis in appropriate teaching practices aligned to content standards in the k-3rd elementary physical education in contrast to physical education 4th-6th. Includes laboratory experiences.

**EDFI 3205. INTRODUCTION TO GYMNASTICS.** One credit hour. One hour of lecture and one hour of practice per week.

The learning and development of skills in acrobatic, rhythmic and aerobic gymnastics.

**EDFI 3215. FUNDAMENTALS OF BASKETBALL.** One credit hour. One hour of lecture and one hour of practice per week.

Theoretical and practical approaches to basketball.

**EDFI 3225. FUNDAMENTALS OF VOLLEYBALL.** One credit hour. One hour of lecture and one hour of practice per week.

Theoretical and practical approaches to volleyball.

**EDFI 3235. SCOUTING.** Two credit hours. Two hours of lecture per week.

History of scouting, troop organization, and problems in the organization of the different activities that characterize a progressive troop.

**EDFI 3245. ELEMENTARY SWIMMING.** One credit hour. One hour of lecture and one hour of practice per week.

A course for beginners, with emphasis on the various strokes.

**EDFI 3246. AQUATIC SKILLS.** One credit hour. One hour of lecture and one hour of practice per week. Prerequisite: EDFI 3245.

Aquatic techniques, with emphasis on recreation: water safety, lifesaving, skin diving, and underwater fishing. Field trips required.

**EDFI 3255. ADVANCED SWIMMING.** One credit hour. One hour of lecture and one hour of practice per week. Prerequisite: EDFI 3245.

A course for advanced swimmers with emphasis in the improvement of strokes.

**EDFI 3265. WEIGHT LIFTING AND WEIGHT TRAINING FOR DIFFERENT SPORTS.** One credit hour. One hour of lecture and one-hour laboratory per week.

Training techniques and development of skills in weight lifting and weight training for different sports.

**EDFI 3285. AQUATIC SKILLS AND WATER SAFETY.** One credit hour. One hour of lecture and one-hour laboratory per week. Prerequisite: EDFI 3245.

Training, techniques and development of skills in aquatic activities, and water safety.

**EDFI 3295. ELEMENTARY TENNIS.** One credit hour. One hour of lecture and one hour of practice per week.

Training, techniques, and development of skills in tennis.

**EDFI 3296. ADVANCED TENNIS.** One credit hour. One hour of conference and one hour of supervised practice per week. Prerequisite: EDFI 3295.

Development of techniques and advanced practice of tennis skills including strokes and strategies for competitive play. The student is expected to play singles and double matches applying basic and complex skills.

**EDFI 3305. FOLK DANCES.** One credit hour. One hour of lecture and one hour of practice per week.

Theory and practice of different folk dances.

**EDFI 3325. CURRICULUM IN PHYSICAL EDUCATION.** Three credit hours. Three hours of lecture per week. Prerequisite: (EDFU 3002 or EDFU 3012) and EDFU 3007 and EDFU 4019.

Philosophy, principles and major trends in curriculum design for particular grade levels.

**EDFI 3380. PHYSICAL ACTIVITIES AND THE ELDERLY.** Three credit hours. Three hours of lecture per week. Prerequisite: CIBI 3002 or CIBI 3032.

Development of beneficial exercises and activities for the elderly.

**EDFI 3395. ADAPTED PHYSICAL EDUCATION: EXCEPTIONALITY AND DISABILITIES.** Three credit hours. Three hours of lecture per week.

Principles, state and federal laws on special education applicable to adapted physical education. Nature and needs of exceptional students and those with disabilities, in the teaching of physical education from inclusion to other least restrictive environments. Adaptations include assistive technology. Field trips of at least 15 observation hours are required. As well as an assessment project.

**EDFI 3397. TEACHING PHYSICAL EDUCATION IN ELEMENTARY AND SECONDARY SCHOOLS.** Three credit hours. Three hours of lecture per week.

Methods and activities for teaching physical education in elementary and secondary schools.

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**EDFI 3408. ADAPTED AQUATICS ACTIVITIES.** Two credit hours. One hour of lecture and two hours of supervised practice per week. Prerequisites: (EDFI 3245 and EDFI 3395) or authorization of the Director.

Methods of teaching and planning aquatic activities oriented to persons with disabilities. Development and application of inclusion strategies in adapted aquatics for persons with different types of disabilities.

**EDFI 3465. PERSONAL AND COMMUNITY HEALTH.** Three credit hours. Three hours of lecture per week.

Basic knowledge of current individual and community health problems.

**EDFI 3555. HISTORY AND PRINCIPLES OF PHYSICAL EDUCATION.** Three credit hours. Three hours of lecture per week.

The origin, nature and development of physical education to the present time as formative experience and medium of education.

**EDFI 3596. FUNDAMENTALS OF SOCCER.** One credit hour. One hour of lecture and one hour of practice per week.

Theory and practice of soccer.

**EDFI 3615. COACHING AND OFFICIATING SWIMMING.** Two credit hours. One hour of lecture and two one-hour laboratories per week. Prerequisite: EDFI 3245.

Theory, strategy, and techniques in coaching swimming.

**EDFI 3620. TRIATHLON TRAINING.** Two credit hours. One hour of conference and two hours of practice per week. Prerequisite: EDFI 3245.

Theory and practice of triathlon training and coaching.

**EDFI 3645. FIRST AID AND SECURITY.** Two credit hours. Two hours of lecture per week.

Incidence, causes and prevention of injuries; adequate procedures for the prevention and treatment of emergency situations.

**EDFI 3649. SUMMER PRACTICUM IN ADAPTED PHYSICAL EDUCATION.** Four credit hours. One hundred fifty hours of practicum. Prerequisites: (EDFI 3395 and EDFI 3645) or authorization of the Director of the Department.

Practical work and field experience for students in physical education, sports, and/or recreation programs

that include persons with disabilities. The student will plan and apply strategies for the teaching of adapted physical activities to individuals with disabilities. The student will be jointly supervised by the Department of Physical Education and a qualified representative from the participating programs. The student will present a portfolio and a reflective journal upon the completion of the work done in the program.

**EDFI 3665. RECREATIONAL SPORTS.** Two credit hours. Two hours of lecture per week.

Methods, materials, and techniques in teaching selected recreational activities.

**EDFI 3685. FUNDAMENTALS OF HANDBALL AND RACQUETBALL.** One credit hour. One hour of lecture and one hour of practice per week.

Theory and practice of handball and racquetball.

**EDFI 3696. LABORATORY OF METHODS AND TECHNIQUES IN ADAPTED PHYSICAL EDUCATION.** One credit hour. One two-hour laboratory per week. Prerequisite: EDFI 3395. Co-requisite: EDFI 3098.

Administration of tests, scheduling of activities, and application of teaching methods in areas of physical education for individuals with disabilities.

**EDFI 4000/SOCI 4000. SOCIOLOGICAL FUNDAMENTALS OF RECREATION AND SPORTS.** Three credit hours. Three hours of lecture per week.

The interaction among society, sports, and recreation.

**EDFI 4005. FUNDAMENTALS OF MOTOR LEARNING.** Three credit hours. Three hours of lecture per week. Prerequisite: CIBI 3002 or CIBI 3032.

Aspects of physiology, psychology, and education that form the basis for understanding motor activity.

**EDFI 4010/PSIC 4010. PSYCHOLOGICAL ASPECTS OF SPORTS.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3001.

Psychological factors involved in motor performance and in sports.

**EDFI 4016. INCLUSION IN PHYSICAL EDUCATION ACTIVITIES.** Three credit hours. Three hours of lecture per week. Prerequisite: EDFI 3395.

Analysis and application of strategies for the integration of persons with disabilities in adapted physical activities. Identification of the psychomotor needs of the disabled

person in order to facilitate inclusion in adapted sports activities.

**EDFI 4017. ADAPTED SPORTS.** Two credit hours. One hour of lecture and one two-hour laboratory per week. Prerequisite: EDFI 3395.

Teaching of sports for individuals with disabilities in mainstream or adapted settings. Design and application of lesson plans in laboratories. Adaptation of standard sports equipment and construction of assistive equipment for sports participation.

**EDFI 4026. MEASUREMENT AND EVALUATION IN ELEMENTARY AND SECONDARY PHYSICAL EDUCATION.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: ESMA 3101 or ESMA 3015.

Theory, methods, and practice in measurement and evaluation of elementary and secondary physical education, according to NASPE standards adopted in Puerto Rico. Students will measure the attainment of cognitive, psychomotor, and affective objectives in the teaching of physical education. Includes lectures, discussions, and laboratories in test construction and administration, and in the use of statistical packages for the analysis and evaluation of test results.

**EDFI 4027. STRENGTH TRAINING AND CONDITIONING.** Three credit hours. Two hours of lecture and two hours of supervised practice per week. Prerequisite: EDFI 3265 and EDFI 4105 and EDFI 4115.

Training techniques and strategies for strength and conditioning for the development of different physical abilities of young and adult elite athletes. The course will prepare the student to take the Certified Strength Conditioning Specialist examination of the *National Strength and Conditioning Association*.

**EDFI 4029. ADAPTED PHYSICAL EDUCATION AND ASSISTIVE TECHNOLOGY.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: EDFI 3395.

Study of the unique attributes in most disabilities specified by IDEA; adaptations and assistive technology needed to implement appropriate physical education programs. Application of educational strategies in choosing and implementing activities, assistive technology, and assessment appropriate for persons with physical or cognitive disabilities.

**EDFI 4045. EVALUATION AND RESEARCH IN PHYSICAL EDUCATION.** Three credit hours. Three hours of lecture per week. Prerequisite: ESMA 3015 or ESMA 3101.

Methods of evaluation and research in physical education including the use of microcomputers.

**EDFI 4055. COACHING AND OFFICIATING VOLLEYBALL.** Two credit hours. One hour of lecture and two hours of practice per week. Prerequisite: EDFI 3225.

Theory and practice in coaching and officiating volleyball.

**EDFI 4065. COACHING AND OFFICIATING SOCCER.** Two credit hours. One hour of lecture and two hours of practice per week. Prerequisite: EDFI 3596.

Theory and practice in coaching and officiating soccer.

**EDFI 4075. COACHING AND OFFICIATING SOFTBALL AND BASEBALL.** Two credit hours. One hour of lecture and two hours of practice per week. Prerequisite: EDFI 3077.

Theory and practice in coaching and officiating softball and baseball.

**EDFI 4106. BIOMECHANICS OF HUMAN MOVEMENT.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: MATE 3086 or MATE 3171.

Application of mechanical principles to the study of human movement with emphasis on the function of the musculoskeletal system. Identification and analysis of the mechanical and musculoskeletal factor that affect the performance of motor skills through the use of technology available for this purpose.

**EDFI 4125. ORGANIZATION, ADMINISTRATION AND SUPERVISION OF PHYSICAL EDUCATION.** Three credit hours. Three hours of lecture per week. Prerequisite: EDFI 3555.

Organization, administration and supervision of physical education, including intramural and interscholastic sports.

**EDFI 4167. GYMNASTICS, DANCE AND FITNESS IN ELEMENTARY PHYSICAL EDUCATION.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: EDFI 4179 and EDFI 4205.

Teaching and practice of gymnastics, dance, rhythms and physical fitness activities appropriate to teaching physical education k-3rd grade and 4-6th grades. Planning and progression designs aligned to naspe content standards. Includes laboratory in elementary school.



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**EDFI 4176. MECHANICS OF MOVEMENT FOR CHILDREN.** Three credit hours. Three hours of lecture per week.

General principles of the mechanics of movement applied to physical education in elementary school (K-6); the use of games and movement activities as a method of instruction.

**EDFI 4177. EXERCISE PHYSIOLOGY (WITH LABORATORY).** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: (CIBI 3032 or BIOL 3052) and (ESMA 3015 or ESMA 3101).

Scientific evaluation of the effects of physical activity on human body functions in order to plan an effective training routine. Study of the mechanisms and factors related to physical fitness, fatigue, and diet.

**EDFI 4179. INTRODUCTION TO MOTOR DEVELOPMENT WITH LABORATORY.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisite: EDFU 3001 or EDFU 3011.

Introduction to the study of motor development changes since infancy. Emphasis in motor development theories, factors, and its relation to appropriate practices in teaching and sports participation, according to motor development stages.

**EDFI 4186. SPECIAL TOPICS IN PHYSICAL EDUCATION.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Selected topics in physical education. The content will vary according to interest and demand.

**EDFI 4190. EXERCISE PRESCRIPTION.** Three credit hours. Three hours of lecture per week.

Concepts and procedures in the prescription of exercise for physical fitness and health.

**EDFI 4195. TEACHING AND TRAINING IN TENNIS.** Two credit hours. One hour of lecture and two hours of practice per week. Prerequisite: EDFI 3295.

Theory and practice of teaching and training in tennis.

**EDFI 4205. TEACHING METHODS AND TECHNIQUES IN PHYSICAL EDUCATION.** Three credit hours. Three hours of lecture per week. Prerequisites: (EDFI 4005 or EDFI 4026) y EDFU 3007.

Philosophy, curriculum, evaluation, methods and techniques in the process of teaching physical education.

**EDFI 4225. LIFEGUARDING.** Three credit hours. Two hours of lecture and two hours of supervised practice

per week. Prerequisite: EDFI 3285 or authorization of the Director of the Department.

The duties, responsibilities, knowledge, training, lifeguarding skills and its applications in various aquatic emergencies.

**EDFI 4230. ATHLETIC TRAINING.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: EDFI 3645.

Prevention, treatment, and rehabilitation of injuries related to sports.

**EDFI 4250. SEMINAR IN COACHING AND OFFICIATING.** Two credit hours. Two hours of lecture per week. Corequisite: eight credit hours in coaching and officiating.

Discussion and analysis of the principal issues in the field of coaching and officiating sports.

**EDFI 4998. UNDERGRADUATE RESEARCH.** From one to three credit hours. From two to four hours of research per week per credit. Prerequisites: EDFI 4045 and authorization of the Director of the Department.

A research project in Physical Education under the supervision of a professor of the department.

**EDFI 5005. BIOMECHANICS OF SPORTS.** Three credit hours. Three hours of lecture per week. Prerequisites: (EDFI 4115 and EDFI 4045) or authorization of the Director of the Department.

The application of the laws of mechanics to the analysis of sport techniques. A research project will be required.

## RECREATION

**RECR 3705. COMMUNITY RECREATION.** Three credit hours. Three hours of lecture per week.

Procedures for organizing and administering school and community recreation programs, social services, and youth organizations.

**RECR 4135. ORGANIZATION OF RECREATION.** Two credit hours. Two hours of lecture per week.

Content and organization of school, community and outdoor recreation.

**RECR 4255. SEMINAR IN RECREATION.** Two credit hours. Two hours of lecture per week. Prerequisites: Authorization of the Director of the Department. Corequisite: RECR 4135.

Discussion and analysis of recent literature and problems in the field of recreation.

## DEPARTMENT OF MARINE SCIENCES

The Department of Marine Sciences (DMS) is a graduate department offering instruction leading to a **Master's** and **Doctor of Philosophy** degree in Marine Sciences. Several advanced undergraduate courses are available as electives to qualified students. Information concerning courses offered at DMS is available here and in the Graduate School Catalogue.

The DMS had its origins in the Institute of Marine Biology, established at the Mayagüez Campus in 1954 to promote and conduct research in this discipline. The Institute grew to become the Department of Marine Sciences in 1968 when its scope of work was expanded to include in addition physical, chemical and geological oceanography. In 1972 a Ph.D. degree was added to the program. The Department comprises nine (10) teaching faculty and two (2) researcher professors at present. Undergraduate students interested in pursuing further studies in a marine science related disciplines are encouraged to apply for the undergraduate courses offered by the DMS.

The main departmental administrative offices and a specialized Marine Science library are located at the Mayagüez campus. The field laboratories of the Department of Marine Sciences are situated at Magueyes Island, La Parguera on the southwest coast of Puerto Rico, approximately 38 kilometers from the main campus.

In addition to classroom-laboratory facilities, Magueyes Island counts with a running seawater system to support specimens and experimentation at indoor and outdoor locations. The department has access to invertebrate, fish, and algae collections. Laboratories capable of sophisticated research are available. A number of vessels provide access to the marine environment. The 47ft Sultana supports day trips for oceanographic work and 35ft R/V Gaviota has been fitted as a diving support boat. A number of smaller outboard motor boats are available for shorter term trips in support of research and educational activities.

The Department maintains considerable interaction with other science departments of the UPR system by stimulating collaboration among departments and through collaboration in cross department curriculum.

### *Mission*

The mission of the Department of Marine Sciences (DMS) is to promote a greater understanding of the marine environment within the disciplines of biological, chemical, geological and physical oceanography, and related areas. The specific goals of the department are to increase knowledge in the marine sciences, educate graduate students in the marine sciences, and serve the community.

Research by faculty and students is the central focus of the department's program, and emphasizes the complementary and mutualistic relationship among these goals. The Department offers Master of Marine Science and Doctor of Philosophy degrees in marine sciences encompassing both the full breadth of these disciplines and the specialization needed to develop specific technical and analytical skills within a larger scientific context. The program seeks to produce graduates with a strong background in marine sciences able to critically analyze problems, and effectively communicate solutions based on the application of scientific knowledge and research. Students are prepared for careers in teaching, research, industry, as well as resource and environmental management.

### *Vision*

The vision of the (DMS) are to increase and transmit knowledge of the marine environment by means of scientific research; service the community by applying scientific knowledge and education by means of its professors, researchers, students and graduates; contribute to social and economic development by promoting the conservation and rational use of the marine environment; provide leadership and serve as a model for graduate education

### *Definition of general education for the Department of Marine Sciences*

The DMS offers both Master of Marine Sciences (MS) and Doctor of Philosophy (PhD) degrees in oceanography, with concentrations in the general fields of biology, chemistry, geology and physics. Marine Sciences education provides opportunity for interdisciplinary studies across core fields, research being a necessary fundamental component of graduate training.

In addition, the department provides opportunity for undergraduate students to interact with graduate students enrolled in our department and counts with courses specifically designed for students interested in

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general knowledge of oceanography and physics for atmospheric sciences.

### ***Student Learning Outcomes***

The learning outcomes of the DMS are focused on training students that: communicate effectively; identify and solve problems, think critically, and synthesize knowledge appropriate to their discipline; apply mathematical reasoning skills, scientific inquiry methods, and tools of information technology; recognize the need to engage in life-long learning.

### ***Courses that fulfill the general education requirements for your department***

The curriculum available for undergraduate students at DMS provides the opportunity for students to further develop and practice the general learning outcomes at DMS.

## **DEPARTMENTAL FACULTY**

**ROY ARMSTRONG**, *Professor*, Ph.D., 1990, University of Puerto Rico. Research and Teaching interests: Remote Sensing and Water Optics.

**MIGUEL CANALS SILANDER**, *Adjunct Associate Professor*, Ph.D. University of Hawaii at Manoa. Research and Teaching interests: Ocean Observing Systems, Coastal Engineering Applications; Physical Oceanography.

**JUAN J. CRUZ MOTTA**, *Assistant Professor*, Ph.D., 2005. University of Sydney, Australia. Research and Teaching interests: Quantitative Ecology, Environmental Impacts Detection, Biometry, Multivariate Methods.

**JUAN GONZALEZ LAGOA**, *Professor Emeritus*, Ph.D. 1973. University of Rhode Island. Research Training and Teaching Interests. Plankton, Bioluminescent Bays and Outreach.

**JULIO MORELL**, *Researcher*, M.S., 1983, University of Puerto Rico. Research interests: Biochemistry and Environmental Chemistry. Observational Oceanography. Applied Ocean Science.

**GOVIND NADATHUR**, *Professor*, Ph.D., 1982, Gujarat University of India. Research and Teaching interests: Microbiology, Genetics and Biotechnology of Marine Organisms.

**ERNESTO OTERO MORALES**, *Researcher*, Ph.D., 1998, University of Georgia. Research interests: Microbial Biogeochemistry, Microbial Ecology, Biogeochemistry, Water Quality, Microbial Source Tracking. Applied Marine Sciences.

**NIKOLAOS SCHIZAS**, *Professor*, Ph.D., 1999, University of South Carolina. Research and Teaching interests: Evolution of Marine Invertebrates.

**WILFORD E. SCHMIDT**, *Associate Professor*, Ph.D., 2003, University of California, San Diego. Research and Teaching interests: Oceanography Applied Ocean Science.

**CLARK E. SHERMAN**, *Professor*, Ph.D., 2000, University of Hawaii. Research and Teaching interests: Marine Geology, Carbonate Sedimentology, Coral Reefs, Quaternary Geology.

**ERNESTO WEIL**, *Professor*, Ph.D., 1992, University of Texas at Austin. Research and Teaching interests: Coral Systematics, Ecology, and Evolution, Coral Reef Ecology.

## **COURSES OF INSTRUCTION**

### **MARINE SCIENCES**

#### **Advanced Undergraduate Courses**

**CIMA 5005. INTRODUCTION TO OCEANOGRAPHY.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Basic knowledge, techniques, and areas of interest of the different disciplines of marine sciences. The interaction and research aims in Physical, Geological, Chemical and Biological Oceanography.

**CIMA 5007. INTRODUCTION TO OCEAN OBSERVATION.** Three credit hours. Three hours of lecture per week.

Discussion of the scientific and practical applications of ocean observation. Evaluation of the different types of observation platforms from the most traditional such as buoys and ships to the modern autonomous submersible vehicles and satellites in polar and geostationary orbits. Investigation of the different types of physical, chemical, and biological sensors installed on these platforms, as well as their principles of operation, limitations and environmental and energy requirements. Evaluation of telemetry protocols and data storage in the operation of the observation system.

**CMOB 5015. FISHERIES BIOLOGY.** Three credit hours. Three hours of lecture per week.

A study of the principles and methods of fisheries investigation with emphasis on the fisheries of North America and the Caribbean. Field trips.

**CMOB 5017. MARINE ECOLOGY AND RESOURCE MANAGEMENT.** Five credit hours. Three hours of lecture and two three-hour laboratories per week. Prerequisite: authorization of the Director of the Department.

Description of the marine environment and familiarization with the major tropical marine communities; data-gathering and biological sampling techniques; human impact on the marine environment from the standpoint of pollution, exploitation, protection, and regulation; jurisprudence in major litigation involving marine resources; management practices.

**CMOB 5018. MARINE ECOLOGY.** Six credit hours. Ten hours of lecture and eighteen hours of laboratory per week during six weeks in the Summer. Prerequisite: authorization of the Director of the Department.

A study of marine communities and their environment, with special consideration of ecosystems in the sea.

**CMOF 5005. COASTAL STRUCTURES.** Three credit hours. Three hours of lecture per week.

Types of coastal structures; their purpose, design, construction, and environmental impact.

**CMOF 5015. PHYSICAL OCEANOGRAPHY FOR ATMOSPHERIC SCIENCES.** Three credit hours. Three hours of lecture per week. Prerequisites: (MATE 4009 and (FISI 3172 or FISI 3162)) or authorization of the Director of the Department.

Introduction to topics in physical oceanography such as heat budget, physical properties of seawater, oceanic mixing processes, and equations of conservation of heat, salt, and momentum. Analysis of the origin of marine currents by applying the concepts of potential vorticity conservation and Sverdrup circulation. Description of the mechanics of surface and deep currents.

**CMOG 5001. INTRODUCTION TO CLIMATE CHANGE.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Overview of the principles of Earth's climate covering a broad range of phenomena that influence climate at various regional and global time scales and resolutions. Discussion of climate forced by external controls. Description of the effects of internal forces and their variability, and human-induced climate change. Emphasis on the role of greenhouse gases and rates of change of these processes. Discussion of the future climate change scenarios and possible mitigating steps.

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## DEPARTMENT OF MATHEMATICAL SCIENCES

The Department of Mathematical Sciences offers two programs leading to the **Bachelor of Science** degree: **Mathematics**, and **Mathematics Education**. Also offers a **Bachelor of Computer Sciences**. Both Bachelors provide a solid preparation for students, enabling them to follow careers in industry, in government, in the field of education or to pursue graduate studies.

Courses in Computer Sciences are frequently updated to keep pace with this rapidly changing field. Statistics is emerging as an important component of the Department and a growing number of courses in this field are also available.

The Department of Mathematical Sciences also offers two programs leading to a **Master of Science** degree. One program is in Scientific Computing and the other is in Mathematics, which includes specializations in Mathematics, Applied Mathematics, Statistics and Teaching Mathematics at Secondary Level. The Department of Mathematical Sciences participates in an Interdisciplinary Program leading to a Ph.D. degree in Computing and Information Sciences and Engineering, with the Department of Electrical and Computer Engineering. For more details, see the Graduate Catalogue.

Advanced placement tests may be used to obtain credit for one or more of the following courses: MATE 3005, MATE 3086, MATE 3171, MATE 3172, and MATE 3031. Refer to the section of this catalogue where your program is described to determine which courses are applicable.

The Department of Mathematical Sciences requires a minimum of C in all courses, which are part of the student's major field of study. Further explanation of placement criteria and other important information is provided in the Academic Regulations section.

### Mission

The mission of the Department of Mathematical Sciences is to offer undergraduate and graduate programs, of excellence, to the students in mathematics, statistics, math education and computer sciences; promote the development of research in the above fields; promote the planning of workshops and projects for teachers and pre-service teachers to improve the mathematical knowledge of high school students in Puerto Rico; and to continue offering

courses to others academic programs of the campus, and mentoring in computation, statistics and mathematics to the whole community in general.

### Vision

The vision is to provide a high quality education for all the students; promote the development of the investigation and the wide dissemination of mathematics, statistics, education, computing sciences and other related areas; and maintain effective links that promote development of the industry and the general community.

### Student Learning Outcomes

Upon graduation, students of Department of Mathematical Sciences should be able to:

- communicate effectively,
- identify and solve problems, think critically and synthesize the knowledge related to their disciplines,
- apply mathematical reasoning, the methods of scientific research and information technologies,
- abide by ethical standards,
- Recognize the Puerto Rican heritage and interpret contemporary issues,
- appreciate the essential values of a democratic society,
- serve in a global context, interact in a social context and show respect for other cultures,
- develop appreciation for the arts and humanities,
- recognize the need for continuous learning,
- recognize the importance of the protection of the environment.

**Facilities:** The Department of Mathematical Sciences is located in the Monzón building. Currently, the building is being remodeled to improve our infrastructure and expand our services. The Department has the following facilities: 15 classrooms, 1 conference room, 1 seminar room, 1 tutoring center, and 7 computer laboratories. The department also has 46 offices for academic and administrative services in Monzón. All computer laboratories are connected to the internet and have access to Office Suite Programs (Microsoft Office) in addition to programs like C, C++, Java, R, Python, Matlab, Mathematica, Minitab. The following laboratories are exclusively reserved for our majors:

- **CASTLE, Laboratory** of the group in computational and statistic learning for Knowledge Discovery.

- **PC Laboratory** with 16 Dual Boot Systems (Windows 7 and Linux Fedora 23) and one laser printer.
- **Teaching Laboratory** with 33 Dual Boot Systems workstations (Windows 7 and Linux Fedora 23). This room is used for teaching computer, and mathematics courses.
- **Statistics/Computer Literacy Instructional Laboratory** with 24 Dual Boot Systems (Windows 7 and Linux Fedora 22).
- **Computer Graphics Laboratory** with 11 Computer Dual Boot Workstations for graphics (Windows 7 and Linux Fedora 23) and visualization courses.
- **Statistics/Computer Literacy and Electronic Quizzes Laboratory** with 64 Windows 7 Workstations for Mathematics and Statistics courses, also for electronic quizzes offered to students taking precalculus and calculus courses.
- **Educational Technology Classroom with 12 Ipad's, 2 IMac, and 2 Mac Notebooks** for developing educational videos for the following courses: Reasoning Mathematics, Precalculus, and the "Instituto de Fortalecimiento Matemático". Also for the AvirMat Project ("Apoyo Virtual en Matemáticas").

The Department of Mathematical Sciences provide the following services:

- **Tutoring center** provides mathematics tutoring in the courses of Reasoning Mathematics, Precalculus and Calculus. The tutors are graduate students from our department.

In addition, the Math Department houses the following equipment:

- Dell PowerEdge R610 Windows 2008 Server for Active Directory, DNS, DHCP, and License Manager. It also works as a file server for administrative and academic documents.
- Dell PowerEdge R720 Linux CentOS Server for faculty and students accounts. It is mainly used for programming, mathematics courses, and research.
- Dell PowerEdge T610 that is mainly used for electronic quizzes precalculus and calculus.
- Dell PowerEdge R630 Linux CentOS 7 which is used as an R Studio Server for statistical applications.

## BACHELOR OF SCIENCE IN MATHEMATICS

### PROGRAM OF STUDY

#### PURE MATHEMATICS CURRICULUM

##### FIRST YEAR

###### First Semester

| Number         | Credits | Course                        |
|----------------|---------|-------------------------------|
| *MATE 3005     | 5       | Pre-Calculus                  |
| QUIM 3131-3133 | 4       | General Chemistry I           |
| CIBI 3031      | 3       | Intro. to the Biol. Science I |
| *ESPA 3101     | 3       | Basic course in Spanish I     |
| *INGL 3---     | 3       | First year course in English  |
|                | 18      |                               |

###### Second Semester

| Number         | Credits | Course                          |
|----------------|---------|---------------------------------|
| MATE 3031      | 4       | Calculus I                      |
| QUIM 3132-3134 | 4       | General Chemistry II            |
| CIBI 3032      | 3       | Intro. to the Biol. Sciences II |
| *ESPA 3102     | 3       | Basic course in Spanish II      |
| *INGL 3---     | 3       | First year course in English    |
| EDFI ----      | 1       | Course in Physical Education    |
|                | 18      |                                 |

##### SECOND YEAR

###### First Semester

| Number    | Credits | Course                              |
|-----------|---------|-------------------------------------|
| MATE 3032 | 4       | Calculus II                         |
| COMP 3010 | 3       | Intro. to Comp. Programming I       |
| ESPA 3--- | 3       | Course above level of Basic Spanish |
| INGL 3--- | 3       | Second year course in English       |
| MATE 3020 | 3       | Intro. to the Foundations of Math.  |
| EDFI ---- | 1       | Course in Physical Education        |
|           | 17      |                                     |

###### Second Semester

| Number     | Credits | Course                              |
|------------|---------|-------------------------------------|
| MATE 3063  | 3       | Calculus III                        |
| FISI 3171  | 4       | Physics I                           |
| FISI 3173  | 1       | Physics Laboratory I                |
| ESPA 3---  | 3       | Course above level of Basic Spanish |
| *INGL 3--- | 3       | Second year course in English       |
| MATE 4031  | 3       | Intro. to Linear Algebra            |
|            | 17      |                                     |

### THIRD YEAR

#### First Semester

| Number                              | Credits  | Course  |
|-------------------------------------|----------|---|
| MATE 4009                           | 3        | Ordinary Differential Equations                           |
| MATE 4008                           | 3        | Intro. to Algebraic Structures                            |
| MATE ----                           | 3        | **Choose from: MATE 4007, MATE 4020, MATE 4021, MATE 4088 |
| FISI 3172                           | 4        | Physics II  |
| FISI 3174                           | 1        | Physics Laboratory II                                     |
| +Course in Social Sciences or Econ. | <u>3</u> |   |
|                                     | 17       |   |

#### Second Semester

| Number                              | Credits  | Course  |
|-------------------------------------|----------|---|
| ESMA 4001                           | 3        | Mathematical Statistics I                                 |
| MATE ----                           | 3        | **Choose from: MATE 3040, ESMA 4002, MATE 4071, MATE 4072 |
| +Course in Social Sciences or Econ. | 3        |   |
| Recommended Elective                | 3        |   |
| Recommended Elective                | 3        |   |
| Free Elective                       | <u>3</u> |   |
|                                     | 18       |   |

### FOURTH YEAR

#### First Semester

| Number               | Credits  | Course                      |
|----------------------|----------|-----------------------------|
| MATE 4051            | 3        | Advanced Calculus I         |
| MATE 4000            | 3        | Elements of Topology        |
| HUMA 3111            | 3        | Intro. to Western Culture I |
| Recommended Elective | 3        |                             |
| Free Elective        | 3        |                             |
| Free Elective        | <u>3</u> |                             |
|                      | 18       |                             |

#### Second Semester

| Number               | Credits  | Course  |
|----------------------|----------|---|
| MATE 4052*           | 3        | Advanced Calculus II                          |
| MATE 4010*           | 3        | Intro. to Complex Variables with Applications |
| MATE 4050*           | 1        | Undergraduate Seminar                         |
| HUMA 3112            | 3        | Intro. to Western Culture II                  |
| Recommended Elective | 3        |   |
| Free Elective        | <u>3</u> |   |
|                      | 16       |   |

**Total credits required: 139**

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*Choose from MATE 4007, MATE 4020, MATE 4021, or MATE 4088.

\*\*Choose from: MATE 3040, ESMA 4002, MATE 4071, or MATE 4072.

+ Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI 3261-3262, SOCI 3315, or ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

### BACHELOR OF SCIENCE IN MATHEMATICS

#### PROGRAM OF STUDY

#### MATHEMATICS EDUCATION CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits  | Course                              |
|------------|----------|-------------------------------------|
| *MATE 3005 | 5        | Pre-Calculus                        |
| EDFU 3011  | 3        | Foundations of Human Development    |
| CIBI 3031  | 3        | Intro. to the Biological Sciences I |
| *ESPA 3101 | 3        | Basic course in Spanish I           |
| *INGL 3--- | <u>3</u> | First year course in English        |
|            | 17       |                                     |

##### Second Semester

| Number     | Credits  | Course                                |
|------------|----------|---------------------------------------|
| MATE 3031* | 4        | Calculus I                            |
| EDFU 3012  | 3        | Foundations of Educational Psychology |
| CIBI 3032  | 3        | Intro. to the Biological Sciences II  |
| *ESPA 3102 | 3        | Basic course in Spanish II            |
| *INGL 3--- | <u>3</u> | First year course in English          |
|            | 16       |                                       |

### SECOND YEAR

#### First Semester

| Number           | Credits | Course                                   |
|------------------|---------|--|
| MATE 3032*       | 4       | Calculus                                 |
| MATE 3020*       | 3       | Intro. to the Foundations of Mathematics |
| ESPA 3---        | 3       | Course above level of Basic Spanish      |
| Science Elective | 4       |  |
| HIST 3241-3242   | 3       | History of Puerto Rico                   |

|           |          |                              |
|-----------|----------|------------------------------|
| EDFI ---- | <u>1</u> | Course in Physical Education |
|           | 18       |                              |

### Second Semester

| Number           | Credits  | Course                              |
|------------------|----------|-------------------------------------|
| MATE 3063*       | 3        | Calculus III                        |
| ESMA 3016*       | 3        | Statistical Data Analysis           |
| MATE 3030*       | 3        | Intro. to Geometry                  |
| ESPA 3---        | 3        | Course above level of Basic Spanish |
| Science Elective | 4        |                                     |
| EDFI---          | <u>1</u> |                                     |
|                  | 17       |                                     |

### THIRD YEAR

#### First Semester

| Number         | Credits  | Course                                  |
|----------------|----------|---|
| MATE 4031*     | 3        | Introduction to Linear Algebra          |
| MATE 3040*     | 3        | Number Theory                           |
| COMP 3010*     | 3        | Intro. to Comp. Programming I           |
| EDFU 3007      | 3        | Social Foundations of Educations        |
| HIST 3111-3112 | 3        | History of the United States of America |
| ^INGL 3---     | <u>3</u> | Second year course in English           |
|                | 18       |   |

#### Second Semester

| Number        | Credits  | Course                                |
|---------------|----------|---------------------------------------|
| MATE 4008*    | 3        | Intro. to Algebraic Structures        |
| MATE 3181*    | 3        | Discrete Mathematics I                |
| EDFU 4019     | 3        | Philosophical Foundation of Education |
| EDPE 3129*    | 3        | Use Microcomputers in the Classroom   |
| ^INGL 3---    | 3        | Second year course in English         |
| Free Elective | <u>3</u> |                                       |
|               | 18       |                                       |

### FOURTH YEAR

#### First Semester

| Number         | Credits  | Course   |
|----------------|----------|--|
| MATE 4023*     | 3        | Mathematics Education I                                  |
| EDPE 4145      | 3        | Theory Methodology Teaching Mathematics Secondary School |
| HUMA 3111      | 3        | Intro. to Western Culture I                              |
| MATE 4120*     | 3        | History of Mathematics                                   |
| EDES 4006      | 3        | Nature and Needs of the Exceptional Child                |
| Free Electives | <u>3</u> |  |
|                | 18       |  |

### Second Semester

| Number        | Credits  | Course   |
|---------------|----------|--|
| EDPE 4146     | 6        | Theory, Methodology and Student Teaching in the Secondary School |
| MATE 4039     | 2        | Use of Technology Teaching Mathematics                           |
| Free Elective | 3        |  |
| Free Elective | 3        |  |
| HUMA 3112     | <u>3</u> | Intro. to Western Culture II                                     |
|               | 17       |  |

Note: The courses EDPE 3129, EDES 4006, and DESC 3005, are also required to obtain a teacher's license from the Puerto Rico Department of Education.

### Total credits required: 139

\*Refer to the Academic Regulations section for information on Advanced Placement.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## BACHELOR OF SCIENCE IN MATHEMATICS

### PROGRAM OF STUDY

#### COMPUTER SCIENCE CURRICULUM

### FIRST YEAR

#### First Semester

| Number     | Credits  | Course  |
|------------|----------|---|
| *MATE 3005 | 5        | Pre-Calculus  |
| CISO 3121  | 3        | An Introduction to the Study of the Social Sciences |
| CIBI 3031  | 3        | Intro. to the Biological Sciences I                 |
| *ESPA 3101 | 3        | Basic Course in Spanish I                           |
| *INGL 3--- | <u>3</u> | First year course in English                        |
|            | 17       |   |

#### Second Semester

| Number     | Credits  | Course                               |
|------------|----------|--------------------------------------|
| MATE 3031* | 4        | CALCULUS I                           |
| COMP 3010* | 3        | Intro. to Computer Programming I     |
| CIBI 3032  | 3        | Intro. to the Biological Sciences II |
| *ESPA 3102 | 3        | Basic course in Spanish II           |
| *INGL 3--- | 3        | First year course in English         |
| EDFI ----  | <u>1</u> | Course in Physical Education         |
|            | 17       |                                      |



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## SECOND YEAR

### First Semester

| Number           | Credits  | Course                               |
|------------------|----------|--------------------------------------|
| MATE 3032*       | 4        | CALCULUS II                          |
| MATE 3181*       | 3        | Discrete Mathematics I               |
| COMP 3110*       | 3        | INTRODUCTION TO COMPUTERS II         |
| ESPA 3---        | 3        | Course above level of Basic Spanish  |
| <b>INGL 3---</b> | <b>3</b> | <b>Second year course in English</b> |
| EDFI ----        | <u>1</u> | Course in Physical Education         |
|                  | 17       |                                      |

### Second Semester

| Number            | Credits  | Course   |
|-------------------|----------|--|
| MATE 3063         | 3        | Calculus III   |
| <b>COMP 4016*</b> | <b>3</b> | <b>COMPUTER ORGANIZATION</b>                           |
| COMP 3075*        | 3        | INTRODUCTION TO DATA STRUCTURES                        |
| ESPA 3---         | 3        | Course above level of Basic Spanish                    |
| ^INGL 3---        | 3        | Second year course in English                          |
| CISO 3122         | <u>3</u> | An Introduction to the Study of the Social Sciences II |
|                   | 18       |  |

## THIRD YEAR

### First Semester

| Number             | Credits  | Course                                    |
|--------------------|----------|---|
| MATE 4031*         | 3        | Introduction to Linear Algebra            |
| COMP 4017*         | 3        | Computer Algorithms                       |
| COMP ----          | 3        | Computer Sciences Elective                |
| FISI, QUIM or GEOL | 3        | Elective in Physics, Chemistry or Geology |
| HUMA 3111          | 3        | Introduction to Western Culture I         |
| Free Elective      | <u>3</u> |   |
|                    | 18       |   |

### Second Semester

| Number             | Credits  | Course                             |
|--------------------|----------|------------------------------------|
| ESMA 3016*         | 3        | Statistical Data Analysis          |
| COMP 4036*         | 3        | Programming Languages              |
| COMP 4009*         | 3        | Software Engineering               |
| FISI, QUIM or GEOL | 3        | Elective in Science                |
| HUMA 3112          | 3        | Introduction to Western Culture II |
| FILO 3185          | <u>3</u> | Computer Ethics                    |
|                    | 18       |                                    |

## FOURTH YEAR

### First Semester

| Number        | Credits  | Course                     |
|---------------|----------|----------------------------|
| COMP 4006*    | 3        | Operating Systems          |
| COMP 4046*    | 3        | Computer Graphics          |
| COMP ----     | 3        | Computer Sciences Elective |
| Recommended   |          |                            |
| Elective      | 3        |                            |
| ADMI ----     | 3        | Business Elective          |
| Free Elective | <u>3</u> |                            |
|               | 18       |                            |

### Second Semester

| Number        | Credits  | Course                     |
|---------------|----------|----------------------------|
| COMP 4018*    | 3        | Database Systems           |
| COMP ----     | 3        | Computer Sciences Elective |
| COMP ----     | 1        | Computer Sciences Elective |
| Recommended   |          |                            |
| Elective      | 3        |                            |
| Free Elective | 3        |                            |
| Free Elective | <u>3</u> |                            |
|               | 16       |                            |

**Total credits required for program: 139**

\*Refer to the Academic Regulations section for information on Advanced Placement.

+Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI 3261-3262, SOCI 3315, or ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## CURRICULAR SEQUENCE IN APPLIED MATHEMATICS

### Main Objective

The Curricular Sequence in Applied Mathematics for Sciences and Engineering allows students in Science and Engineering fields interested in deepening their understanding in mathematics to be exposed to the methods and fundamental concepts in applied analysis, linear algebra, and numerical analysis. The sequence provides an incentive for students to broaden their mathematical preparation, enhances the mathematical reach of their training, and fosters the development of the intellectual maturity needed to pursue scientific endeavors in their respective disciplines.

### Admissions Requirements

- An overall GPA of 2.5 or higher.
- Having approved Calculus III (MATE 3063) or its equivalent with C or higher.
- Being registered in a bachelor program at UPRM or having already obtained such a degree.

### Summary of Credits in Sequence

|                       |          |
|-----------------------|----------|
| Required courses      | 12       |
| Recommended Electives | <u>3</u> |

**Total** **15**

### CORE COURSES

#### REQUIRED COURSE

|   |   |
|---|---|
| <b>MATE 4009</b><br>Ordinary Differential Equations | 3 |
|---|---|

#### EXACTLY ONE OF THESE COURSES

|   |   |
|---|---|
| <b>MATE 4031</b><br>Introduction to Linear Algebra            | 3 |
| <b>MATE 4145</b><br>Linear Algebra and Differential Equations | 4 |

#### EXACTLY ONE OF THESE COURSES

|  |   |
|--|---|
| <b>MATE 4061</b><br>Numerical Analysis                       | 3 |
| <b>INGE 4035</b><br>Numerical Methods Applied to Engineering | 3 |

#### EXACTLY ONE OF THESE COURSES

|   |   |
|---|---|
| <b>MATE 4020</b><br>Partial Differential Equations and Fourier Series | 3 |
| <b>MATE 4071</b><br>Introduction to Modern Science I                  | 3 |

### RECOMMENDED ELECTIVES

|   |   |
|---|---|
| <b>MATE 4010</b><br>Introduction to Complex Variables with Applications | 3 |
| <b>ESMA 4001</b><br>Mathematical Statistics I                           | 3 |
| <b>MATE 4020</b><br>Partial Differential Equations and Fourier Series   | 3 |
| <b>MATE 4062</b><br>Numerical Analysis II                               | 3 |
| <b>MATE 4071</b><br>Introduction to Modern Science I                    | 3 |
| <b>MATE 4072</b><br>Introduction to Modern Science II                   | 3 |
| <b>MATE 4088</b><br>Differential Geometry with Computers                | 3 |
| <b>MATE 4997</b><br>Special Topics in Mathematics                       | 3 |
| <b>MATE 5016</b><br>Game Theory   | 3 |

|   |   |
|---|---|
| <b>MATE 5047</b><br>Intermediate Differential Equations | 3 |
| <b>MATE 5049</b><br>Calculus of Variations              | 3 |
| <b>MATE 5055</b><br>Vector Analysis                     | 3 |
| <b>MATE 5056</b><br>Tensor Analysis                     | 3 |

### CURRICULAR SEQUENCE IN PURE MATHEMATICS

#### Main Objective

The Curricular Sequence in Pure Mathematics provides science and engineering students with the opportunity to enrich their academic experience, complement their core professional studies, and expand and strengthen their mathematical preparation and analytical skills through the systematic and formal study of pure mathematics. Students in the sequence will learn a wide variety of mathematical concepts, structures, theorems, and methods, expanding their understanding of mathematics beyond Calculus and Differential Equations and acquiring an appreciation for its intellectual integrity and the beauty and power of its methods. The courses in the sequence present and investigate the conceptual structure of several branches of mathematics. The properties of mathematical constructs and their relationships are summarized in fundamental theorems which are rigorously discussed and proved. Students will develop mathematical reasoning skills and the ability to understand, formulate, analyze and validate formal mathematical arguments and solve problems working within the context of a complex conceptual structure. They will then be able to use mathematics in their studies and professional fields with greater sophistication and success.

#### Summary of Credits in Sequence

|                       |          |
|-----------------------|----------|
| Required courses      | 15       |
| Recommended Electives | <u>3</u> |

**Total** **18**

#### Admissions Requirements

- An overall GPA of 2.5 or higher.
- Having approved Calculus I (MATE 3031), Calculus II (MATE 3032), Calculus III (MATE 3063) and Ordinary Differential Equations (MATE 4009) or its equivalent with C or higher.

- Being registered in a bachelor program at UPRM or having already obtained such a degree.

### CORE COURSES

|   |   |
|---|---|
| <b>MATE 3020</b>                                    |   |
| Introduction to the Foundations of Mathematics      | 3 |
| <b>MATE 4031</b>                                    |   |
| Introduction to Linear Algebra                      | 3 |
| <b>MATE 4008</b>                                    |   |
| Introduction to Algebraic Structures                | 3 |
| <b>MATE 4051</b>                                    |   |
| Advanced Calculus I                                 | 3 |
| <b>MATE 4010</b>                                    |   |
| Introduction to Complex Variables with Applications | 3 |

### RECOMMENDED ELECTIVES

|   |   |
|---|---|
| <b>MATE 3030</b>                                  |   |
| Introduction to Geometry                          | 3 |
| <b>MATE 3040</b>                                  |   |
| Number Theory                                     | 3 |
| <b>MATE 4000</b>                                  |   |
| Elements of Topology                              | 3 |
| <b>MATE 4020</b>                                  |   |
| Partial Differential Equations and Fourier Series | 3 |
| <b>MATE 4021</b>                                  |   |
| Fundamentals of Mathematical Logic                | 3 |
| <b>MATE 4052</b>                                  |   |
| Advanced Calculus II                              | 3 |
| <b>MATE 4071</b>                                  |   |
| Introduction to Modern Science I                  | 3 |
| <b>MATE 4072</b>                                  |   |
| Introduction to Modern Science II                 | 3 |
| <b>MATE 4088</b>                                  |   |
| Differential Geometry with Computers              | 3 |
| <b>MATE 4120</b>                                  |   |
| History of Mathematics                            | 3 |

### CURRICULAR SEQUENCE IN STATISTICS AND PROBABILITY

#### Main Objective

The Curricular Sequence in Statistics and Probability complements the academic offerings for UPRM students interested in deepening their knowledge in statistics and probability. This sequence provides students with a solid preparation in the theoretical foundations of statistics, as well as the skills needed to gather, present, interpret and analyze statistical information, formulate hypothesis, and make and interpret inferences. Students completing this sequence will be able to successfully take advantage of professional and academic opportunities related to statistical modeling.

### Admissions Requirements

- An overall GPA of 2.5 or higher.
- Having approved Calculus I (MATE 3031) or its equivalent with C or higher.
- Being registered in a bachelor program at UPRM or having already obtained such a degree.

### Summary of Credits in Sequence

|                       |           |
|-----------------------|-----------|
| Required courses      | 12        |
| Recommended Electives | <u>3</u>  |
| <b>Total</b>          | <b>15</b> |

### CORE COURSES

|                           |   |
|---------------------------|---|
| <b>ESMA 3016</b>          |   |
| Statistical Data Analysis | 3 |
| <b>ESMA 4001</b>          |   |
| Mathematical Statistics I | 3 |
| <b>ESMA 4038</b>          |   |
| Sampling Methods          | 3 |
| <b>MATE 3047</b>          |   |
| Introductory Probability  | 3 |

### RECOMMENDED ELECTIVES

|                                   |   |
|-----------------------------------|---|
| <b>ESMA 4002</b>                  |   |
| Mathematical Statistics II        | 3 |
| <b>ESMA 4005</b>                  |   |
| Non-parametric Applied Statistics | 3 |
| <b>ESMA 5015</b>                  |   |
| Stochastic Simulation             | 3 |
| <b>AGRO 5005</b>                  |   |
| Biometrics                        | 3 |
| <b>MATE 4997</b>                  |   |
| Special Topics in Mathematics     | 3 |

### DEPARTMENTAL FACULTY

**ROBERT ACAR**, *Associate Professor*, Ph.D., 1987, University of Wisconsin-Madison.

**EDGAR ACUÑA-FERNÁNDEZ**, *Professor*, Ph.D., 1989, University of Rochester.

**LUIS F. CÁCERES-DUQUE**, *Professor*, Ph.D., 1998, University of Iowa.

**GABRIELE CASTELLINI**, *Professor*, Ph.D., 1986, Kansas State University.

**PAUL E. CASTILLO**, *Professor*, Ph.D., 2001, University of Minnesota.

**SILVESTRE COLÓN-RAMÍREZ**, *Professor*, M.S., 1996, University of Puerto Rico at Mayagüez.

**OMAR COLÓN-REYES**, *Professor*, Ph.D., 2005, Virginia Tech Polytechnic Institute.

**ÁNGEL CRUZ-DELGADO**, *Professor*, Ph.D., 2000, Louisiana State University.

**STAN M. DZIOBIAK**, *Assistant Professor*, Ph.D., 2011, Louisiana State University.

**WIESLAW DZIOBIAK**, *Professor*, Ph.D., 1982, Wrocław University, Poland.

**ANA C. GONZÁLEZ-RÍOS**, *Professor*, M.S., 1988, University of Puerto Rico at Mayagüez.

**EDGARDO LORENZO-GONZÁLEZ**, *Professor*, Ph.D., 2002 Wichita State University.

**FLOR E. NARCISO FARIAS**, *Assistant Professor*, Ph.D., 1999, University of South Florida.

**VÍCTOR A. OCASIO GONZÁLEZ**, *Assistant Professor*, Ph.D., 2014, Notre Dame University.

**REYES M. ORTIZ-ALBINO**, *Professor*, Ph.D., 2008, The University of Iowa.

**JUAN A. ORTIZ-NAVARRO**, *Associate Professor*, Ph.D., 2007, University of Iowa.

**ARTURO PORTNOY**, *Professor*, Ph.D., 1997, Rensselaer Polytechnic Institute.

**WILFREDO QUIÑONES-ECHEVARRÍA**, *Professor*, Ph.D., 1986, University of Massachusetts.

**KAREN RÍOS-SOTO**, *Professor*, Ph.D., 2008, Cornell University.

**OLGAMARY RIVERA-MARRERO**, *Professor*, Ph.D., 2007, Virginia Tech Polytechnic Institute.

**WOLFGANG ROLKE**, *Professor*, Ph.D., 1992, University of Southern California.

**JUAN ROMERO-OLIVERAS**, *Professor*, Ph.D., 2005, University of Maryland, College Park.

**KRZYSZTOF ROZGA**, *Professor*, Ph.D., 1976, University of Warsaw, Poland.

**HÉCTOR SALAS-OLAGUER**, *Professor*, Ph.D., 1983, University of Iowa.

**DÁMARIS SANTANA-MORANT**, *Professor*, Ph.D., 2001, University of Florida.

**FREDDIE SANTIAGO-HERNÁNDEZ**, *Professor*, Ph.D., 1988, State University of New York at Stony Brook, New York.

**MARKO SCHÜTZ-SCHMUCK**, *Professor*, Ph.D., 2001, J.W. Goethe University, Frankfurt.

**ALEXANDER SHRAMCHENKO**, *Associate Professor*, Ph.D., 1980, USSR Academy of Sciences.

**LEV STEINBERG**, *Professor*, 1988, Ph.D., Institute for Mathematics and Mechanics of Academy of Sciences, Alma, USSR.

**NILSA I. TORO-RAMOS**, *Professor*, M.S., 1983, University of Puerto Rico at Mayagüez.

**PEDRO M. VÁSQUEZ-URBANO**, *Professor*, D.Sc., 1997, The George Washington University.

**ALEJANDRO VÉLEZ SANTIAGO**, *Assistant Professor*, Ph.D., 2010, University of Puerto Rico at Río Piedras.

**JULIO VIDAURRÁZAGA**, *Professor*, Ph.D., 1982, State University of New York at Stony Brook, N.Y.

**UROYOÁN R. WALKER-RAMOS**, *Professor*, Ph.D., 2001, Louisiana State University.

**KEITH WAYLAND**, *Professor*, Ph.D., 1979, Louisiana State University.

**XUERONG YONG**, *Professor*, Ph.D. 2002, Hong Kong University of Science and Technology.

## COURSES OF INSTRUCTION

### DEPARTMENT OF MATHEMATICAL SCIENCES

#### Undergraduate Courses

**MATE 3000. FINITE MATHEMATICS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3171 or MATE 3173.

Counting techniques, probability, matrix algebra, linear programming, and systems of linear equations.

**MATE 3005. PRE-CALCULUS.** Five credit hours. Five hours of lecture per week. Prerequisite: placement by College Board Mathematics Advanced Exam.

A preparatory course for calculus covering the essentials of relations, functions, complex numbers, linear algebra, trigonometry and analytic geometry.

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**MATE 3020.** INTRODUCTION TO THE FOUNDATIONS OF MATHEMATICS. Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3031 or MATE 3183 or MATE 3144 or authorization of the Director of the Department.

An introductory course in set theory and logic. Topics include the propositional calculus and set algebra, finite and infinite sets, well-ordered sets, transfinite arithmetic, Peano's axioms, and development of the real number system.

**MATE 3021.** CALCULUS FOR BIOLOGICAL SCIENCES I. Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3172 or MATE 3174.

A basic course in differential and integral calculus of one real variable with applications.

**MATE 3022.** CALCULUS FOR BIOLOGICAL SCIENCES II. Three credit hour. Three hours of lecture per week. Prerequisite: MATE 3021.

Integration techniques, topics in probability, functions of several variables, introduction to differential equations, and applications.

**MATE 3030.** INTRODUCTION TO GEOMETRY. Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3032 or MATE 3184.

Brief review of Euclidean geometry, geometric constructions, similarity of figures, geometry of the triangle and of the circle, foundations of axiomatic geometry, and elements of non-Euclidean geometry.

**MATE 3031.** CALCULUS I. Four credit hours. Four hours of lecture per week. Prerequisite: MATE 3005 or MATE 3143 or MATE 3172 or MATE 3174.

Elementary differential and integral calculus of one real variable with applications.

**MATE 3032.** CALCULUS II. Four credit hours. Four hours of lecture per week. Prerequisite: MATE 3031 or MATE 3183 or MATE 3144.

Integration techniques, infinite series, vectors, polar coordinates, vector functions, and quadric surfaces; applications.

**MATE 3040.** THEORY OF NUMBERS. Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3032 or MATE 3184.

Divisibility, number systems, Euclid's algorithm, factorization, the distribution of primes, perfect numbers and related topics, Euler's function, indeterminate problems, diophantine problems and congruences.

**MATE 3047.** INTRODUCTORY PROBABILITY. Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3031, and MATE 3011 and MATE 3021.

Topics to be covered include: sample spaces, events, rules, permutations and combinations, conditional probability, bayes theorem, random variables, probability distributions, mathematical expectation and variance, chevyshevs theorem, the law of large numbers, the central limit theorem, and markov chains.

**MATE 3048.** MATHEMATICAL ANALYSIS. Four credit hours. Four hours of lecture per week. Prerequisite: MATE 3032 or MATE 3184. Corequisite: MATE 3010 or COMP 3010 or INGE 3016.

Theory and application of functions of several variables, vector calculus, first order differential equations, linear differential equations, the Laplace transform and numerical methods for solving or approximating solutions of differential equations.

**MATE 3049.** MATHEMATICAL ANALYSIS FOR MANAGEMENT SCIENCES. Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3171 or MATE 3173.

Exponential functions and logarithms, of limit and continuity, differential and integral calculus of one variable, and functions of two variables with applications.

**MATE 3063.** CALCULUS III. Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3032 or MATE 3184.

Differential and integral calculus of several variables, and an introduction to differential equations with applications.

**MATE 3086.** MATHEMATICAL REASONING. Three credit hours. Three hours of lecture per week.

Strategies and techniques of mathematics used in diverse areas of human endeavor: problem-solving; linear equations in one variable; proportion; linear systems of equations in two variables; basic concepts of statistics; graphical representation of data; the mathematics of finance.

**MATE 3143.** CALCULUS WITH PRECALCULUS I. Five credit hours. Five hours of lecture per week. Prerequisite: placement by College Board Mathematics Advanced Exam.

Introduction to the concepts of calculus of one variable with a simultaneous exposition of relevant pre-calculus topics.

**MATE 3144. CALCULUS WITH PRECALCULUS II.** Four credit hours. Four hours of lecture per week. Prerequisite: MATE 3143.

Techniques and applications of the differential and integral calculus with a simultaneous exposition of relevant pre-calculus topics.

**MATE 3171. PRECALCULUS I.** Three credit hours. Three hours of lecture and one hour of workshop per week. Prerequisites: 650 or more on the College Board Mathematics Achievement Exam or MATE 0066.

Systems of real numbers, equations, inequalities, cartesian plane, midpoint, distance, midpoint, circle, line, basic functions, transformations of functions, operations with functions, inverse functions, complex numbers, polynomial functions and rational function. Each unit can add 20% of content.

**MATE 3172. PRECALCULUS II.** Three credit hours. Three hours of lecture and one hour of workshop per week. Prerequisites: MATE 3171 or MATE 3173.

Exponential functions, logarithm functions, trigonometric functions, systems of equations, matrices, determinants, sequences and series. Each unit can add 20% of content.

**MATE 3181. DISCRETE MATHEMATICS I.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3005 or MATE 3172.

Sets, relations, and notation, algorithms, logic, graphs, trees.

**MATE 3182. DISCRETE MATHEMATICS II.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3181.

Combinatorics, difference equations, relations, Boolean algebra, computational models.

**MATE 4000. ELEMENTS OF TOPOLOGY.** Three credit hours. Three hours of lecture per week. Corequisite: MATE 4008.

Introduction to topology including topological spaces, continuous functions and homeomorphisms, metric spaces, compact spaces, connected spaces, separation axioms, and elements of homotopy.

**MATE 4003. MATHEMATICS PRACTICE FOR COOP STUDENTS I.** Three credit hours per semester. Prerequisite: authorization of the Director of the Department.

Practical experience in mathematics in cooperation with private industry or government, to be jointly supervised by the academic department, the COOP Program Coordinator, and an official from the COOP organization. A report will be required of the student and the official at the end of the semester.

**MATE 4004. MATHEMATICS PRACTICE FOR COOP STUDENTS II.** Three credit hours per semester. Prerequisite: authorization of the Director of the Department.

Practical experience in mathematics in cooperation with private industry or government, to be jointly supervised by the academic department, the COOP Program Coordinator, and an official from the COOP organization. A report will be required of the student and the official at the end of the semester.

**MATE 4007. HIGHER GEOMETRY.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3063 or MATE 3185.

Coordinate systems in Euclidean 3-space, basic configurations, vectors and geometry of n-space, transformations, introduction to projective geometry, axioms of non-Euclidean geometries.

**MATE 4008. INTRODUCTION TO ALGEBRAIC STRUCTURES.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3020.

Introduction to algebraic systems; sets, semigroups, groups, rings, fields.

**MATE 4009. ORDINARY DIFFERENTIAL EQUATIONS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3063 or MATE 3185.

Ordinary differential equations with applications: basic existence theorem, linear systems, the Laplace transform, series solutions, introduction to Fourier series and orthogonal functions.

**MATE 4010. INTRODUCTION TO COMPLEX VARIABLES WITH APPLICATIONS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3063 or MATE 3185.

Course designed for students who desire a working knowledge of complex variables. Topics to be covered include analytic functions, singularities, residues, complex integration, power series, conformal mapping.

**MATE 4020. PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER SERIES.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 4009.

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Separation of variables in the solution of partial differential equations, orthogonal expansions, Fourier series in certain function spaces, and an introduction to boundary value problems.

**MATE 4021. FUNDAMENTALS OF MATHEMATICAL LOGIC.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3020 or authorization of the Director of the Department.

An introductory course to the fundamental problems of logic, such as variables, the sentential calculus, the theory of identity, the theory of classes, the theory of relations, and the deductive method.

**MATE 4023. MATHEMATICS EDUCATION I.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3020.

Strategies for teaching mathematics at the elementary and secondary levels; analysis of innovative programs of instruction in mathematics; the use of computers in the teaching of mathematics.

**MATE 4031. INTRODUCTION TO LINEAR ALGEBRA.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3032 or MATE 3184.

Euclidean vector spaces, matrices and linear equations, spectral decomposition of normal operators.

**MATE 4039. THE USE OF TECHNOLOGY IN THE TEACHING OF MATHEMATICS.** Two credit hours. One hour of lecture and one hour of discussion per week. Prerequisite: MATE 4023 and EDPE 3129.

Use and impact of technology for the exploration of mathematical concepts at the high school level, from the teaching learning process perspective. Various technologies will be used including graphing calculators, spreadsheets, dynamic geometry, and symbolic computation software, and online resources.

**MATE 4050. UNDERGRADUATE SEMINAR.** One credit hour. One hour of lecture per week. Prerequisite: authorization of the Department Director.

Introduction to the methods of mathematical research; application of abstract methods to concrete situations. Recommended for all students who intend to pursue graduate studies in Mathematics.

**MATE 4051. ADVANCED CALCULUS I.** Three credit hours. Three hours of lecture per week. Prerequisites: (MATE 3063 or MATE 3185) and (MATE 3020 or authorization of the Director of the Department).

A rigorous treatment of the basic ideas and techniques of mathematical analysis, including such topics as point set

algebra, the real number system, functions, sequences, limits, continuity, theorems on continuous functions, uniform continuity, differentiation, Riemann integration, the Riemann-Stieltjes integral, power series, uniform convergence.

**MATE 4052. ADVANCED CALCULUS II.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 4051.

Continuation of a rigorous treatment of the basic ideas and techniques of mathematical analysis, including such topics as functions of several variables, implicit functions, Jacobians and transformations of multiple integrals, line and surface integrals, improper integrals, linear function spaces, Fourier series and orthogonal functions.

**MATE 4061. NUMERICAL ANALYSIS I.** Three credit hours. Three hours of lecture per week. Prerequisites: (MATE 3063 or MATE 3185) and (MATE 3010 or INGE 3016 or COMP 3010).

Roots of equations, interpolation and approximation procedures, numerical integration, numerical solution of initial value problems for ordinary differential equations of first and second order, direct and iterative methods for solving systems of linear equations.

**MATE 4062. NUMERICAL ANALYSIS II.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 4031 and MATE 4061.

The numerical solution of Fredholm integral equations; extension of the difference calculus to functions of several variables; brief study of analytical methods for the solution of the partial differential equations of mathematical physics; the numerical solution of boundary value problems; introduction to the numerical solution of eigen value problems.

**MATE 4071. INTRODUCTION TO MATHEMATICS OF MODERN SCIENCE I.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 4009.

Brief explanation of certain mathematical topics essential for science and engineering: infinite series, elliptic integrals, Fourier series, solution of equations, partial differentiation, multiple and line integrals.

**MATE 4072. INTRODUCTION TO MATHEMATICS OF MODERN SCIENCE II.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 4009.

Laplace transforms; Gamma, Beta and Bessel functions; partial differential equations and boundary value problems; vector analysis; probability, empirical formulas, and curve fitting.

**MATE 4088. DIFFERENTIAL GEOMETRY USING COMPUTERS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisites: MATE 4009 and (MATE 4031 or authorization of the Director of the Department).

Introduction to differential geometry of curves and surfaces in three-dimensional Euclidean space, including computer-aided visualization, and numerical and symbolic computation of geometric properties.

**MATE 4120. HISTORY OF MATHEMATICS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3032 or MATE 3184.

A survey of the historical development of the elementary branches of Mathematics.

**MATE 4145. LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS.** Four credit hours. Three hours of lecture and one two-hour laboratory per week. Prerequisites: MATE 3063 and either COMP 3010 or INGE 3016.

Integrated approach to linear algebra and ordinary differential equations with applications in engineering. Use of software to solve differential equations and linear algebra problems.

**MATE 4990. UNDERGRADUATE RESEARCH.** One to six credit hours. Three hours of research per credit week. Prerequisite: authorization of the Director of the Department.

A research project under the supervision of professors of the Department.

**MATE 4997. SPECIAL TOPICS IN MATHEMATICS.** One to three credit hours. One to three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Introduction to topics of Mathematics which are not normally covered in regular courses in the curriculum, and which would serve to stimulate further advanced studies in Mathematics.

### **Advanced Undergraduate and Graduate Courses**

**MATE 5016. GAME THEORY.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Mathematical theory and solution of different classes of games, such as two-person, rectangular or matrix, and multipersonal games.

**MATE 5047. INTERMEDIATE DIFFERENTIAL EQUATIONS.** Three credit hours. Three hours of lecture per week. Prerequisites: (MATE 4009 and MATE 4031) or authorization of the Director of the Department.

Existence, continuity and differentiability of solutions; stability and Lyapunov's theorem.

**MATE 5049. CALCULUS OF VARIATIONS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 4009 or authorization of the Director of the Department.

Origin and historical development of the calculus of variations; first variation of a functional; canonical forms of Euler's equations; second variation: sufficient conditions for weak and strong extremals; applications to problems in geometry, mechanisms and physics.

**MATE 5055. VECTOR ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3063 or authorization of the Director of the Department.

Introduction to vector analysis as a tool for mathematicians. The algebra and calculus of vectors, including gradient, divergence and curl, Stokes' and Green's Theorems, curvilinear coordinates, and simple N-Dimensional space. Applications in physics and geometry.

**MATE 5056. TENSOR ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3063 or authorization of the Director of the Department.

Cartesian tensors, Cartesian tensor fields, gradient vector, Laplacian, covariant and contravariant tensor fields, the differential line-element and the fundamental tensors, covariant differentiation and the Riemann-Christoffel tensor.

**MATE 5150. LINEAR ALGEBRA.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 4008 or authorization of the Director of the Department.

The study of the essentials of linear algebra, including finite dimensional vector spaces. Linear equations, matrices, determinants, bilinear forms, inner products, Spectral Theorem for normal operators and linear transformations.



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## COMPUTER SCIENCES

### Undergraduate Courses

**COMP 3010.** INTRODUCTION TO COMPUTER PROGRAMMING I. Three credit hours. Two hours of conference and two hours of laboratory per week. Prerequisite: MATE 3171 or MATE 3005 or MATE 3143.

Fundamentals concepts of procedural programming. Topics include data types, control structures, functions, arrays, files, and the experience of running, testing, and debugging programs.

**COMP 3015.** LINUX AND FREE/OPEN SOURCE SOFTWARE FOR STEM. Three credit hour. Two hours of lecture and two hours of laboratory per week.

Introduction to different programming languages and their applications in the disciplines of science, technology, engineering and mathematics (STEM). Exploration of the different FOSS (Free and open source software) as a computational environment and as a fundamental tool for visualizing and interpreting data in these fields. Configuration and administration of the GNU/Linux operating system in order to maintain, access, and analyze STEM data. Development of “scripts” pertaining to a variety of computational operations including the collection, manipulation, processing of multidimensional data (numerical and/or symbolic), and automation of related processes.

**COMP 3057.** COMPUTER FUNDAMENTALS. Three credit hours. Two hours of lecture and one two-hour laboratory per week.

Historical development of computers; functions of the main hardware components and systems software; elementary concepts of programming. The laboratory will provide practical experience with some applications of the computer.

**COMP 3075.** INTRODUCTION TO DATA STRUCTURES. Three credit hours. Three hours of lecture per week. Prerequisites: COMP 3110 and (MATE 3181 or LING 5090).

Basic concepts of data. Linear and orthogonal lists. Representation of trees and graphs. Recovery and allocation of memory for storage. Symbol tables. Searching and sorting techniques. Data structures in programming languages. Efficiency of sorting algorithms.

**COMP 3110.** INTRODUCTION TO COMPUTER PROGRAMMING II. Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisite: COMP 3010 or MATE 3010.

Methodology of object-oriented programming. Topics include searching and sorting techniques, recursion, and elementary algorithm analysis.

**COMP 4006.** OPERATING SYSTEMS. Three credit hours. Three hours of lecture per week. Prerequisite: COMP 4016.

Structure and implementation of operating systems including scheduling, input-output, control and storage management, file systems and their organization, timing and synchronization.

**ICOM/COMP 4009.** SOFTWARE ENGINEERING. Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 4035.

Techniques used during the software development cycle; specification, design, testing, documentation and maintenance. Use of a procedure oriented language in the design and implementation of a software project.

**COMP 4016.** COMPUTER ORGANIZATION. Three credit hours. Three hours of lecture per week. Prerequisite: COMP 3010.

Internal computer organization including the control processing unit, computer arithmetic, digital circuits, logical design, control units, and assembly language programming.

**COMP 4017.** COMPUTER ALGORITHMS. Three credit hours. Three hours of lecture per week. Prerequisite: COMP 3075.

Introduction to the design, analysis, and complexity of algorithms.

**COMP 4018.** DATABASE SYSTEMS. Three credit hours. Three hours of lecture per week. Prerequisite: COMP 3075.

Introduction to database system architecture and design. Topics will include the entity-relation model and the relational model. Queries, relational algebra, and the SQL language. Functional dependencies and normalization.

**COMP 4025.** COMPUTING MODELS. Three credit hours. Three hours of lecture per week. Prerequisite: COMP 3010 or authorization of the Director of the Department.

Various models for the modern use of computers, including operations research, and applications of probability and statistics.

**COMP 4036. PROGRAMMING LANGUAGES.** Three credit hours. Three hours of lecture per week. Prerequisite: COMP 3110 or MATE 3110.

Basic aspects of programming languages including data, operations, sequence control, data control, management, operational environments, syntax, and semantics.

**COMP 4046. COMPUTER GRAPHICS.** Three credit hours. Three hours of lecture per week. Prerequisites: COMP 3075 and MATE 4031.

Introduction to computer graphics: graphics hardware and packages, user-interface design, geometric modeling and algorithms, image manipulation and compression.

**COMP 4075. PROGRAMMING METHODOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: ((COMP 3075 or MATE 3075) and MATE 3020) or authorization of the Director of the Department.

Methods for reasoning about programs. The use of propositional and predicate calculus for programming notation and its semantics; the discipline of developing correct programs and their proofs.

**COMP 4086. COMPUTER ARCHITECTURE.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3110 or COMP 3110.

Introduction to the organization and architecture of computer systems including logic circuits, addressing and management of memory, design and organization of processors, input and output of data.

**SICI/COMP 4308. NETWORKING AND ROUTING FUNDAMENTALS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3063 or SICI 4088 or COMP 3075.

Study of the terminology of computer networks and their protocols, Internet protocol (IP) addressing, introduction to network design, and networking standards. Presentation, study, and configuration of several routing protocols.

**COMP 4995. COMPUTER SCIENCE PRACTICUM.** Three to six credit hours. Three to six hours of practice per week. Prerequisite: authorization of the Director of the Department.

Practical experience in a computer science application jointly supervised by the department and a public or private organization.

**COMP 4998. TOPICS IN COMPUTER SCIENCE I.** One to six credit hours. One to six hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Selected topics in Computer Science.

**COMP 4999. TOPICS IN COMPUTER SCIENCE II.** One to six credit hours. One to six hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Special topics in Computer Science.

### **Advanced Undergraduate and Graduate Courses**

**ICOM/COMP 5015. ARTIFICIAL INTELLIGENCE.** Three credit hours. Three hours of conference per week. Prerequisite: ICOM 4035 or authorization of the Director of the Department.

An introduction to the field of artificial intelligence: Lisp language, search techniques, games, vision, representation of knowledge, inference and process of proving theorems, natural language understanding.

**COMP 5045. AUTOMATA AND FORMAL LANGUAGES.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Finite automata and regular languages; pushdown automata and context-free languages; Turing machines and recursively enumerable sets; linearly bounded automata and context-sensitive languages; computability and the halting problem; undecidable problems.

**COMP 5055. PARALLEL COMPUTATION.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 4061 and authorization of the Director of the Department.

The use of supercomputers: parallel architecture, design of algorithms for scientific computation and their implementation with parallel multiprocessors, and performance analysis.

**INEL/ICOM/SICI/COMP 5318. INTERMEDIATE ROUTING, SWITCHING AND WIDE AREA NETWORKS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL/ICOM/SICI/COMP 4308 or authorization of the Director of the Department.

Study and configuration of link state protocols. Study of intermediate level concepts such as switching, wide area network or WAN standards, virtual local area networks or VLAN, network design, and redundancy. Presentation

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and study of strategies for managing and saving address space such as variable length subnet masks and network address translation.

## MATHEMATICAL STATISTICS

### Undergraduate Courses

**ESMA 3015.** ELEMENTARY STATISTICS. Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3171 or MATE 3173 or MATE 3086.

Nature and meaning of statistics; elements of probability; normal and binomial distributions; organization of data; measures of location and variability; elements of statistical inference; simple regression and correlation. Statistical analysis through computers.

**ESMA 3016.** STATISTICAL DATA ANALYSIS. Three credit hours. Two hours of lecture and one two-hour laboratory per week. Pre-requisite: (MATE 3031 or MATE 3144) and COMP 3010.

Statistical data analysis including descriptive and inferential statistics and exploratory data analysis.

**ESMA 3101.** APPLIED STATISTICS I. Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3171 or MATE 3173.

Basic concepts of methods of applied statistics. Descriptive statistics: probability; random variables; probability distribution. Statistical analysis through computers.

**ESMA 3102.** APPLIED STATISTICS II. Three credit hours. Three hours of lecture per week. Prerequisite: ESMA 3101.

Sampling, elements of estimation and tests of hypotheses, regression and correlation analysis, chi-square and contingency tables.

**ESMA 4001.** MATHEMATICAL STATISTICS I. Three credit hour. Three hours of lecture per week. Prerequisite: MATE 3032.

Nature of statistics, probability, random variables and their probability distributions, moment generating functions, sampling distributions and the central limit theorem.

**ESMA 4002.** MATHEMATICAL STATISTIC II. Three credit hour. Three hours of lecture per week. Prerequisite: ESMA 4001 and MATE 3063.

Multivariate probability distributions, methods of estimation, tests of hypotheses, linear models, design of experiments, analysis of variance, and contingency tables.

**ESMA 4005.** NON-PARAMETRIC APPLIED STATISTICS. Three credit hours. Three hours of lecture per week. Prerequisite: ESMA 3102 or ESMA 4001 or ESTA 3002.

Non-parametric statistical techniques applied to independent samples and correlated samples; independence and homogeneity of factors; computation of point estimates and confidence intervals for parameters, and the testing of hypotheses.

**ESMA 4006.** STATISTICS FOR THE BIOLOGICAL SCIENCES. Three credit hours. Two hours of lectures and a two-hour laboratory per week. Prerequisite: MATE 3021.

Statistics methods applied to the biological sciences. Includes descriptive statistics, probability, statistical inference, variance analysis, categorical data analysis, regression analysis, and sampling methods. Intensive use of statistical computer packages.

**ESMA 4016.** DATA MINING AND MACHINE LEARNING. Three credit hours. Three hours of lecture per week. Prerequisites: (ESMA 3016 and MATE 4031) or authorization of the Director of the Department.

Introduction to the techniques for data mining and machine learning applied to both supervised and unsupervised learning. Basic concepts of regression and classification, nearest neighbor methods, decision trees, boosting, neural networks and support vector machines.

**ESMA 4038.** SAMPLING METHODS. Three credit hours. Three hours of lecture per week. Prerequisite: ESMA 3102 or ESMA 4001 or ESTA 3002.

Introduction to the theory and application of statistical sampling methods.

### Advanced Undergraduate and Graduate Course

**ESMA 5015.** STOCHASTIC SIMULATION. Three credit hours. Three hours of lecture per week. Prerequisite: ESMA 4001 or authorization of the Director of the Department.

Basic methods of simulation, modeling of complex systems, simulation languages, generation of random numbers, model validity, analysis of solutions, variance reduction techniques, and the design of experiments.

## DEPARTMENT OF NURSING

The Department of Nursing offers a program leading to the **Bachelor of Science in Nursing**. The Program is accredited by the Accreditation Commission for Education in Nursing.

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Atlanta, Georgia 30326  
Phone: (404) 975-5000  
Fax: (404) 975-5020  
Email: [info@acenursing.org](mailto:info@acenursing.org)  
Web: [www.acenursing.org](http://www.acenursing.org)  
Contact Marsal P. Stoll, EdD, MSN  
Chief Executive Officer  
<http://www.acenursing.org>

The curriculum of the Bachelor's program prepares a nurse generalist to carry out the professional role of the nurse in a variety of health care settings. Course work includes lectures, simulated laboratory experiences, independent studies and clinical practice. Clinical practice is arranged under faculty direction with the cooperation of a variety of health care facilities.

The Department of Nursing sponsors the following student and professional organizations: The Nursing Student Association, the Epsilon Lambda Chapter of the Sigma Theta Tau International, Inc., Nursing Honor Society and the Coalition of Nurses for Communities in Disaster (CONCID).

### Vision

To prepare accountable, competent, and committed professional nurses to improve the health and quality of life of the Puerto Rican and international society.

### Mission

Prepare highly qualified nursing professionals who participate in health promotion and maintenance, prevention and management of illness, rehabilitation and end of life care to a diverse society at all levels of healthcare delivery; as well as, contribute in healthcare public policies.

## STUDENT LEARNING OUTCOMES

At the end of the program, the student will:

1. Apply knowledge and skills from nursing science and other disciplines while caring for

the client system as it pertains to promotion and maintenance of health, prevention, management and rehabilitation of illness, and end of life care.

2. Demonstrate leadership, communication and interpersonal relationship knowledge and skills when managing care in a collaborative effort with the client system.
3. Provide and promote safe, quality care that will continually allow the client system to progress toward higher levels of wellness as they adapt to changes.
4. Integrate critical thinking, professional judgment, values and ethical/legal principles within generalist nursing practice.
5. Act as an evolving scholar demonstrating continuous professional development, use of creative thinking, technology and evidence base as a foundation for decision making and problem solving.
6. Incorporate professional nursing roles while providing holistic, competent and culturally sensitive nursing care in multiple settings.

## BACHELOR OF SCIENCE IN NURSING

### Summary of Credits in Program

|                          |            |
|--------------------------|------------|
| General Education Course |            |
| Faculty requirements     | 50         |
| Free electives           | 12         |
| Core Courses             |            |
| Major Course             | 57         |
| Non-major area           | <u>25</u>  |
| <b>Total</b>             | <b>144</b> |

## PROGRAM OF STUDY

### NURSING CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits | Course                              |
|------------|---------|-------------------------------------|
| *INGL ---- | 3       | First year course in English        |
| CIBI 3031  | 3       | Intro. to the Biological Sciences I |
| PSIC 3001  | 3       | Principles of Psychology I          |

|            |          |  |
|------------|----------|--|
| *MATE 3171 | 3        | Pre-Calculus I   |
| or         |          |  |
| MATE 3086  | 3        | Mathematical Reasoning                                   |
| QUIM 3141  | 4        | Principles of General, Organic and<br>Biologic Chemistry |
| EDFI ----  | <u>1</u> | Course in Physical Education                             |
|            | 17       |  |

### Second Semester

| Number      | Credits  | Course   |
|-------------|----------|--|
| *INGL ----  | 3        | First year course in English                               |
| CIBI 3032   | 3        | Intro. to the Biological Sciences II                       |
| PSIC 3002   | 3        | Principles of Psychology II                                |
| **MATE ---- | 3        | Recommended course in<br>Mathematics                       |
| QUIM 3142   | 4        | Principles of General, Organic and<br>Biological Chemistry |
| ENFE 3005   | <u>3</u> | Introduction to Nursing                                    |
|             | 19       |  |

## SECOND YEAR

### First Semester

| Number     | Credits  | Course                                    |
|------------|----------|---|
| INGL 3---  | 3        | Second year course in English             |
| *ESPA 3101 | 3        | Basic course in Spanish I                 |
| BIOL 3715  | 3        | Anatomy and Physiology                    |
| BIOL 3716  | 1        | Anatomy and Physiology<br>Laboratory      |
| ENFE 3015  | 3        | Interpersonal Relationships in<br>Nursing |
| ENFE 3021  | 4        | Introduction to Clinical Nursing I        |
| EDFI ----  | <u>1</u> | Course in Physical Education              |
|            | 18       |   |

### Second Semester

| Number     | Credits  | Course                              |
|------------|----------|-------------------------------------|
| ^INGL 3--- | 3        | Second year course in English       |
| *ESPA 3102 | 3        | Basic course in Spanish II          |
| ENFE 3022  | 4        | Introduction to Clinical Nursing II |
| ENFE 3035  | 2        | Fundamentals of Nutrition           |
| ENFE 3045  | <u>6</u> | Psychiatric Nursing                 |
|            | 18       |                                     |

## THIRD YEAR

### First Semester

| Number    | Credits | Course                                 |
|-----------|---------|--|
| ESPA 3--- | 3       | Course above level of basic<br>Spanish |
| HUMA 3111 | 3       | Intro. to Western Culture I            |
| BIOL 3725 | 4       | Microbiology                           |

|           |          |  |
|-----------|----------|--|
| ENFE 4001 | 6        | Maternal and Neonatal Nursing              |
|           | <u>3</u> | +Course in Social Sciences or<br>Economics |
|           | 19       |  |

### Second Semester

| Number    | Credits  | Course                                     |
|-----------|----------|--|
| ESPA 3--- | 3        | Course above level of basic<br>Spanish     |
| HUMA 3112 | 3        | Intro. to Western Culture II               |
| ESMA 3015 | 3        | Elementary Statistics                      |
| ENFE 4002 | 6        | Pediatric Nursing                          |
|           | <u>3</u> | +Course in Social Sciences or<br>Economics |
|           | 18       |  |

## FOURTH YEAR

### First Semester

| Number    | Credits  | Course                         |
|-----------|----------|--------------------------------|
| ENFE 4015 | 3        | Management of Nursing Services |
| ENFE 4031 | 6        | Medical-Surgical Nursing I     |
| ENFE 4041 | 1        | Seminar in Nursing I           |
| ELECTIVES | <u>2</u> |                                |
|           | 19       |                                |

### Second Semester

| Number    | Credits  | Course                      |
|-----------|----------|-----------------------------|
| ENFE 4025 | 6        | Community Health Nursing    |
| ENFE 4032 | 6        | Medical-Surgical Nursing II |
| ENFE 4042 | 1        | Seminar in Nursing II       |
| ELECTIVES | <u>3</u> |                             |
|           | 16       |                             |

### Total credits required: 144

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*Choose from the following alternatives defined by the Department: MATE 3172 or COMP 3057 or COMP 3010.

+Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI 3261-3262, SOCI 3315, or ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3202 or INGL 3209 or INGL 3289.

\*\*\* Course available to complete the INGL 3103-3104 Sequence: INGL 3056, 3057, 3225, 3227, 3231, 3236, 3238, 3250, 3268, 3276, 3277, 3278, 3279, 3296, 3300, 3305, 3306, 3312, 3317, 3318, 3321, 3322, 3323, 3325, 3326, 3345, 3351, 3352.

## DEPARTMENTAL FACULTY

**CELIA R. COLÓN-RIVERA**, *Professor*, Ph.D., 1989, University of Wisconsin-Madison.

**MADLINE DELGADO CARABALLO**, *Professor*, Ed.D, 2009, Interamerican University of Puerto Rico.

**ANA C. LÓPEZ-AVILÉS**, *Professor*, MSN, 1992, Pontifical Catholic University of Puerto Rico.

**ABIGAIL MATOS-PAGÁN**, *Professor*, DNP, 2003, RUSH University, Chicago, ILL.

**ROSE M. MÉNDEZ-AVILÉS**, *Professor*, DNP, 2010, University of Virginia.

**LOURDES MÉNDEZ CRUZ**, *Assistant Professor*, Ph.D., 2002, Andrews University, Michigan.

**MIRIAM J. NIETO-VÁZQUEZ**, *Professor*, Ph.D., 2005, Barry University, Miami, Florida.

**GLORIBELL ORTIZ-RÍOS**, *Associate Professor*, DrPH, 2017, Ponce School of Medicine and Health Sciences, Ponce, PR

**LOURDES E. RAMÍREZ-ACEVEDO**, *Professor*, MSN, 1990, Pontifical Catholic University of Puerto Rico.

**LOURDES M. SANTIAGO SANTIAGO**, *Professor*, MSN, 1979, University of Puerto Rico, Medical Sciences Campus.

**MARÍA I. SANTIAGO-GALARZA**, *Professor*, MSN, 1992, Pontifical Catholic University of Puerto Rico.

**MARISOL SANTIAGO-SEPÚLVEDA**, *Professor*, Ph.D., 2005, Pontifical Catholic University of Puerto Rico.

**XAYMARA L. TIRADO GARCÍA**, *Associate Professor*, Ed.D., 2012, Pontifical Catholic University of Puerto Rico.

**MARGARET E. TORO-PÉREZ**, *Professor*, Ed.D, 2005, Interamerican University of Puerto Rico.

**SANDRA ZAPATA CASIANO**, *Professor*, MSN, 1987, Pontifical Catholic University of Puerto Rico.

## COURSES OF INSTRUCTION

### DEPARTMENT OF NURSING

#### Undergraduate Courses

**ENFE 3005. INTRODUCTION TO NURSING.** Three credit hours. Three hours of lecture per week.

The historical development of nursing, its evolution and current trends; introduction to the concept of professional nursing.

**ENFE 3007. DECISION-MAKING IN NURSING.** Three credit hours. Three hours of lecture per week. Prerequisite: ENFE 3005.

Discussion and analysis of concepts and principles inherent to the process of decision-making in nursing. Emphasis in the models and theoretical frameworks for the decision-making process in clinical situations in diverse health service scenarios. Integration of concepts such as problem solving, reflexive and critical thinking, values and ethics from a nursing perspective, when providing care to clients in different cultural contexts. Emphasis on the role of the nursing profession and the impact on the client system.

**ENFE 3015. INTERPERSONAL RELATIONSHIPS IN NURSING.** Three credit hours. Three hours of lecture per week. Prerequisite: (PSIC 3002 and ENFE 3005) or authorization of the Department Director.

Introduction to the study of nursing as a therapeutic interpersonal process.

**ENFE 3021. INTRODUCTION TO CLINICAL NURSING I.** Four credit hours. Two hours of lecture and one six-hour laboratory per week. Prerequisites: (ENFE 3005 and (CIBI 3002 or CIBI 3032)) or authorization of the Director of the Department. Corequisites: (BIOL 3715, BIOL 3716 and ENFE 3015) or authorization of the Director of the Department.

Fundamental concepts, knowledge and skills necessary for the practice of nursing in any clinical area.

**ENFE 3022. INTRODUCTION TO CLINICAL NURSING II.** Four credit hours. Two hours of lecture and one six-hour laboratory per week. Prerequisite: ENFE 3021. Corequisite: ENFE 3035.

Development of more complex clinical nursing skills.

**ENFE 3025. FUNDAMENTALS OF GERONTOLOGY.** Three credit hours. Three hours of lecture per week.

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Study and analysis of fundamental aspects of the elderly population such as perceptions of aging and old age, demographic aspects, bio-psycho-social and spiritual changes, promotion and maintenance of health, and legal considerations. Development of knowledge, skills, and attitudes for the adequate management of the needs and special problems of the elderly population.

**ENFE 3035. FUNDAMENTALS OF NUTRITION.** Two credit hours. Two hours of lecture per week. Corequisite: ENFE 3022.

Basic concepts of nutrition, and its relation to health maintenance; nutritional requirements of various members of the family; psychological, cultural and economic factors which influence nutrition, with emphasis on low cost adequate nutrition; dietary problems in various illnesses.

**ENFE 3045. PSYCHIATRIC NURSING.** Six credit hours. Two hours of lecture and two six-hour laboratories per week. Prerequisites: ENFE 3015. Corequisite: ENFE 3022.

Care and rehabilitation of mentally ill adults and children. Integration of in-patient care with local resources and family.

**ENFE 3095. POSOLOGY AND PHARMACOLOGY FOR NURSING.** Three credit hours. Two hours of lecture and two hours of computation per week. Prerequisites: authorization of the Director of the Department.

Concepts of posology and pharmacology related to Nursing, including the nature, administration, action and reaction, and dosage of common drugs.

**ENFE 3116. FORENSIC NURSING IN SEXUAL ASSAULT.** Three credit hours. Three hours of lecture per week. Prerequisite: ENFE 3021.

Discussion and analysis of the essential aspects of forensic nursing including the role of nurses with rape victims from a bio-psycho-social intervention, until the conviction of the aggressor. Familiarization with suitable methods for case reporting, documenting, and testifying in court. Discussion of the legal aspects in the care of sexual assault victims and the laws related to this crime. Consideration of relevant aspects for obtaining the S.A.N.E (Sexual Assault Nurse Examiner) certification.

**ENFE 3126. BASIC PRINCIPLES OF PHARMACOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: ENFE 3022.

Discussion of the basic interactions of drugs and their effects on humans, considering all systems: cardiovascular, renal, endocrine, immune and nervous, among others. Analysis of drugs from the perspective of

their action, dosage, adverse reactions and interaction. Emphasis on the study of pharmacokinetics and pharmacodynamics of drugs.

**ENFE 3305. NURSING IN HEALTH PROMOTION.** Three credit hours. Three hours of lecture per week.

Concepts, models, and theories related with health promotion. Focus on professional nursing, functions in health promotion for individuals, families, and communities.

**ENFE 3315. FUNDAMENTALS OF THANATOLOGY.** Three credit hours. Three hours of lecture per week.

Theories, issues, and research related to the dying person, death, bereavement and its implications in the practice of health professions.

**ENFE 4001. MATERNAL AND NEONATAL NURSING.** Six credit hours. Two hours of lecture and two six-hour laboratories per week. Prerequisites: ENFE 3022 and ENFE 3035 and ENFE 3045. Corequisite: BIOL 3725.

Theory and clinical experience in maternal and neonatal care following a family-centered approach.

**ENFE 4002. PEDIATRIC NURSING.** Six credit hours. Two hours of lecture and two six-hours laboratories per week. Prerequisite: ENFE 4001.

Theory and clinical experiences in pediatric care considering the growth and development stages in a family centered approach and their environment.

**ENFE 4015. MANAGEMENT OF NURSING SERVICES.** Three credit hours. Three hours of lecture per week. Prerequisites: ENFE 4002 or authorization of the Director of the Department.

Identification and application of principles of management in planning and providing nursing care.

**ENFE 4025. COMMUNITY HEALTH NURSING.** Six credit hours. Two hours of lecture and two six-hours laboratories per week. Prerequisites: ENFE 4002 or authorization of the Director of the Department. Corequisite: ESMA 3015.

Concepts and principles of community health and public health nursing, community health problems, vital statistics, health services and basic skills in community health nursing.

**ENFE 4026. LEGAL ASPECTS OF NURSING.** Two credit hours. Two hours of lecture per week. Prerequisite: ENFE 3021 or its equivalent.

Legal implications in Nursing Practice.

**ENFE 4031. MEDICAL-SURGICAL NURSING I.** Six credit hours. Two hours of lecture and two-six hours laboratories per week. Prerequisites: ENFE 4002 or authorization of the Director of the Department.

Theories, concepts and principles which underlie nursing interventions in the care of the medical surgical client from young adult into old age. Discussion of conditions on immunologic, endocrine, cardiovascular and respiratory system.

**ENFE 4032. MEDICAL-SURGICAL NURSING II.** Six credit hours. Two hours of lecture and two-six hours laboratories per week. Prerequisite: ENFE 4031.

Theories, concepts and principles which underlie nursing interventions in the care of the medical surgical client from young adult into old age. Discussion of conditions on genitourinary, neurological, sensorial, gastrointestinal and musculoskeletal systems.

**ENFE 4041. SEMINAR IN NURSING I.** One credit hour. One hour of lecture per week. Prerequisites: ENFE 4002 or authorization of the Director of the Department. Corequisite: ESMA 3015.

Research in nursing: the application of the scientific method for the conception and definition of a research problem; its ethical and legal aspects.

**ENFE 4042. SEMINAR IN NURSING II.** One credit hour. One hour of lecture per week. Prerequisite: ENFE 4041 and ESMA 3015. Corerequisite: ESMA 3015.

Research in nursing: the planning and implementation phases in the research process; its application to the solution of problems in health care services. A written proposal will be required.

**ENFE 4991. UNDERGRADUATE RESEARCH I.** One to three credit hours. Three to nine hours of research per week. Prerequisites: ENFE 3022 and authorization of the Director of the Department.

Supervised research in nursing.

**ENFE 4992. UNDERGRADUATE RESEARCH II.** One to three credit hours. Three to nine hours of research per week. Prerequisites: ENFE 4991 and authorization of the Director of the Department.

Supervised research in nursing.

**ENFE 4995. COOP PRACTICE.** Three to six credit hours. Prerequisite: authorization of the Director of the Department.

Practical experience in nursing in cooperation with private industry or government, jointly supervised by the

Nursing Department, the COOP program Coordinator, and an official from the cooperating organization.

**ENFE 4996. SPECIAL TOPICS IN NURSING.** One to three credit hours. One to three hours of lecture per week.

Discussion and analysis of selected topics in Nursing.

**ENFE 5005. HEALTH ASSESSMENT.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: (BIOL 3715 and BIOL 3716) or authorization of the Director of the Department.

Directed experiences toward achieving competency in conducting health assessment: health history, physical examination, analysis of the data, and planning for care.

**ENFE 5115. WOMEN AND HEALTH: INTEGRAL PERSPECTIVE IN SEXUAL AND REPRODUCTIVE HEALTH.** Three credit hours. Three hours of lecture per week.

This course will include a depth discussion of the sexual and reproductive health of women in Puerto Rico from a holistic perspective emphasizing the clinical and social component. Nurses and health care professionals interested in this topic, will be prepared within his/her roles and responsibilities to attend the Puerto Rican Women's need using resources and services available.

**ENFE 5397. APPLIED PATHOPHYSIOLOGY.** Three credit hours. Three hours of lecture per week.

Analysis of pathophysiological alterations occurring within the geriatric health-illness continuum. Particular attention is placed on risk, mitigation of chronicity, and health repercussions for the geriatric client in critical condition.

**ENFE 5665. THEORIES OF NURSING.** Three credit hours. Three hours of lecture per week.

Analysis and discussion of theories in nursing, such as system, self-care, and environmental theories and their relevance to education, practice, and research.

**ENFE 5667. EKG INTERPRETATION: NURSING CARE.** Three credit hours. Three hours of lecture per week.

Analysis of the electrophysiological manifestations of the heart's conduction system. Discussion of the electrophysiological, ischemic, and structural changes which are represented in the electrocardiogram (EKG). Detection of health problems and the application of knowledge to the diagnosis, treatment, and nursing care.



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## DEPARTMENT OF PHYSICS

The Department of Physics offers Bachelor of Science degree programs in Physics and in Physical Sciences, and a Master of Science program in Physics. We also offer a Curricular Sequence in Atmospheric Science and Meteorology. The curricula for the undergraduate degrees are covered in the following. Students seeking information concerning the graduate program should consult the Graduate Catalogue.

The Bachelor of Science program in Physics is the traditional program designed for students who wish to obtain a solid background in the field. It prepares students to work in government and private laboratories, to pursue graduate work in physics or to teach physics at the secondary level if additional courses in education are taken to obtain the teacher's license required by the Department of Education. This program is recommended to students who would like to pursue a career in Physics.

The Bachelor of Science Program in Physical Sciences is directed specifically to the preparation of secondary school teachers in the physical sciences. The program includes most of the courses in education required for certification by the Department of Education. However, it can also be used by students who do not want to make a commitment to any of the traditional fields of study in the physical sciences and require a broader preparation in general science.

A wide variety of subjects can be chosen by students in order to fulfill free electives requirements. These include traditional choices from mathematics, chemistry, geology, computer sciences, arts and humanities and non-traditional selections from business, biology, education and engineering. Students who contemplate taking courses outside the Faculty of Arts and Sciences should consult their departmental advisor regarding the availability of such courses. Students are encouraged to choose electives wisely.

Recommended electives must be taken from the list of courses corresponding to the program of study which follows. This list is revised periodically to incorporate changes in academic offerings. Other courses might be taken only after consultation with a departmental academic advisor.

Courses with the code ASTR (Astronomy) or METE (Meteorology) are offered by the Department of Physics. Only those cases determined by the Department may be accepted as recommended electives in Physics.

### Mission

- The mission of the Department of Physics derives from the triple mission of the University of Puerto Rico:
- Teaching: To educate our students to better understand and explore physical phenomena, to apply critical thinking in posing, analyzing and solving problems, and to maintain high professional standards in pursuing their careers.
- Research: To sustain and advance research and scholarship in Physics and related disciplines.
- Service: To promote Physics as a discipline throughout the university, the local school system and the community at large.

### General Objectives of the Department of Physics

- To provide effective teaching of physics and related fields.
- To perform and advance research in physics and related fields.
- To prepare our students to compete in the job market.
- To disseminate and promote scientific knowledge.
- To provide to the University and the community services according to the human resources and the physical facilities of the department.
- To encourage the development of interdisciplinary activities among physics or related fields and other branches of knowledge.
- To promote interactions of faculty and students in the Department with industry, governmental agencies, national laboratories and other academic or research institutions.

### General Education Student Learning Outcomes of the Department of Physics

*Upon graduation the student of the Department of Physics will:*

- Have critical thinking and problem solving skills using the scientific method.
- Be a professional that values independent study and embraces self-learning.

- Be able to identify physical variables in a physical problem.
- Dominate mathematical skills appropriate for stating and solving physical problems.
- Be competent conceptually and quantitatively in the following areas: Classical Mechanics, Electromagnetism, Waves, Optics, Thermodynamics, Statistical Mechanics, Relativity and Quantum Mechanics.
- Be able to analyze physical problems and, when appropriate, solve them in terms of smaller and simpler ones.
- Be able to formulate basic aspects of factors contributing to a physical problem.
- Demonstrate skills to perform a supervised research project.
- Communicate effectively in Spanish and English.
- Have some familiarity with current topics in Physics.
- Be aware of professional ethic standards.

## BACHELOR OF SCIENCE IN PHYSICS

### Summary of Credits In Program

|  |            |
|--|------------|
| Faculty requirements   | 49         |
| Departmental requirements  |            |
| Major area   | 43         |
| (6 credits in recommended<br>electives in Physics or<br>Astronomy) |            |
| Non-major area   | 31         |
| (3 credits computer<br>programming course)                         |            |
| Recommended electives  | 6          |
| Free electives   | <u>12</u>  |
| <b>Total</b>   | <b>141</b> |

## PROGRAM OF STUDY

### PHYSICS CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits  | Course                                 |
|------------|----------|--|
| *INGL 3--- | 3        | First year course in English           |
| *ESPA 3101 | 3        | Basic course in Spanish                |
| +----      | 3        | Course in Social Sciences or Economics |
| QUIM 3131  | 3        | General Chemistry I                    |
| QUIM 3133  | 1        | General Chemistry Laboratory I         |
| MATE 3005  | <u>5</u> | Pre-Calculus                           |
|            | 18       |  |

##### Second Semester

| Number     | Credits  | Course                                 |
|------------|----------|--|
| *INGL 3--- | 3        | First year course in English           |
| *ESPA 3102 | 3        | Basic course in Spanish                |
| +----      | 3        | Course in Social Sciences or Economics |
| QUIM 3132  | 3        | General Chemistry II                   |
| QUIM 3134  | 1        | General Chemistry Laboratory II        |
| MATE 3031  | 4        | Calculus I                             |
| EDFI ----  | <u>1</u> | Course in Physical Education           |
|            | 18       |  |

#### SECOND YEAR

##### First Semester

| Number    | Credits  | Course                              |
|-----------|----------|-------------------------------------|
| INGL 3--- | 3        | Second year course in English       |
| ESPA 3--- | 3        | Course above level of basic Spanish |
| CIBI 3031 | 3        | Intro. to the Biological Sciences I |
| MATE 3032 | 3        | Calculus II                         |
| FISI 3161 | 4        | GENERAL PHYSICS I                   |
| FISI 3163 | <u>1</u> | GENERAL PHYSICS LAB. I              |
|           | 18       |                                     |

##### Second Semester

| Number     | Credits  | Course                               |
|------------|----------|--------------------------------------|
| ^INGL 3--- | 3        | Second year course in English        |
| ESPA 3---  | 3        | Course above level of basic Spanish  |
| CIBI 3032  | 3        | Intro. to the Biological Sciences II |
| FISI 3162  | 4        | GENERAL PHYSICS II                   |
| FISI 3164  | 1        | GENERAL PHYSICS LAB. II              |
| MATE 3063  | 3        | Calculus III                         |
| EDFI ----  | <u>1</u> | Course in Physical Education         |
|            | 18       |                                      |

### THIRD YEAR

#### First Semester

| Number    | Credits  | Course                          |
|-----------|----------|---------------------------------|
| HUMA 3111 | 3        | Intro. To Western Culture I     |
| FISI 4051 | 3        | INTERMEDIATE MECHANICS          |
| FISI 4076 | 2        | INTERMEDIATE LABORATORY I       |
| FISI 4105 | 3        | MODERN PHYSICS                  |
| MATE 4009 | 3        | Ordinary Differential Equations |
| ** ----   | <u>3</u> | Computer programming course     |
| 17        |          |                                 |

#### Second Semester

| Number      | Credits  | Course                             |
|-------------|----------|------------------------------------|
| HUMA 3112   | 3        | Intro. To Western Culture II       |
| FISI 4052   | 3        | DYNAMICS                           |
| FISI 4071   | 3        | ELECTRICITY AND<br>MAGNETISM       |
| FISI 4077   | 2        | INTERMEDIATE LABORATORY II         |
| FISI 4125   | 3        | COMPUTERS IN PHYSICS               |
| **FISI ---- | <u>3</u> | RECOMMENDED ELECTIVE IN<br>PHYSICS |
| 17          |          |                                    |

### FOURTH YEAR

#### First Semester

| Number     | Credits  | Course                                    |
|------------|----------|---|
| FISI 4001  | 1        | SEMINAR I                                 |
| FISI 4063  | 3        | QUANTUM MECHANICS I                       |
| FISI 4057  | 3        | THERMAL PHYSICS                           |
| MATE 4071  | 3        | Intro. To Mathematics of Modern Science I |
| **ELECTIVE | 3        | Recommended Elective                      |
| ELECTIVES  | <u>6</u> | Free Electives                            |
| 19         |          |   |

#### Second Semester

| Number      | Credits  | Course  |
|-------------|----------|---|
| FISI 4002   | 1        | SEMINAR II                                    |
| **FISI ---- | 3        | RECOMMENDED ELECTIVE IN<br>PHYSICS            |
| MATE 4072   | 3        | Intro. To Mathematics of Modern<br>Science II |
| **ELECTIVE  | 3        | Recommended Elective                          |
| ELECTIVES   | <u>6</u> | Free Electives                                |
| 16          |          |   |

**Total credits required: 141**

**Major Area Courses appear in capitals.**

\* Refer to the Academic Regulations section for information on Advanced Placement.

\*\*To be selected from the list of courses in recommended electives.

+Choose any course in Social Sciences: ANTR 3005, ANTR 3015, ANTR/CISO 4066, CIPO 3011, CIPO 3025, CIPO 3035, CIPO 3095, CIPO 3175, CIPO 4016, CIPO 3036, CIPO 4236, CISO 3121-3122, GEOG 3155, GEOG 3185, HIST \_\_\_\_, PSIC 3001-3002, SOCI 3016, SOCI 3261-3262, SOCI 3315, or ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

### RECOMMENDED ELECTIVES

(For the Bachelor of Science in Physics)

#### Geology Courses

|  |   |
|--|---|
| <b>GEOL 3025</b>                                       |   |
| Earth Sciences   | 3 |
| <b>GEOL 3026</b>                                       |   |
| Life in the Past                                       | 3 |
| <b>GEOL 3027</b>                                       |   |
| Geological Aspects of the Environmental<br>Science     | 3 |
| <b>GEOL 3045</b>                                       |   |
| Planetary Geology                                      | 3 |
| <b>GEOL 3046</b>                                       |   |
| Earth Resources  | 3 |
| <b>GEOL 3055</b>                                       |   |
| Morphological Crystallography and<br>Crystal Chemistry | 3 |
| <b>GEOL 3105</b>                                       |   |
| Images of Planet Earth                                 | 3 |
| <b>GEOL 4006</b>                                       |   |
| Elementary Structural Geology                          | 3 |
| <b>GEOL 4048</b>                                       |   |
| Geological Applications of Remote Sensing              | 3 |
| <b>GEOL 5020</b>                                       |   |
| Advanced Geophysics                                    | 3 |

#### Biology Courses

|                                    |   |
|------------------------------------|---|
| <b>BIOL 5045</b>                   |   |
| Scanning Electron Microscopy (SEM) | 3 |

#### Chemistry Courses

|                                    |   |
|------------------------------------|---|
| <b>QUIM 3025</b>                   |   |
| Analytical Chemistry I             | 4 |
| <b>QUIM 3065</b>                   |   |
| Analytical Chemistry II            | 4 |
| <b>QUIM 3085</b>                   |   |
| Environmental Chemistry            | 3 |
| <b>QUIM 3086</b>                   |   |
| Environmental Chemistry Laboratory | 1 |
| <b>QUIM 3461</b>                   |   |
| Organic Chemistry I                | 3 |
| <b>QUIM 3462</b>                   |   |
| Organic Chemistry Laboratory I     | 1 |
| <b>QUIM 3463</b>                   |   |
| Organic Chemistry II               | 3 |

|                                  |   |
|----------------------------------|---|
| <b>QUIM 3464</b>                 |   |
| Organic Chemistry Laboratory II  | 1 |
| <b>QUIM 4041</b>                 |   |
| Physical Chemistry I             | 3 |
| <b>QUIM 4042</b>                 |   |
| Physical Chemistry II            | 3 |
| <b>QUIM 4101</b>                 |   |
| Physical Chemistry Laboratory I  | 1 |
| <b>QUIM 4102</b>                 |   |
| Physical Chemistry Laboratory II | 1 |
| <b>QUIM 4015</b>                 |   |
| Instrumental Methods of Analysis | 4 |

### **Chemistry Courses**

|                         |   |
|-------------------------|---|
| <b>QUIM 5095</b>        |   |
| Nuclear Chemistry       | 3 |
| <b>QUIM 5105</b>        |   |
| Quantum Chemistry       | 3 |
| <b>QUIM 5125</b>        |   |
| Chemical Thermodynamics | 3 |

### **Computer Sciences Courses**

|   |   |
|---|---|
| <b>COMP 3010</b>                                  |   |
| Introduction to Computer Programming I            | 3 |
| <b>COMP 3075</b>                                  |   |
| Introduction to Data Structures                   | 3 |
| <b>COMP 4036</b>                                  |   |
| Programming Languages                             | 3 |
| <b>COMP 5055</b>                                  |   |
| Parallel Computation                              | 3 |
| <b>ICOM 4035</b>                                  |   |
| Data Structures                                   | 3 |
| <b>ICOM 4036</b>                                  |   |
| Structure and Properties of Programming Languages | 3 |
| <b>ICOM 4015</b>                                  |   |
| Advanced Programming                              | 3 |
| <b>INGE 3016</b>                                  |   |
| Algorithms and Computer Programming               | 3 |

### **Mathematics Courses**

|   |   |
|---|---|
| <b>MATE 4008</b>                                  |   |
| Introduction to Algebraic Structures              | 3 |
| <b>MATE 4010</b>                                  |   |
| Intro. to Complex Variables with Applications     | 3 |
| <b>MATE 4020</b>                                  |   |
| Partial Differential Equations and Fourier Series | 3 |
| <b>MATE 4021</b>                                  |   |
| Fundamentals of Mathematical Logic                | 3 |
| <b>MATE 4031</b>                                  |   |
| Introduction to Linear Algebra                    | 3 |
| <b>MATE 4051</b>                                  |   |
| Advanced Calculus I                               | 3 |
| <b>MATE 4052</b>                                  |   |
| Advanced Calculus II                              | 3 |
| <b>MATE 4061</b>                                  |   |
| Numerical Analysis I                              | 3 |

|                                     |   |
|-------------------------------------|---|
| <b>MATE 4062</b>                    |   |
| Numerical Analysis II               | 3 |
| <b>MATE 5047</b>                    |   |
| Intermediate Differential Equations | 3 |
| <b>MATE 5049</b>                    |   |
| Calculus of Variations              | 3 |
| <b>MATE 5056</b>                    |   |
| Tensor Analysis                     | 3 |
| <b>ESMA 4001</b>                    |   |
| Mathematical Statistics I           | 3 |
| <b>ESMA 4002</b>                    |   |
| Mathematical Statistics II          | 3 |

### **ESMA 3101**

|                       |   |
|-----------------------|---|
| Applied Statistics I  | 3 |
| <b>ESMA 3102</b>      |   |
| Applied Statistics II | 3 |
| <b>ESMA 4038</b>      |   |
| Sampling Methods      | 3 |

### **Philosophy Courses**

|                          |   |
|--------------------------|---|
| <b>FILO 3157</b>         |   |
| Introduction to Logic    | 3 |
| <b>FILO 3167</b>         |   |
| Symbolic Logic I         | 3 |
| <b>FILO 3168</b>         |   |
| Philosophy of Science    | 3 |
| <b>FILO 4145</b>         |   |
| Symbolic Logic II        | 3 |
| <b>FILO 4160</b>         |   |
| Philosophy of Technology | 3 |

### **Electives in Astronomy, Meteorology, or Physics**

|                                     |       |
|-------------------------------------|-------|
| <b>ASTR 4005</b>                    |       |
| Astronomy I                         | 3     |
| <b>ASTR 4006</b>                    |       |
| Astronomy II                        | 3     |
| <b>ASTR 4015</b>                    |       |
| Radio Astronomy                     | 3     |
| <b>ASTR 4017</b>                    |       |
| Stellar Evolution                   | 3     |
| <b>ASTR 4025</b>                    |       |
| Radio Pulsars                       | 3     |
| <b>ASTR 4999</b>                    |       |
| Undergraduate Research              | 1 – 3 |
| <b>ASTR 5005</b>                    |       |
| Formation and Evolution of Galaxies | 3     |
| <b>ASTR 5007</b>                    |       |
| Planetary Astronomy                 | 3     |
| <b>FISI 3180</b>                    |       |
| Introduction to Relativity          | 3     |
| <b>FISI 4017</b>                    |       |
| Optics                              | 3     |
| <b>FISI 4020</b>                    |       |
| Physics of Waves                    | 3     |
| <b>FISI 4049</b>                    |       |
| Electronics                         | 3     |
| <b>FISI 4135</b>                    |       |
| Applied Optics                      | 4     |
| <b>FISI 4996</b>                    |       |
| Coop Practice                       | 3-6   |

|   |     |
|---|-----|
| <b>FISI 4997</b>                          |     |
| Special Problems in Physics               | 1-3 |
| <b>FISI 4999</b>                          |     |
| Undergraduate Research                    | 1-3 |
| <b>FISI 5037</b>                          |     |
| Introduction to Solid State Physics       | 3   |
| <b>FISI 5047</b>                          |     |
| Laser Physics                             | 3   |
| <b>METE 4006</b>                          |     |
| Introductory Meteorology                  | 3   |
| <b>METE 4007</b>                          |     |
| Meteorological Measurements               | 1   |
| <b>METE 4008</b>                          |     |
| Physical Meteorology                      | 3   |
| <b>METE 4057</b>                          |     |
| Atmospheric Thermodynamics                | 3   |
| <b>METE 4061</b>                          |     |
| Dynamic Meteorology                       | 3   |
| <b>METE 4075</b>                          |     |
| Synoptic Meteorology                      | 3   |
| <b>METE 4085</b>                          |     |
| Mesoscale Meteorology                     | 3   |
| <b>METE 5065</b>                          |     |
| Advanced Dynamic Meteorology              | 3   |
| <br><b><u>Hispanic Studies Course</u></b> |     |
| <b>ESPA 4405</b>                          |     |
| Technical and Scientific Writing          | 3   |

### **English Course**

|                         |   |
|-------------------------|---|
| <b>INGL 3236</b>        |   |
| Technical Communication | 3 |

### **Economy Courses**

|  |   |
|--|---|
| <b>ECON 4017</b>                                 |   |
| Econometrics                                     | 3 |
| <b>ECON 4046</b>                                 |   |
| Input-Output Analysis                            | 3 |
| <b>ECON 4028</b>                                 |   |
| Economics of Natural Resources                   | 3 |
| <b>ECON 4056</b>                                 |   |
| Environmental Economics                          | 3 |
| <b>ECON 4037</b>                                 |   |
| Urban Economics                                  | 3 |
| <b>ECON 4065</b>                                 |   |
| Economics of the Public Sector and Fiscal Policy | 3 |
| <b>ECON 3021</b>                                 |   |
| Principles of Economics: Microeconomics          | 3 |
| <b>ECON 3022</b>                                 |   |
| Principles of Economy: Macroeconomics            | 3 |

### **Education Courses**

|                                       |   |
|---------------------------------------|---|
| <b>EDFU 3011</b>                      |   |
| Foundations of Human Development      | 3 |
| <b>EDFU 3007</b>                      |   |
| Social Foundations of Education       | 3 |
| <b>EDFU 3012</b>                      |   |
| Foundations of Educational Psychology | 3 |

|  |   |
|--|---|
| <b>EDFU 4019</b>                       |   |
| Philosophical Foundations of Education | 3 |

Note: The total number of required credits of recommended electives (in Biology, Chemistry, Computer Sciences, Mathematics and Philosophy), and electives in Astronomy or Physics are distributed as follows:

|                             |           |
|-----------------------------|-----------|
| Computer programming course | 3         |
| Astronomy or Physics        | 6         |
| Recommended Electives       | <u>6</u>  |
| <b>TOTAL</b>                | <b>15</b> |

## **BACHELOR OF SCIENCE IN PHYSICAL SCIENCES**

### **Summary of Credits in Program**

|                           |            |
|---------------------------|------------|
| Faculty requirements      | 49         |
| Departmental requirements |            |
| Major area                | 32         |
| Non-major area            | 31         |
| Recommended electives     | 12         |
| Free electives            | <u>12</u>  |
| <b>Total</b>              | <b>136</b> |

### **PROGRAM OF STUDY**

#### **PHYSICAL SCIENCES CURRICULUM**

#### **FIRST YEAR**

##### **First Semester**

| Number    | Credits   | Course                           |
|-----------|-----------|----------------------------------|
| INGL 3--- | 3         | First year course in English     |
| ESPA 3--- | 3         | Basic Course in Spanish          |
| EDFU 3011 | 3         | Foundations of Human Development |
| QUIM 3131 | 3         | General Chemistry I              |
| QUIM 3133 | 1         | General Chemistry Laboratory I   |
| MATE 3005 | <u>5</u>  | Pre-Calculus                     |
|           | <b>18</b> |                                  |

##### **Second Semester**

| Number    | Credits   | Course                                |
|-----------|-----------|---------------------------------------|
| INGL 3--- | 3         | First year course in English          |
| ESPA 3102 | 3         | Basic Course in Spanish II            |
| EDFU 3012 | 3         | Foundations of Educational Psychology |
| QUIM 3132 | 3         | General Chemistry II                  |
| QUIM 3134 | 1         | General Chemistry Laboratory II       |
| MATE 3031 | 4         | Calculus I                            |
| EDFI ---- | <u>1</u>  | Course in Physical Education          |
|           | <b>18</b> |                                       |

## SECOND YEAR

### First Semester

| Number    | Credits | Course                              |
|-----------|---------|-------------------------------------|
| INGL 3--- | 3       | Second year course in English       |
| EDFU 3007 | 3       | Social Foundations of Education     |
| CIBI 3031 | 3       | Intro. to the Biological Sciences I |
| MATE 3032 | 4       | Calculus II                         |
| FISI 3151 | 3       | Modern College Physics I            |
| FISI 3153 | 1       | Modern College Physics Lab. I       |
|           | 17      |                                     |

### Second Semester

| Number    | Credits | Course                                 |
|-----------|---------|--|
| INGL 3--- | 3       | Second year course in English          |
| CIBI 3032 | 3       | Intro. to the Biological Sciences II   |
| FISI 3152 | 3       | MODERN COLLEGE PHYSICS II              |
| FISI 3154 | 1       | MODERN COLLEGE PHYSICS LAB. II         |
| EDFU 4019 | 3       | Philosophical Foundations of Education |
| ELECTIVE  | 3       | Free Elective                          |
| EDFI ---- | 1       | Course in Physical Education           |
|           | 17      |  |

## THIRD YEAR

### First Semester

| Number     | Credits | Course                                     |
|------------|---------|--|
| ESPA 3---  | 3       | Course above level of Intermediate Spanish |
| FISI 4106  | 4       | CONCEPTS AND LAWS IN MECHANICS             |
| HIST 3111  | 3       | History of the United States of America    |
| HUMA 3111  | 3       | Intro. to Western Culture I                |
| ASTR 4005  | 3       | ASTRONOMY I                                |
| **ELECTIVE | 3       | Recommended Elective                       |
|            | 19      |  |

### Second Semester

| Number     | Credits | Course                                     |
|------------|---------|--|
| FISI 4107  | 4       | CONCEPTS AND LAWS OF THE HEAT AND WAVES    |
| METE 4006  | 3       | INTRODUCTORY METEOROLOGY                   |
| HIST 3241  | 3       | History of Puerto Rico                     |
| HUMA 3112  | 3       | Intro. to Western Culture II               |
| ESPA 3---- | 3       | Course above level of Intermediate Spanish |
| ELECTIVE   | 3       | Recommended Elective                       |
|            | 19      |  |

## FOURTH YEAR

### First Semester

| Number    | Credits | Course  |
|-----------|---------|---|
| FISI 4126 | 4       | CONCEPTS AND LAWS OF ELECTRICITY AND MAGNETISM                        |
| FISI 4127 | 3       | TEACHING METHODOLOGIES OF PHYSICS                                     |
| EDPE 4135 | 3       | Theory and Methodology in the Teaching of Science in Secondary School |
| ELECTIVE  | 3       | Free Elective   |
| ELECTIVE  | 3       | Free Elective   |
|           | 16      |   |

### Second Semester

| Number      | Credits | Course                |
|-------------|---------|-----------------------|
| FISI 4105   | 3       | MODERN PHYSICS        |
| **ELECTIVES | 6       | Recommended Electives |
| ELECTIVE    | 3       | Free Elective         |
|             | 12      |                       |

**Total credits required: 136**

### Major Area Courses appear in capitals.

\* Refer to the Academic Regulations section for information on Advanced Placement.

\*\*To be selected from the list of courses in recommended electives.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3202, INGL 3209 or INGL 3289.

^ Only for students who are in the Intermediate Sequence, choose from the following courses:

## RECOMMENDED ELECTIVES

(For the Bachelor of Sciences in Physical Sciences)

### Chemistry Courses

|                                    |   |
|------------------------------------|---|
| <b>QUIM 3025</b>                   |   |
| Analytical Chemistry I             | 3 |
| <b>QUIM 3065</b>                   |   |
| Analytical Chemistry II            | 3 |
| <b>QUIM 3085</b>                   |   |
| Environmental Chemistry            | 3 |
| <b>QUIM 3086</b>                   |   |
| Environmental Chemistry Laboratory | 1 |
| <b>QUIM 3335</b>                   |   |
| Introduction to Food Chemistry     | 3 |
| <b>QUIM 3461</b>                   |   |
| Organic Chemistry I                | 3 |
| <b>QUIM 3462</b>                   |   |
| Organic Chemistry Laboratory I     | 1 |
| <b>QUIM 3463</b>                   |   |
| Organic Chemistry II               | 3 |

|                                  |     |
|----------------------------------|-----|
| <b>QUIM 3464</b>                 |     |
| Organic Chemistry Laboratory II  | 1   |
| <b>QUIM 4041</b>                 |     |
| Physical Chemistry I             | 3   |
| <b>QUIM 4042</b>                 |     |
| Physical Chemistry II            | 3   |
| <b>QUIM 4101</b>                 |     |
| Physical Chemistry Laboratory I  | 1   |
| <b>QUIM 4102</b>                 |     |
| Physical Chemistry Laboratory II | 1   |
| <b>QUIM 4015</b>                 |     |
| Instrumental Methods of Analysis | 4   |
| <b>QUIM 4998</b>                 |     |
| Undergraduate Research I         | 1-4 |

#### **Mathematics Courses**

|   |   |
|---|---|
| <b>MATE 3030</b>                          |   |
| Introduction to Geometry                  | 3 |
| <b>MATE 3063</b>                          |   |
| Calculus III                              | 3 |
| <b>MATE 4009</b>                          |   |
| Ordinary Differential Equations           | 3 |
| <b>MATE 4031</b>                          |   |
| Introduction to Linear Algebra            | 3 |
| <b>MATE 4071</b>                          |   |
| Intro. to Mathematics of Modern Science I | 3 |

|  |   |
|--|---|
| <b>MATE 4072</b>                           |   |
| Intro. to Mathematics of Modern Science II | 3 |

#### **Computer Sciences Courses**

|  |   |
|--|---|
| <b>COMP 3010</b>                       |   |
| Introduction to Computer Programming I | 3 |
| <b>INGE 3016</b>                       |   |
| Algorithms and Computer Programming    | 3 |

#### **Geology**

|   |   |
|---|---|
| <b>GEOL 3025</b>                                    |   |
| Earth Sciences                                      | 3 |
| <b>GEOL 3026</b>                                    |   |
| Life in the Past                                    | 3 |
| <b>GEOL 3027</b>                                    |   |
| Geological Aspects of the Environmental Sciences    | 3 |
| <b>GEOL 3045</b>                                    |   |
| Planetary Geology                                   | 3 |
| <b>GEOL 3046</b>                                    |   |
| Earth Resources                                     | 3 |
| <b>GEOL 3055</b>                                    |   |
| Morphological Crystallography and Crystal Chemistry | 3 |
| <b>GEOL 3105</b>                                    |   |
| Images of Planet Earth                              | 3 |
| <b>GEOL 4006</b>                                    |   |
| Elementary Structural Geology                       | 3 |
| <b>GEOL 4048</b>                                    |   |
| Geological Applications of Remote Sensing           | 3 |
| <b>GEOL 5020</b>                                    |   |
| Geophysics  | 3 |

#### **Physics, Astronomy and Meteorology**

|                                       |       |
|---------------------------------------|-------|
| <b>ASTR 4006</b>                      |       |
| Astronomy II                          | 3     |
| <b>ASTR 4005</b>                      |       |
| Formation and Evolution of Galaxies   | 3     |
| <b>ASTR 4015</b>                      |       |
| Radio Astronomy                       | 3     |
| <b>ASTR 4017</b>                      |       |
| Stellar Evolution                     | 3     |
| <b>ASTR 4025</b>                      |       |
| Radio Pulsars                         | 3     |
| <b>ASTR 4999</b>                      |       |
| Undergraduate Research                | 1 – 3 |
| <b>ASTR 5005</b>                      |       |
| Formation and Evolution of Galaxies   | 3     |
| <b>ASTR 5007</b>                      |       |
| Planetary Astronomy                   | 3     |
| <b>FISI 4017</b>                      |       |
| Optics                                | 3     |
| <b>FISI 4049</b>                      |       |
| Electronics                           | 3     |
| <b>FISI 4117</b>                      |       |
| Introduction to Relativity            | 3     |
| <b>FISI 4135</b>                      |       |
| Applied Optics                        | 3     |
| <b>FISI 4996</b>                      |       |
| Coop Practice                         | 3-6   |
| <b>FISI 4997</b>                      |       |
| Special Problems Physics              | 1-3   |
| <b>FISI 4999</b>                      |       |
| Undergraduate Research                | 1-3   |
| <b>FISI 5037</b>                      |       |
| Introduction to Solid State Physics I | 3     |
| <b>FISI 5047</b>                      |       |
| Laser Physics                         | 3     |

#### **Meteorology**

|                              |   |
|------------------------------|---|
| <b>METE 4007</b>             |   |
| Meteorological Measurements  | 3 |
| <b>METE 4008</b>             |   |
| Physical Meteorology         | 3 |
| <b>METE 4057</b>             |   |
| Atmospheric Thermodynamics   | 3 |
| <b>METE 4061</b>             |   |
| Dynamic Meteorology I        | 3 |
| <b>METE 4075</b>             |   |
| Synoptic Meteorology         | 3 |
| <b>METE 4085</b>             |   |
| Mesoscale Meteorology        | 3 |
| <b>METE 5065</b>             |   |
| Advanced Dynamic Meteorology | 3 |

### **Education and Methodology**

#### **EDFU 3017**

Evaluation of Learning 3

#### **EDPE 3129**

The Use of Microcomputers in the Classroom 3

#### **EDES 4006**

Seminar on the Nature and Needs of Exceptional Children 3

#### **EDPE 4138**

Student Teaching of Physics in Secondary School 6

### **Major Area Courses in CAP Letters.**

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*To be selected from the list of courses in recommended electives.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## **CURRICULAR SEQUENCE IN ASTRONOMY AND ASTROPHYSICS**

### **Main Objective**

After successful completion of the program, students will be prepared for a variety of future studies and work experiences. One aim is to prepare students to pursue a graduate degree in astronomy and astrophysics. The courses in the curriculum will provide a solid knowledge base and help in deciding which specific field to enter. With the additional curricular sequence in Astronomy and Astrophysics, the student can work as science writer/editor, public outreach official, astrophotographer, or planetarium/observatory assistant.

### **Admissions Requirements**

- An overall GPA of 2.50 or higher
- Having approved FISI 3161 and FISI 3162 (or equivalent) with a minimum grade of C.
- Having approved MATE 3031 and MATE 3032 (or equivalent) with a minimum grade of C.
- This curricular sequence is mainly considered for students who are enrolled in a STEM undergraduate program as a primary program, although students from other programs who satisfy the requirements may be considered.

### **Summary of Credits in Sequence**

Astronomy requirements 12  
Recommended elective 3

**Total 15**

### **\*Astronomy Requirements**

| Number    | Credits | Course            |
|-----------|---------|-------------------|
| ASTR 4005 | 3       | Astronomy I       |
| ASTR 4006 | 3       | Astronomy II      |
| ASTR 4015 | 3       | Radio Astronomy   |
| ASTR 4017 | 3       | Stellar Evolution |

### **\*Recommended electives**

|           |   |                                     |
|-----------|---|-------------------------------------|
| ASTR 4025 | 3 | Radio Pulsars                       |
| ASTR 4999 | 3 | Undergraduate Research              |
| ASTR 5005 | 3 | Formation and Evolution of Galaxies |
| ASTR 5007 | 3 | Planetary Astronomy                 |
| FISI 4997 | 3 | Special Problems in Physics         |

The pre-requisite courses to the core and optional courses along with their pre-requisites (not including Introductory Physics courses) are:

|           |                           |
|-----------|---------------------------|
| FISI 4020 | Physics of Waves          |
| FISI 4105 | Modern Physics            |
| FISI 4071 | Electricity and Magnetism |

\* Courses required for the Curricular Sequence must be approved with a grade of C or better.

## **CURRICULAR SEQUENCE IN ATMOSPHERIC SCIENCES AND METEOROLOGY**

### **Main Objective**

Provide formal training in Meteorology and Atmospheric Sciences that would allow students to pursue a career in meteorology and related fields. The curriculum covers all of the fundamental topics required for graduate studies or a career as an operational meteorologist.

### **Admissions Requirements**

- An overall GPA of 2.50 or higher.
- A GPA in both Math and Physics courses of 2.50 or higher.
- Having approved a Physics I and II sequence such as: Fisi3151/3152 or Fisi3161/3162 or Fisi3171/3172.



- Having approved Calculus II (MATE 3032) or its equivalent
- Being registered in a Science, Math or Engineering bachelor program at UPRM or having already obtained such a degree.

#### Summary of Credits in Sequence

|                             |          |
|-----------------------------|----------|
| Meteorology Requirements    | 16       |
| Remote Sensing Requirements | 3        |
| Recommended Electives       | <u>6</u> |

**Total** **25**

#### \*Meteorology Requirements

| Number    | Credits | Course                      |
|-----------|---------|-----------------------------|
| METE 4006 | 3       | Introductory Meteorology    |
| METE 4007 | 1       | Meteorological Measurements |
| METE 4008 | 3       | Physical Meteorology        |
| METE 4057 | 3       | Atmospheric Thermodynamics  |
| METE 4061 | 3       | Dynamic Meteorology I       |
| METE 4075 | 3       | Synoptic Meteorology        |

#### Remote Sensing Requirements

|            |   |                        |
|------------|---|------------------------|
| +GEOL 3105 | 3 | Images of Planet Earth |
|------------|---|------------------------|

#### Recommended Electives

|           |   |  |
|-----------|---|--|
| METE 4085 | 3 | Mesoscale Meteorology                          |
| METE 5065 | 3 | Advanced Dynamic Meteorology                   |
| CMOF 5015 | 3 | Physical Oceanography for Atmospheric Sciences |
| METE 4085 | 3 | Mesoscale Meteorology                          |
| METE 5065 | 3 | Advanced Dynamic Meteorology                   |
| GEOL 4048 | 3 | Geological Applications of Remote Sensing      |
| QUIM 3085 | 3 | Environmental Chemistry                        |

\* Required Meteorology courses must be approved with a grade of C or better.  
 + Can be substituted with equivalent Remote Sensing Courses with permission of Physics Department.

## CURRICULAR SEQUENCE IN PHYSICS

### Main Objective

Provide a structured alternative for students of other specializations who wish to deepen their knowledge of Physics, whether to strengthen their professional preparation or for personal interest.

### Admissions Requirements

- An overall GPA of 2.50 or higher
- Having approved FISI 3171-3173 and FISI 3172-3174 (or equivalent) with 2.50 or higher
- Having an average greater than or equal to 2.50 in the Physics courses approved at the time of making the request.

### Summary of Credits in Sequence

|                               |          |
|-------------------------------|----------|
| Specific Physics requirements | 6        |
| Recommended electives         | <u>6</u> |

**Total** **12**

### \*Specific Physics requirements:

| Number    | Credits | Course           |
|-----------|---------|------------------|
| FISI 4020 | 3       | Physics of Waves |
| FISI 4105 | 3       | Modern Physics   |

### \*Recommended electives

Approve two of the following intermediate or advanced Physics courses:

|           |   |   |
|-----------|---|---|
| FISI 4017 | 3 | Optics                                    |
| FISI 4051 | 3 | Intermediate Mechanics                    |
| FISI 4052 | 3 | Dynamics                                  |
| FISI 4057 | 3 | Thermodynamics                            |
| FISI 4063 | 3 | Quantum Mechanics I                       |
| FISI 4064 | 3 | Quantum Mechanics II                      |
| FISI 4071 | 3 | Electricity and Magnetism                 |
| FISI 4078 | 3 | Introduction to Classical Electrodynamics |
| FISI 4117 | 3 | Introduction to Relativity                |
| FISI 4135 | 3 | Applied Optics                            |
| FISI 5037 | 3 | Introduction to Solid State Physics       |
| FISI 5047 | 3 | Laser Physics                             |
| FISI 5045 | 3 | Fluid Physics                             |

## DEPARTMENTAL FACULTY

**LUIS F. BEJARANO-AVENDAÑO**, *Associate Professor*, Ph.D., 2006, Florida State University.

**FÉLIX E. FERNÁNDEZ**, *Professor*, Ph.D., 1987, University of Arizona.

**HÉCTOR JIMÉNEZ-GONZÁLEZ**, *Professor*, Ph.D., 1992, Massachusetts Institute of Technology.

**YONG-JIHN KIM**, *Professor*, Ph.D., 1989, Seoul National University.

**MARK JURY**, *Professor*, Ph.D., University of Cape Town, Meteorology.

**JOSÉ R. LÓPEZ**, *Professor*, Ph.D., 1983, Michigan State University.

**SERGIY LYSENKO**, *Professor*, Ph.D., 2001, Institute of Semiconductor Physics, NAS, Kiev, Ukraine.

**JUNQIANG LU**, *Associate Professor*, Ph.D., 2003, Tsinghua University, Beijing, China.

**SUDHIR MALIK**, *Associate Professor*, Ph.D., 1997, University of Delhi, India.

**PABLO J. MARRERO-SOTO**, *Professor*, Ph.D., 2001, University of Massachusetts at Amherst.

**HÉCTOR MÉNDEZ**, *Professor*, Ph.D., 1990, CINVESTAV (Centro de Investigación y de Estudios Avanzados), Mexico City, Mexico.

**LESZEK NOWAKOWSKI**, *Professor*, Ph.D., 1983, N. Copernicus University-Torun, Poland.

**MOISÉS ORENGO-AVILÉS**, *Professor*, Ph.D., 1996, Brown University.

**CARLOS U. PABÓN**, *Professor*, Ph.D., 1994, City College of New York.

**RAÚL PORTUONDO**, *Professor*, Ph.D., University of La Habana, Pedagogy.

**HENRI A. RADOVAN**, *Professor*, Ph.D., 1998, University of Ulm, Germany.

**JUAN E. RAMÍREZ**, *Professor*, Ph.D., 2002, University of Colorado at Boulder.

**RAFAEL A. RAMOS**, *Professor*, Ph.D., 1994, Boston University.

**ERICK ROURA-DÁVILA**, *Professor*, Ph.D., 2001, University of Massachusetts at Amherst.

**ARMANDO RÚA**, *Assistant Professor*, Ph.D., 2014, City University of New York.

**SAMUEL SANTANA-COLÓN**, *Associate Professor*, Ph.D., 2008, Indiana University.

## COURSES OF INSTRUCTION

### DEPARTMENT OF PHYSICS

#### Undergraduate Courses

**FISI 3000. ORIENTATION FOR PHYSICS MAJORS.** Non-credit. One hour seminar per week. Prerequisite: student in the Physics Department.

Academic and professional orientation for students entering the Department of Physics.

**FISI 3028. ELECTROMAGNETISM FOR TEACHERS.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisite: FISI 3027.

Introduction to electromagnetism for high school teachers, including teaching methodologies and techniques. Topics include Coulomb's Law, electric fields, electric potential, circuits, magnetic force, Biot-Savart's law, magnetic induction, and electromagnetic waves.

**FISI 3029. MODERN PHYSICS FOR TEACHERS.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisite: FISI 3028.

Introduction to modern physics for high schools teachers, including methodologies and techniques. Topics include special relativity, the photoelectric effect, blackbody radiation, the Compton effect, atomic spectra, Bohr's atom, quantum mechanics, and nuclear physics.

**FISI 3091. ELEMENTS OF PHYSICS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3172 or MATE 3174 or MATE 3005 or MATE 3143.

Basic concepts of mechanics, thermodynamics, optics, and electromagnetism oriented specially towards agriculture.

**FISI 3092. ELEMENTS OF PHYSICS LABORATORY.** One credit hour. One two-hour laboratory per week. Corequisite: FISI 3091.

Laboratory exercises and demonstrations applying the principles studied in FISI 3091.

**FISI 3151. MODERN COLLEGE PHYSICS I.** Three credit hours. Three hours of lecture per week. Corequisite: MATE 3021 or MATE 3031 or MATE 3144 or MATE 3183.

Mechanics, heat, sound, electricity, magnetism, and optics, differential and integral calculus will be used as much as possible.

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**FISI 3152.** MODERN COLLEGE PHYSICS II. Three credit hours. Three hours of lecture per week. Prerequisites: FISI 3151.

Mechanics, heat, sound, electricity, magnetism, and optics. Differential and integral calculus will be used as much as possible.

**FISI 3153.** MODERN COLLEGE PHYSICS LABORATORY. One credit hour per semester. One two-hour laboratory per week each semester. Corequisite: FISI 3151.

This course is to supplement FISI 3151-3152.

**FISI 3154.** MODERN COLLEGE PHYSICS LABORATORY. One credit hour per semester. One two-hour laboratory per week each semester. Corequisite: FISI 3152. Prerequisite: FISI 3153.

This course is to supplement FISI 3151-3152.

**FISI 3161.** GENERAL PHYSICS I. Four credit hours. Four hours of lecture per week. Prerequisite: MATE 3031 or MATE 3183.

Principles of mechanics, acoustics, and thermodynamics, with application to classical and modern physics.

**FISI 3162.** GENERAL PHYSICS II. Four credit hours. Four hours of lecture per week. Prerequisite: FISI 3161 or FISI 3171.

Principles of electricity, magnetism, and optics, with application to classical and modern physics.

**FISI 3163.** LABORATORY OF GENERAL PHYSICS I. One credit hour. One two-hour laboratory per week. Corequisite: FISI 3161 or FISI 3171.

Experiments in mechanics, waves, and thermodynamics to complement FISI 3161.

**FISI 3164.** LABORATORY OF GENERAL PHYSICS II. One credit hour. One two-hour laboratory per week. Prerequisite: FISI 3163 or FISI 3173. Corequisite: FISI 3162 or FISI 3172.

Experiments in electricity, magnetism, and optics to complement FISI 3162.

**FISI 3171.** PHYSICS I. Four credit hours. Four hours of lecture per week. Prerequisite: MATE 3031 or MATE 3183 or MATE 3144.

Principles of mechanics, waves, and thermodynamics for engineering and physical sciences.

**FISI 3172.** PHYSICS II. Four credit hours. Four hours of lecture per week. Prerequisite: FISI 3171 or FISI 3161.

Principles of electricity, magnetism, optics, and modern physics for engineering and the physical sciences.

**FISI 3173.** PHYSICS LABORATORY I. One credit hour. A two-hour laboratory per week. Corequisite: FISI 3171 or FISI 3161.

Experiments in mechanics, waves, and optics to complement the PHYSICS I course.

**FISI 3174.** PHYSICS LABORATORY II. One credit hour. A two-hour laboratory per week. Prerequisite: FISI 3173 or FISI 3163. Corequisite: FISI 3172 or FISI 3162.

Experiments in electricity, magnetism, and modern physics to complement the PHYSICS II course.

**FISI 4001.** SEMINAR I. One credit hour. Two hours of seminar per week. Prerequisite: authorization of the Director of the Department. Corequisite: FISI 4046.

Discussion and reports of special topics in physics.

**FISI 4002.** SEMINAR II. One credit hour. Two hours of seminar per week. Prerequisite: FISI 4001.

Discussion and reports of special topics in physics.

**FISI 4007.** PHOTOGRAPHY. Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: authorization of the Director of the Department.

Study of lens systems, basic photochemistry, composition, light and color balance; laboratory practices and techniques of the darkroom; appropriate use of natural and artificial light.

**FISI 4017.** OPTICS. Three credit hours. Three hours of lecture per week. Prerequisite: FISI 3162 or FISI 3172.

Survey of main themes of classical optics, emphasizing the representation of light as a wave, but including geometrical optics and its applications to simple optical instruments. Interference and diffraction phenomena, from the viewpoint of light as a scalar wave will be discussed. Light will be described as an electromagnetic wave and interaction of light with matter, including phenomena of reflection, refraction, absorption, scattering, polarization, and birefringence will also be considered.

**FISI 4020.** PHYSICS OF WAVES. Three credit hours. Three hours of lecture per week. Prerequisites: FISI 3162 or FISI 3172. Co-requisite: MATE 4009.

Study of the physics of wave phenomena including their underlying principles, mathematical analysis, and their applications. Discussion of topics in harmonic oscillations, waves in multiple dimensions, Fourier analysis, polarization, interference, and diffraction.

**FISI 4049. ELECTRONICS.** Three credit hours. Two lectures and one three-hour laboratory per week. Prerequisites: (FISI 3164 or FISI 3174 or FISI 3154) and (FISI 3162 or FISI 3172 or FISI 3152).

Discussion of AC circuits theory, vacuum tubes, transistors, power supplies, amplifiers, oscillations, servo systems, operational amplifiers, electronic switching and other electronic circuits. Laboratory exercises are designed so that students develop a practical knowledge of electronic circuits.

**FISI 4051. INTERMEDIATE MECHANICS.** Three credit hours. Three hours of lecture per week. Prerequisite: (FISI 3162 or FISI 3172) and (MATE 3063 or MATE 3185).

A study of kinematics, dynamics, gravitation, and motion of rigid bodies; elasticity, hydrostatics and hydrodynamics; vibration and wave motion.

**FISI 4052. DYNAMICS.** Three credit hours. Three hours of lecture per week. Prerequisite: FISI 4051.

Dynamics of particles and rigid bodies. Lagrange and Hamilton's equations of motion and related matters.

**FISI 4057. THERMAL PHYSICS.** Three credit hours. Three hours of lecture per week. Prerequisite: (FISI 3162 or FISI 3172 or FISI 3012) and (MATE 3063 or MATE 3185).

A study of the three laws of thermodynamics, equations of state, phase transitions, and thermodynamics potentials, with an introduction of classical and quantum statistics and applications of the distribution functions of Boltzman, Bose-Einstein, and Fermi-Dirac.

**FISI 4063. QUANTUM MECHANICS I.** Three credit hours. Three hours of lecture per week. Prerequisites: (FISI 4052 and MATE 4009) or authorization of the Director of the Department.

The course is an introduction to quantum mechanics. The Schrödinger equation, its interpretation, and its applications to one and three dimensional problems will be studied, including the harmonic oscillator, the hydrogen atom, angular momentum, and spin. The matrix operator formalism will be presented and applied to quantum mechanics.

**FISI 4064. QUANTUM MECHANICS II.** Three credit hours. Three hours of lecture per week. Prerequisite: FISI 4063.

Study of the general theory of angular momentum, identical particles, and an introduction to quantum statistical mechanics, as well as time-independent perturbation theory, approximation methods, time-dependent perturbation theory, and scattering.

**FISI 4071. ELECTRICITY AND MAGNETISM.** Three credit hours. Three hours of lecture per week. Prerequisite: (MATE 3063 or MATE 3185) and (FISI 3162 or FISI 3172).

Electrostatics and magnetostatics in vacuum and matter. Determination of electric fields for charge distributions and stationary currents, and special techniques for the calculation of electric potential. Solutions to Laplace and Poisson equations, study of magnetic vector potential and Maxwell's equations.

**FISI 4076. INTERMEDIATE LABORATORY I.** Two credit hours. Two three-hour laboratories per week. Prerequisite: FISI 3164 or FISI 3174 or FISI 4049.

Includes intermediate laboratory experiments in mechanics, electricity, magnetism, and modern physics, stressing the importance of precision measurements and appropriate experimental techniques.

**FISI 4077. INTERMEDIATE LABORATORY II.** Two credit hours. One six-hour laboratory per week. Prerequisite: FISI 4076.

Includes intermediate laboratory experiments in wave phenomena, solid state, atomic, nuclear, and molecular physics. The student will acquire general research laboratory techniques in spectroscopy, electric and magnetic measurements, vacuum systems, and low temperatures.

**FISI 4078. INTRODUCTION TO CLASSICAL ELECTRODYNAMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 4009 and FISI 4071.

Introduction to concepts and techniques of classical electrodynamics based on Maxwell's equations. Electromagnetic wave propagation in continuous media and wave guides, radiation emission by accelerated charges and antennas, and the fundamentals of relativistic electrodynamics will be discussed.

**FISI 4105. MODERN PHYSICS.** Three credit hours. Three hours of lecture per week. Prerequisite: FISI 3162 or FISI 3172.

A study of topics of twentieth century physics, including Relativity theory, Radiation theory, atomic structure of hydrogen like atoms, introduction to Schrodinger's equation, radioactive and selected topics in nuclear and solid state physics.

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**FISI 4106. CONCEPTS AND LAWS IN MECHANICS.** Four credit hours. Three hours of lecture and three hours of laboratory per week. Prerequisites: MATE 3032 and ((FISI 3152 and FISI 3154) or (FISI 3172 and FISI 3174)).

Theoretical and practical study of the phenomena, laws and principles of classical mechanics, including applications to daily life occurrences. The course is designed to prepare students to become high school teachers.

**FISI 4107. CONCEPTS AND LAWS OF HEAT AND WAVES.** Four credit hours. Three hours of lecture and three hours of laboratory per week. Prerequisites: MATE 3032 and ((FISI 3152 and FISI 3154) or (FISI 3172 and FISI 3174)).

Theoretical and practical study of the phenomena and laws of heat, oscillations and waves, as well as the use of the laws of thermodynamics in the analysis of problems. The course is designed to prepare students to become physics teachers in secondary education.

**FISI 4117. INTRODUCTION TO RELATIVITY.** Three credit hours. Three hours of lecture per week. Prerequisites: FISI 3152 or FISI 3162 or FISI 3172 or authorization of the Director of the Department.

Introduction to the theories of relativity. Development of the Special Theory of Relativity and its implications for Newtonian mechanics and electromagnetism. Study of the main concepts and results of General Relativity Theory and their applications to topics of interest.

**FISI 4125. COMPUTERS IN PHYSICS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INGE 3016 or MATE 3010 or COMP 3010.

Introduction to computer techniques and their applications in physics.

**FISI 4126. CONCEPTS AND LAWS OF ELECTRICITY AND MAGNETISM.** Four credit hours. Three hours of lecture and three hours of laboratory per week. Prerequisites: MATE 3032 and ((FISI 3152 and FISI 3154) or (FISI 3172 and FISI 3174)).

Theoretical and practical study of phenomena and laws to electricity, magnetism, electromagnetic radiation and basic circuits, as well as the use of relevant measurement instruments. The course is designed to prepare students to become physics teachers in secondary education.

**FISI 4127. TEACHING METHODOLOGIES OF PHYSICS.** Three credit hours. Three hours of lecture per week. Prerequisites: FISI 4106 and FISI 4107. Corequisite: FISI 4126.

Study of the most effective strategies for teaching theoretical and experimental Physics at the pre-college level, as well as of problem-solving techniques. Classification and discussion of the most common misconceptions in the comprehension and interpretation of principles and laws of Physics. The course is designed to prepare students to become high school Physics teachers.

**FISI 4135. APPLIED OPTICS.** Four credit hours. Three hours of lecture and one two-hour laboratory per week. Prerequisite: FISI 4017.

Current topics in applied optics including: radiometry and photometry, light detectors, optical fibers and wave guides, Fourier optics and optical image processing, holography, electro-optics, and integrated optics.

**FISI 4797. COSMIC EVOLUTION.** Three credit hours. Three hours of lecture per week. Prerequisites: FISI 3172 or FISI 3162 or FISI 3152.

Discussion of the laws and concepts of physics (both classical and modern) required to interpret and explain the major evolutionary stages of the cosmos, from the “Big Bang” up to the emergence of intelligent life. Presentation of the logical sequence of evolutionary development, from the primordial soup of radiations and quarks up to the complex chemistry in a planet with conscious and technological life.

**FISI 4871. INTRODUCTION TO ELEMENTARY PARTICLE PHYSICS.** Three credit hours. Three hours of lecture per week. Prerequisite: FISI 4105- Modern Physics. Corequisite: FISI 4063- Quantum Mechanics I.

Study of the physics of elementary particles, their classification and interactions. Discussion of Feynman diagrams and the characteristics of the quarks model, qualitative and quantitative aspects of the Quantum Electrodynamics, Quantum Chromodynamics and Weak Interactions theories. Analysis of fundamental questions such as: what is matter, why do particles have mass, which are the known particles and why do they exist and where is anti-matter found.

**FISI 4996. COOP PRACTICE.** Three to six credit hours. Prerequisite: authorization of the Director of the Department.

Practical experience in physics in cooperation with private industry or government to be jointly supervised by the academic department, the COOP Program Coordinator, and an official from the cooperating organization.

**FISI 4997. SPECIAL PROBLEMS PHYSICS.** One to nine credit hours. One to nine hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Short research problems, assigned or selected, subject to approval by the instructor. A written report is required.

**FISI 4999. UNDERGRADUATE RESEARCH.** One to three credit hours. Prerequisite: authorization of the Director of the Department.

A research project in either basic or applied physics to be supervised by a member of the Department.

### Advanced Undergraduate and Graduate Courses

**FISI 5025. INTRODUCTION TO SOLID STATE PHYSICS.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisites: FISI 5037 or authorization of the Director of the Department.

An introduction to X-ray diffraction, crystal structures, elastic constant of crystals, lattice energy and vibrations; thermal properties of solids, dielectric properties, ferroelectric crystals; diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism; free electron model of metals, superconductivity, excitons, photoconductivity and luminescence.

**FISI 5037. INTRODUCTION TO SOLID STATE PHYSICS.** Three credit hours per semester. Three hours of lecture per week each semester.

An introduction to X-ray diffraction, crystal structures, elastic constant of crystals, lattice energy and vibrations; thermal properties of solids, dielectric properties, ferroelectric crystals; diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism; free electron model of metals, superconductivity, excitons, photoconductivity and luminescence.

**FISI 5045. PHYSICS OF FLUIDS.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 4009, FISI 3152 and authorization of the Director of the Department.

Hydrostatics, mathematical models of fluid dynamics, dimensional analysis and similitude, boundary layer flow in pipes and ducts, incompressible potential flow.

**FISI 5047. LASER PHYSICS.** Three credit hours. Three hours of lecture per week. Prerequisites: (FISI 4105 and FISI 4068) or authorization of the Director of the Department.

Semi-classical theory of laser operation. Analysis of laser light characteristics, interaction of radiation with matter, optical resonators, pumping schemes, common laser systems, and non-linear optics.

### ASTRONOMY

**ASTR 3005. DESCRIPTIVE ASTRONOMY.** Three credit hours. Three hours of lecture per week. Open only to non-science or non-engineering majors.

A descriptive treatment of the structure of the universe beginning with naked-eye astronomical observations and progressing to telescopic observations and simple interpretations. Topics to be covered include the solar system, stars, stellar systems and galaxies. Occasional observation periods at night or early morning, as determined by the professor.

**ASTR 4005. ASTRONOMY I.** Three credit hours. Three hours of lecture per week. Prerequisite: FISI 3151 or FISI 3011 or FISI 3161 or FISI 3171.

A descriptive course covering facts and theories pertaining to the solar system and the sidereal universe.

**ASTR 4006. ASTRONOMY II.** Three credit hours. Three hours of lecture per week. Prerequisites: ASTR 4005 and (FISI 3152 or FISI 3162 or FISI 3172).

A continuation of ASTR 4005, including an introduction to celestial mechanics and astrophysics.

**ASTR 4015. RADIO ASTRONOMY.** Three credit hours. Three hours of lecture per week. Prerequisites: ASTR 4006 and FISI 4020.

Study of the fundamentals of Radio Astronomy, including the spectral and intensity properties of thermal and non-thermal sources, both galactic and extra-galactic. Discussion of galactic sources of radio waves such as supernova remnants and the 21-cm radiation of neutral hydrogen. Analysis of radio pulsars, their use to probe the interstellar medium and their role in gravitational wave detection. Discussion of the basic elements of radio wave reception in single and multiple antenna systems, including the study of radio antenna receivers. Application of basic aspects of processing and analysis of astronomical data.

**ASTR 4017. STELLAR EVOLUTION.** Three credit hours. Three hours of lecture per week. Prerequisites: ASTR 4006 and FISI 4105.

Discussion of stellar evolution using concepts of thermal physics, nuclear physics, and quantum mechanics. Study of the general properties of stars, matter and radiation

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under extreme conditions. Analysis of heat transfer processes, thermonuclear fusion and stellar structure.

**ASTR 4025. RADIO PULSARS.** Three credit hours. Three hours of lecture per week. Prerequisites: ASTR 4006 and FISI 4068.

Discussion of the fundamentals of individual and binary radio pulsars, including normal and millisecond classes using basic observational properties, possible radiation mechanisms involved in generating core and conal radiation, and their total power and polarization. Review of pulsar research and the use of stellar objects as accurate clocks in the study of gravitational waves and as probes of the interstellar medium.

**ASTR 4999. UNDERGRADUATE RESEARCH.** One to three credit hours. One to three hours of research per week. Prerequisite: authorization of the Director of the Department.

Research project in astronomy or astrophysics to be supervised by a faculty member.

**ASTR 5005. FORMATION AND EVOLUTION OF GALAXIES.** Three credit hours. Three hours of lecture per week.

Formation, types, structures, evolution, and interactions of galaxies.

**ASTR 5007. PLANETARY ASTRONOMY.** Three credit hours of lecture per week. Prerequisite: ASTR 4005 or authorization of the Director of the Department.

The study of the properties, physical formation, and evolution of the planets and solar system.

## METEOROLOGY

**METE 3006. EXTREME METEOROLOGICAL PHENOMENA.** Three credit hours. Three hours of lecture per week.

Discussion of the most extreme manifestations of weather and climate by analyzing the development and impact of extreme weather events. Analysis of the atmospheric processes that control the weather, and how these processes interact within the context of severe weather events (i.e., hurricanes, ice storms, floods, tornadoes, etc.).

**METE 4006. INTRODUCTORY METEOROLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: FISI 3151 or FISI 3161 or FISI 3171 or FISI 3012.

Elemental study of general meteorology. Principles of thermodynamics, entropy, radiation, state changes and critical temperature.

**METE 4007. METEOROLOGICAL MEASUREMENTS.** One credit hour. One three-hour laboratory per week. Prerequisite: METE 4006.

Laboratory exercises in measurement of meteorological variables. Meteorological instruments.

**METE 4008. PHYSICAL METEOROLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: METE 4006 and MATE 3063.

Radiation, radiation measurements, meteorological optics, atmospheric electricity, and dynamics of the atmosphere.

**METE 4057. ATMOSPHERIC THERMODYNAMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: (FISI 3162 or FISI 3172) and MATE 3063.

Discussion of the laws of classical thermodynamics applied to meteorological problems. Topics include relevant state variables, atmospheric composition, equations of state, conservation principles, enthalpy, entropy, thermodynamic diagrams, water phases in the atmosphere, atmospheric stability, and evolution of hydrometeors. Application of these concepts to the study of meteorological phenomena in the tropics and mid-latitudes and to global climatology.

**METE 4061. DYNAMIC METEOROLOGY I.** Three credit hours. Three hours of lecture per week. Prerequisites: (FISI 3162 or FISI 3172) and METE 4006 and MATE 3063.

Discussion of the equations of momentum, continuity, energy conservation, and vorticity applied to the description of fundamental aspects of the meteorology and atmospheric dynamics of middle latitudes and the tropics.

**METE 4075. SYNOPTIC METEOROLOGY.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisites: METE 4008 and METE 4057 and METE 4061.

Study of large-scale weather phenomena, analysis and forecasting techniques for mid-latitude and tropical weather. Examination of mid-latitude synoptic events. Analysis of weather maps and data acquired from conventional and remotely sensed sources.

**METE 4085. MESOSCALE METEOROLOGY** Three credit hours. Three hours of lecture per week. Prerequisite: (METE 4061 and MATE 4009) or authorization of the Director of the Department.

Identification and discussion of the physics of mesoscale atmospheric processes and their computational representation for predictive models. Analysis of the fundamental equations for atmospheric motion, selection of appropriate physical scales, and examination of parameterizations of sub-scale phenomena, such as radiative interactions, convection, and moisture-induced process. Identification of the types of numerical models, their advantages and disadvantages, and the influence of boundary and initial conditions. Evaluation of atmospheric simulations, and possible applications for mesoscale modeling.

**METE 5065. ADVANCED DYNAMIC METEOROLOGY.** Three credit hours. Three hours of lecture. Prerequisites: (METE 4061 and MATE 4009) or authorization of the Director of the Department.

Discussion of the quasi-geostrophic approximation, linear perturbation theory, and baroclinic instability to describe atmospheric motion in middle latitudes. Mesoscale phenomena and the general circulation of the atmosphere, variability over tropical latitudes, and principles of numerical modeling for atmospheric motion will be studied.

## **PHYSICAL SCIENCE**

**CIFI 3011. PHYSICAL SCIENCE.** Three credit hours per semester. Three hours of lecture per week per semester. Corequisite: MATE 3171 or MATE 3173 or MATE 3086 or authorization of the Director of the Department.

To introduce the students to the major concepts which science has formed of the natural world and to provide a balanced and coherent presentation of the more important theories of physical science; to give students an acquaintance with scientific methods, and to show the relationship of science to other fields of knowledge. The major areas cover the solar system, matter, energy, the structure of matter, elementary concepts of geology, and elements of weather. The lectures are supplemented with demonstrations, slides, films, filmstrips, and field trips.

**CIFI 3012. PHYSICAL SCIENCE.** Three credit hours per semester. Three hours of lecture per week per semester. Prerequisite: CIFI 3011.

To introduce the students to the major concepts which science has formed of the natural world and to provide a balanced and coherent presentation of the more important theories of physical science; to give students an acquaintance with scientific methods, and to show the relationship of science to other fields of knowledge. The major areas cover the solar system, matter, energy, the structure of matter, elementary concepts of geology, and elements of weather. The lectures are supplemented with demonstrations, slides, films, filmstrips, and field trips.



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## DEPARTMENT OF PSYCHOLOGY

Psychology courses at The Mayaguez Campus of the University of Puerto Rico have been a part of the academic offerings since the late nineteen thirties. However, the Bachelor of Arts degree in Psychology was not officially established until 1974. The Department of Psychology was established in 2015. Psychology is the study of behavior and the mental processes within personal, social and cultural contexts. A Bachelor of Arts degree in Psychology prepares students to understand theories, concepts, research techniques and problems relevant to the different fields of inquiry that encompass this program. Specialized courses are offered in social psychology, physiological psychology, experimental psychology, and research methods. Electives in diverse areas of psychology are offered to foster knowledge and strengthen competencies and skills in the discipline. A minimum of 133 credits is required to complete a Bachelor of Arts degree in Psychology. The Department of Psychology has established an articulated transfer agreement with the Aguadilla Campus of the University of Puerto Rico.

### Vision

To be a leading program recognized in Puerto Rico and in the Americas for its social commitment and excellence in training individuals with an understanding of justice, ethics and fairness in research and the creation of solutions to psychosocial problems faced by society from inter and transdisciplinary perspectives.

### Mission and Objectives of the Department

The mission of the Department of Psychology is to:

Prepare students

- Knowledgeable in the discipline and involved in creative work as well as research activity related to behavior and mental processes from a biopsychosocial, inter and transdisciplinary perspective.
- Who will contribute to identify, implement, and evaluate solutions to psychosocial problems in current Puerto Rican society.
- Who can respond to diversity in a culturally aware, sensitive, and respectful manner.

Promote

- Critical thinking.
- The development of skills and competences in the practice of their discipline.
- Lifelong learning.

Prepare professionals

- To behave according to ethical-professional and legal principles.
- Capable of integrating theory and practice in the field of psychology from a biopsychosocial and inter and transdisciplinary perspective.
- Who will contribute to the development and implementation of public policies based on scientific knowledge.

### Student Learning Outcomes

Graduates from the Department of Psychology will be able to demonstrate:

- a. Knowledge of the discipline of Psychology
- b. Skills in scientific research
- c. Critical thinking skills
- d. Skills in the use of technology and handling of scientific information
- e. Oral and written communication skills
- f. Professional skills
- g. Ethical and responsible behavior in a diverse world

Psychology graduates are prepared to work in public and private centers of psychological services, in public service departments like Health, Social Services and Housing. Graduates are also prepared to pursue graduate studies in psychology, law, education, public health, public relations, and public administration among others.

### Summary of Credits in Program

|                           |                   |
|---------------------------|-------------------|
| Faculty requirements      | 56 or 58          |
| Departmental requirements |                   |
| Major area                | 35                |
| Non-major area            | 18                |
| Recommended electives     | 12                |
| Free electives            | <u>12</u>         |
| <b>Total</b>              | <b>133 or 135</b> |

## PROGRAM OF STUDY

### PSYCHOLOGY CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits  | Course                       |
|------------|----------|------------------------------|
| *INGL 3--- | 3        | First year course in English |
| *ESPA 3101 | 3        | Basic course in Spanish I    |
| HUMA 3111  | 3        | Intro. to Western Culture I  |
| PSIC 3001  | 3        | Principles of Psychology I   |
| *MATE 3171 | 3        | Pre-Calculus I               |
| EDFI ----  | 1        | Course in Physical Education |
| PSIC 3050  | <u>1</u> | Psychology as a Profession   |
|            | 17       |                              |

##### Second Semester

| Number     | Credits  | Course                       |
|------------|----------|------------------------------|
| *INGL 3--- | 3        | First year course in English |
| *ESPA 3102 | 3        | Basic course in Spanish II   |
| HUMA 3112  | 3        | Intro. to Western Culture II |
| PSIC 3002  | 3        | Principles of Psychology II  |
| ESMA 3101  | 3        | Applied Statistics I         |
| EDFI ----  | <u>1</u> | Course in Physical Education |
|            | 16       |                              |

#### SECOND YEAR

##### First Semester

| Number       | Credits  | Course   |
|--------------|----------|--|
| INGL 3---    |          |  |
| or INGL 4--- | 3        | Second year course in English                            |
| ESPA 3---    |          |  |
| or ESPA 4--- | 3        | Second year course in Spanish                            |
| PSIC 3006    | 3        | Social Psychology  |
| CISO 3145    | 3        | Bibliography and Library Research in the Social Sciences |
| ESMA 3102    | 3        | Applied Statistics II                                    |
| CIBI 3031    | <u>3</u> | Intro. to the Biological Sciences I                      |
|              | 18       |  |

##### Second Semester

| Number       | Credits  | Course                               |
|--------------|----------|--------------------------------------|
| ^INGL 3---   |          |                                      |
| or INGL 4--- | 3        | Second year course in English        |
| ESPA 3---    |          |                                      |
| or ESPA 4--- | 3        | Second year course in Spanish        |
| CIBI 3032    | 3        | Intro. to the Biological Sciences II |
| PSIC ----    | 3        | Elective in Psychology               |
| ELECTIVE     | <u>3</u> | Free Elective                        |
|              | 15       |                                      |

#### THIRD YEAR

##### First Semester

| Number         | Credits  | Course                             |
|----------------|----------|------------------------------------|
| +ELECTIVE      | 3        | In Social Sciences                 |
| CIFI 3011      | 3        | Physical Science                   |
| or             |          |                                    |
| QUIM 3131-3133 | 3 or 4   | General Chemistry I                |
| PSIC 3018      | 3        | Physiological Psychology           |
| PSIC ----      | 3        | Elective in Psychology             |
| PSIC 4006      | <u>4</u> | Experimental Methods in Psychology |
|                | 16 or 17 |                                    |

##### Second Semester

| Number         | Credits  | Course                 |
|----------------|----------|------------------------|
| +ELECTIVE      | 3        | In Social Sciences     |
| CIFI 3012      | 3        | Physical Science       |
| or             |          |                        |
| QUIM 3132-3134 | 3 or 4   | General Chemistry II   |
| PSIC ----      | 3        | Elective in Psychology |
| PSIC ----      | 3        | Elective in Psychology |
| ELECTIVE       | <u>3</u> | Free Elective          |
|                | 15 or 16 |                        |

#### FOURTH YEAR

##### First Semester

| Number    | Credits  | Course                                    |
|-----------|----------|---|
| FILO 3001 | 3        | Intro. to Philosophy: Major Questions     |
| or        |          |   |
| FILO 3002 | 3        | Intro. to Philosophy: Historical Approach |
| HIST 3241 | 3        | History of Puerto Rico                    |
| PSIC 4065 | 3        | Seminar on Psychological Research         |
| ELECTIVE  | 3        | Recommended Elective                      |
| ELECTIVE  | 3        | Recommended Elective                      |
| ELECTIVE  | <u>3</u> | Free Elective                             |
|           | 18       |   |

##### Second Semester

| Number       | Credits  | Course                        |
|--------------|----------|-------------------------------|
| HIST 3242    | 3        | History of Puerto Rico        |
| FILO 3155    | 3        | Elective course in Philosophy |
| or FILO 3156 | 3        |                               |
| or FILO 3157 | 3        |                               |
| or FILO 3168 | 3        |                               |
| or FILO 3169 | 3        |                               |
| or FILO 4147 | 3        |                               |
| PSIC ----    | 3        | Elective in Psychology        |
| ELECTIVE     | 3        | Recommended Elective          |
| ELECTIVE     | 3        | Recommended Elective          |
| ELECTIVE     | <u>3</u> | Free Elective                 |
|              | 18       |                               |

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**Total credits required: 133 or 135**

\*Refer to the Academic Regulations section for information on Advanced Placement.

+Social Sciences students will choose six credits in courses which are not included in their specialized area or any of the following Economy courses: ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

**DEPARTMENTAL FACULTY**

**JANET BONILLA MUJICA**, *Professor*, Ph.D., 1997, University of Puerto Rico, Río Piedras Campus.

**BERNANDETTE M. DELGADO ACOSTA**, *Professor*, Ph.D., 1995, Texas A&M University.

**LIZZIE M. GARCIA PABÓN**, *Associate Professor*, Ph.D., 2006, Pontifical Catholic University of Puerto Rico.

**MILAGRITOS GONZÁLEZ RIVERA**, *Professor*, Ph.D., 1992, Michigan State University.

**LUISA GUILLEMARD GREGORY**, *Professor*, Ph.D., 1999, Texas A & M University.

**EDUARDO A. LUGO HERNÁNDEZ**, *Assistant Professor*, Ph.D., 2003, De Paul University.

**MARY A. MORENO TORRES**, *Professor*, Ph.D., 2003, University of Puerto Rico, Río Piedras.

**ANA NIEVES ROSA**, *Professor*, Ph.D., 2001, University of Puerto Rico, Río Piedras.

**MARIO A. NÚÑEZ MOLINA**, *Professor*, Ed.D., 1987, Harvard University.

**GILBERTO E. RÍOS**, *Associate Professor*, Ed.D., 1990, University of Massachusetts.

**AXEL A. SANTOS FIGUEROA**, *Assistant Professor*, Ph.D., 2005, University of Puerto Rico, Río Piedras.

**DOUGLAS SANTOS SÁNCHEZ**, *Professor*, Ph.D., 1996, University of Puerto Rico, Río Piedras.

**COURSES OF INSTRUCTION****Undergraduate Courses**

**PSIC 3001. PRINCIPLES OF PSYCHOLOGY I.** Three credit hours. Three hours of lecture per week.

Principles of human behavior, including topics such as: biological bases of behavior, sensation, perception, memory, and learning.

**PSIC 3002. PRINCIPLES OF PSYCHOLOGY II.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3001.

Principles of human behavior, including topics such as: personality, stress, psychological disorders, and social behavior.

**PSIC 3006. SOCIAL PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

A conceptual and empirical analysis of the behavior, thought, and emotion of individuals in social contexts, including topics such as: social perception, attitudes, and leadership.

**PSIC 3015. THEORIES OF PERSONALITY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Personality analyzed from various psychological perspectives, including psychoanalytic, behavioristic, humanistic, cognitive, and trait theories.

**PSIC 3016. ABNORMAL PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Principal theories and recent research in abnormal psychology; incidence, causes, formation, development, and manifestations of emotional disorders; therapeutic approaches; diagnostic classification. Field trips required.

**PSIC 3017. INTRODUCTION TO PSYCHOLOGICAL ASSESSMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: PSIC 3002 and (ESMA 3102 or MATE 3102).

Principles and techniques in the construction, selection, administration, and interpretation of major psychological tests, including ethical and social considerations.

**PSIC 3018. PHYSIOLOGICAL PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: PSIC 3002 y (CIBI 3032 o BIOL 3052). Introduction to the neuro-physiological bases of behavior the structure, function, and neurochemistry of human and animal models of sensation, perception, motivation, emotion, learning, reproduction, and psychopathology.

**PSIC 3025. HUMAN DEVELOPMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002- Principles of Psychology II.

Discussion and analysis of theories, processes and issues related to the physical, social, cognitive and psychological development from conception to death. Study of key issues in the development of the individual within different contexts: individual, family, school and community, from a psychological perspective.

**PSIC 3027. CHILDHOOD PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Physical and psychosocial development of the individual from the prenatal period to puberty, with special interest in the child's healthy development.

**PSIC 3028. PSYCHOLOGY OF ADULTHOOD.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Physical and psychosocial development of the individual in adulthood.

**PSIC 3035. APPLIED PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Application of psychological knowledge to the solution of problems, emphasizing the following areas: health psychology, legal psychology, environmental psychology, consumer psychology, and sport psychology.

**PSIC 3036. EDUCATIONAL PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Principles of human learning and thinking as applied to the educational environment. Analysis of educational objectives, student characteristics, teaching methods, and learning assessment.

**PSIC 3039. PSYCHOLOGY OF ADOLESCENCE.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Physical and psychosocial development of the individual from puberty to adulthood.

**PSIC 3040. PERSONAL DEVELOPMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Psychological perspectives that facilitate the awareness of the individual's capacity to cope with day-to-day events and challenges.

**PSIC 3046. HISTORY AND SYSTEMS OF PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

History of psychology emphasizing the development of its various systems.

**PSIC 3047. COUNSELING PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: PSIC 3002.

The function of the helping professional as a facilitator of personal growth, the educational process, and vocational development.

**PSIC 3050. PSYCHOLOGY AS A PROFESSION.** One credit hour. One hour of lecture per week.

Professional development in psychology.

**PSIC 3060. ENVIRONMENTAL PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

The interrelationship between the behavior of the individual and the natural and anthropogenic environment.

**PSIC 3070. INTRODUCTION TO COGNITIVE PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Psychological foundations of information processing by the individual.

**PSIC 3117. FOLK HEALING SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002 or authorization of the Director of the Department.

Analysis of Caribbean folk healing systems in terms of their functions, therapeutic elements and antitherapeutic dimensions.

**PSIC 3185. PSYCHOSOCIAL ASPECTS OF THE HIV/AIDS EPIDEMIC.** Three credit hours. Three hours of lecture per week.

The social and psychological impact of the HIV/AIDS epidemic.

**PSIC 4005. INTRODUCTION TO SCHOOL PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Introduction to the general principles and notions of school psychology that integrate both theoretical and applied aspects. Historical development of school psychology and the roles and functions of professionals in the field. Presentation and discussion of critical perspectives regarding the importance of school psychology in the promotion of learning, in prevention programs focused on situations that affect school systems, in the development of intervention based on scientific data, and in their role as support resources in the school community.

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**PSIC 4006. EXPERIMENTAL METHODS IN PSYCHOLOGY.** Four credit hours. Three hours of lecture and one two-hour laboratory per week. Prerequisite: CISO 4042 or ESMA 3102.

Application of experimental and quasi-experimental methods to the problems of psychology, including the design, implementation, analysis, and presentation of a research project.

**PSIC 4009. INDUSTRIAL/ ORGANIZATIONAL PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Identification and analysis of the individual, group and organizational variables which help to explain and predict human behavior in the work setting.

**PSIC 4010/EDFI 4010. PSYCHOLOGICAL ASPECTS OF SPORTS.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3001.

Psychological factors involved in motor performance and in sports.

**PSIC 4065. SEMINAR ON PSYCHOLOGICAL RESEARCH.** Three credit hours. Three hours of seminar per week. Prerequisite: PSIC 4006.

Planning, design, and implementation of an empirical investigation. An oral presentation and a written report are required.

**PSIC 4070. QUALITATIVE RESEARCH IN PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3006.

Procedures for planning, conducting, and analyzing qualitative research in psychology such as: interviews, observation, case studies, life-stories, and content analysis.

**PSIC 4076. PSYCHOLOGY OF THE INTERNET.** Three credit hours. Three hours of lecture per week. Prerequisites: 12 credits in psychology or authorization of the Director of the Department.

Analysis of the psychological implications of internet use, emphasizing themes such as internet addiction, virtual communities, multiple identities, and disinhibited behavior.

**PSIC 4086. PRACTICUM IN PSYCHOLOGY.** Four credit hours. Two hours of lecture and two two-hour workshops per week. Prerequisite: 15 credits in psychology.

Supervised experiences in service agencies and other community organizations. Field trips required.

**PSIC 4088. SPECIAL TOPICS IN PSYCHOLOGY.** One to three credit hours. One to three hours of lecture per week.

Selected topics in psychology.

**PSIC 4096. ABNORMAL PSYCHOLOGY IN CHILDREN AND ADOLESCENTS.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3016.

Discussion and analysis of the etiologies, evolution, diagnosis and treatment of psychological disorders that are observed in children and adolescents. Emphasis on the study of disorders within the school context and the evaluation of effective psychoeducational interventions.

**PSIC 4116. PSYCHOLOGY OF HUMAN SEXUALITY.** Three credit hours. Three hours of lecture per week. Prerequisite: PSIC 3002.

Human sexuality from a psychosocial perspective.

**PSIC/SOCI/CIPO 4991. INDEPENDENT STUDY I.** One to three credit hours. Two to four hours of research per week per credit. Prerequisites: 12 credit hours in psychology or sociology or political science, respectively, and authorization of the Director of the Department.

Research project under the supervision of a faculty member.

**PSIC/SOCI/CIPO 4992. INDEPENDENT STUDY II.** One to three credit hours. Two to four hours of research per week per credit. Prerequisites: PSIC 4991 or SOCI 4991 or CIPO 4991, respectively, and authorization of the Director of the Department.

Research project under the supervision of a faculty member.

### **Advanced Undergraduate Course**

**PSIC 5016. ANALYTICAL PSYCHOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: 12 credit hours in psychology or authorization of the Director of the Department.

Fundamental concepts of Jungian psychology applied to personality, psychotherapy, and religion.

**PSIC 5017. PSYCHOLOGY OF HUMAN DIVERSITY.** Three credit hours. Three hours of seminar per week. Prerequisite: PSIC 3006 or authorization of the Director of the Department.

Study and discussion of human diversity, including race, ethnicity, social class, gender, religious identity, erotic orientation, and physical, intellectual, and communication disabilities. Analysis of the effects of "being different" from a psycho-social perspective. Evaluation of strategies at the social, family, and educational levels to raise consciousness about prejudice and discrimination, taking into consideration the Puerto Rican reality.

## DEPARTMENT OF SOCIAL SCIENCES

The Department of Social Sciences was established in 1960 as a result of the merging of the School of Sciences and the Division of General Studies into the College of Arts and Sciences. As a unit within the College of Arts and Sciences, the Department of Social Sciences offers a solid academic training leading to a Bachelor of Arts degree in four academic programs: General Social Sciences, History, Political Sciences and Sociology. The Department of Social Sciences promotes a theoretically and methodologically diversified undergraduate curricula with inter- and multi- disciplinary approaches. It fosters the development of skilled leaders and professionals with competencies for critical thinking and proficiency in their particular academic fields, with strong ethical values, responsive and open-minded towards socio-cultural and human diversity and with a strong commitment for the welfare of society at-large. It also offers courses that are part of the General Education curricula and other undergraduate and graduate programs.

The Department of Social Sciences shares the following common objectives:

1. To provide a solid vital academic groundwork for the four academic programs: General Social Sciences, History, Political Sciences and Sociology.
2. To assist in the attainment and exchange of knowledge and of the required skills indispensable for understanding and performing social research.
3. To provide experiential learning to our students through community initiatives.
4. A faculty accountable for the promotion of interdisciplinary and multidisciplinary social research ventures with our students and in collaborative projects with other departments in UPRM and with other institutions of higher learning.
5. To provide effective counseling for our students
6. To promote social science-related discussion topics through symposia, workshops, congresses and other forms of faculty participation.
7. To sponsor community service amongst our students and faculty.
8. Bachelor of Arts graduates from any our five programs will be able to demonstrate:
  - a. Theoretical as well as applied knowledge.
  - b. Effective oral and written communication skills

- c. Proficiency in the use of technology
- d. Critical thinking and scientific thought
- e. Mathematical and statistical reasoning skills
- f. Competence for team work in different settings: interdisciplinary and multidisciplinary
- g. Appreciation and respect towards cultural diversity
- h. Interest and commitment towards our own society and human welfare
- i. Appreciation for the arts and the humanities
- j. Comprehension and application of ethical principles in personal as well as professional settings.
- k. Knowledge and comprehension of the interaction between local and global processes.
- l. Competence in the labor market
- m. A constant interest in learning

The Department of Social Sciences have a collaborative agreement with the Department of Social Sciences at UPR Aguadilla campus to accept transfers to the four programs. Also, have a collaborative agreement with the Department of Social Sciences at UPR-Utuado campus to accept transfers to the Sociology program.

### **Student Learning Outcomes Department Social Science**

The Department of Social Sciences contemplates a continuous and integrated evaluation process aimed at the students' learning of the Social Sciences, History, Political Science and Sociology programs. The appraisal of learning is established in a systematic process of collecting and interpreting quantitative and qualitative information that is adjusted to the fulfillment of the

Mission, Goals and Objectives of the programs.

- Promote effective communication orally and in writing.
- Develop critical thinking.
- Deepen knowledge and the role of the student in their study discipline.
- Develop strategies in the solution of problems in the social, historical and political context.
- Apply mathematical reasoning.
- Apply educational strategies in scientific methodology.
- Apply resources in information technologies.

- Recognize the ethical implications of different actions in their area of study.
- Integrate ethical codes in decision making.
- Show respect for the nature and environment of Puerto Rico
- Know the Puerto Rican heritage and culture.
- Analyze the values of a democratic society.
- Understand contemporary social, political, economic issues in a local and global context.
- Demonstrate respect for human diversity in all its dimensions.
- Work scientific research from a multi / interdisciplinary context.
- Involve in a continuous and multi / interdisciplinary learning.

## BACHELOR OF ARTS IN SOCIAL SCIENCES

A Bachelor of Arts degree in the General Social Sciences opens a wide array of opportunities in different occupational fields like education, justice, recreational, health and others in the state as well as the private sectors and for free-lancing and independent contractors. It also provides a solid groundwork for graduate academic and professional degrees in social work, counseling, law, journalism and administration among other related fields. The Bachelor of Arts in General Social Studies is awarded after completion a minimum of 134 credits, thirty of which must be in the Social Sciences, twelve free electives and fifteen recommended electives. This program sponsors a Curricular Sequence in Human Welfare.

### Summary of Credits in Program

|                           |                   |
|---------------------------|-------------------|
| Faculty requirements      | 56 or 58          |
| Departmental requirements |                   |
| Major area                | 48                |
| Non-major area            | 3                 |
| Recommended electives     | 15                |
| Free electives            | <u>12</u>         |
| <b>Total</b>              | <b>134 or 136</b> |

## PROGRAM OF STUDY

### SOCIAL SCIENCES CURRICULUM

#### FIRST YEAR

##### First Semester

| Number             | Credits  | Course                                       |
|--------------------|----------|--|
| *INGL 3101 or 3103 | 3        | 1st year course in Eng.                      |
| *ESPA 3101         | 3        | Basic course in Spanish I                    |
| CISO 3121          | 3        | Intro. to the Study of the Social Sciences I |
| CIBI 3031          | 3        | Intro. to the Biological Sciences I          |
| *MATE 3086         | 3        | Mathematical Reasoning                       |
| or                 |          |  |
| MATE 3171          | 3        | Pre-Calculus I                               |
| EDFI ----          | <u>1</u> | Course in Phys. Edu.                         |
|                    | 16       |  |

##### Second Semester

| Number             | Credits  | Course  |
|--------------------|----------|---|
| *INGL 3102 or 3104 | 3        | 1st year course in Eng.                       |
| *ESPA 3102         | 3        | Basic course in Spanish II                    |
| CISO 3122          | 3        | Intro. to the Study of the Social Sciences II |
| CIBI 3032          | 3        | Intro. to the Biological Sciences II          |
| **MATE 3---        | 3        | Recommended course in Mathematics             |
| EDFI ----          | <u>1</u> | Course in Phys. Edu.                          |
|                    | 16       |   |

#### SECOND YEAR

##### First Semester

| Number    | Credits  | Course   |
|-----------|----------|--|
| INGL 3--- | 3        | 2nd year course in Eng.                                |
| ESPA 3--- | 3        | Course above level of basic Spanish                    |
| HUMA 3111 | 3        | Intro. to Western Culture I                            |
| HIST 3201 | 3        | Hist. of the Modern World I                            |
| CISO 3145 | 3        | Bibliography & Library Research in the Social Sciences |
| ELECTIVE  | <u>3</u> | Introductory course in any of the Social Sciences      |
|           | 18       |  |

**Second Semester**

| Number     | Credits  | Course  |
|------------|----------|---|
| ^INGL 3--- | 3        | 2nd year course in Eng.                           |
| ESPA 3---  | 3        | Course above level of basic Spanish               |
| HUMA 3112  | 3        | Intro. to Western Culture II                      |
| HIST 3202  | 3        | Modern World Hist. II                             |
| ESMA 3015  | 3        | Elementary Statistics                             |
| ELECTIVE   | <u>3</u> | Introductory course in any of the Social Sciences |
|            | 18       |   |

**THIRD YEAR****First Semester**

| Number             | Credits  | Course  |
|--------------------|----------|---|
| SOCI 3265          | 3        | Research Methods in the Social Sciences           |
| FISI, QUIM or GEOL | 3 or 4   | Elective in Physics, Chemistry or Geology         |
| ELECTIVE           | 3        | Introductory course in any of the Social Sciences |
| ELECTIVE           | 3        | Elective in Social Sciences                       |
| ELECTIVES          | 3        | Recommended Elective                              |
| ELECTIVES          | <u>3</u> | Free Elective                                     |
|                    | 18       |   |

**Second Semester**

| Number             | Credits  | Course  |
|--------------------|----------|---|
| FISI, QUIM or GEOL | 3 or 4   | Elective in Physics, Chemistry or Geology         |
| ELECTIVE           | 3        | Introductory course in any of the Social Sciences |
| ELECTIVES          | 6        | Electives in Social Sciences                      |
| ELECTIVES          | 3        | Recommended Elective                              |
| ELECTIVES          | <u>3</u> | Free Electives                                    |
|                    | 18       |   |

**FOURTH YEAR****First Semester**

| Number    | Credits  | Course                       |
|-----------|----------|------------------------------|
| HIST 3241 | 3        | History of Puerto Rico I     |
| ELECTIVES | 6        | Electives in Social Sciences |
| ELECTIVES | 3        | Recommended Elective         |
| ELECTIVES | <u>3</u> | Free Elective                |
|           | 15       |                              |

**Second Semester**

| Number    | Credits  | Course                      |
|-----------|----------|-----------------------------|
| HIST 3242 | 3        | History of Puerto Rico II   |
| ELECTIVE  | 3        | Elective in Social Sciences |
| ELECTIVES | 6        | Recommended Electives       |
| ELECTIVES | <u>3</u> | Electives                   |
|           | 15       |                             |

**Total credits required: 134 or 136**

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\* Choose from the alternatives defined by the Department: COMP 3057, MATE 3172, MATE 3000.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

The following courses cannot be used as Electives in Social Sciences: ECON 3021-3022, SOCI 3261-3262, PSIC 3001-3002, ANTR 3015, ANTR 3005

**BACHELOR OF ARTS IN POLITICAL SCIENCES**

Political Science is the study of governments, public policies and political processes, political systems, and behavior. A diversified outlook of Political Science subfields includes political theory, policy studies and analysis, comparative politics, international relations, and a host of related topics such as Government of Puerto Rico, Government of the United States of America, Public Opinion, Public Administration, Latin American and Caribbean politics, Globalization, International Law, and International Organizations, among others. Learning experiences include, but are not limited to, discussion integrated into the lecture, debates, simulations, and online discussion forums. A variety of methodological approaches are used to examine the process, systems, and political dynamics of all countries and regions of the world. Two upper-level courses in methodology are required applying qualitative or quantitative research methods. Students majoring in Political Science gain valuable analytical, communication, data and research skills that they can apply to a wide spectrum of fields. Graduates can follow a variety of career options. The most common are Law School, government service, and teaching at every level. Others work as policy analysts, legislative assistants, in non-profit associations and organizations, campaign management and polling or become involved in electoral politics or even consider journalism. Those who want a deeper understanding of Political Science as a discipline consider graduate



school. Students are encouraged to participate in internships in order to apply and integrate their knowledge outside of a formal classroom setting, according with their interests. This program sponsors a Curricular Sequence in International Relations.

The Bachelor of Arts Degree is awarded after the completion of a minimum of 134 credits. Out of the minimum of 134 credits, forty-two credits are required exclusively in Political Science, twelve in free electives and three credits in recommended electives.

### Summary of Credits in Program

|                           |                   |
|---------------------------|-------------------|
| Faculty requirements      | 56 or 58          |
| Departmental requirements |                   |
| Major area                | 42                |
| Non-major area            | 21                |
| Recommended electives     | 3                 |
| Free electives            | <u>12</u>         |
| <b>Total</b>              | <b>134 or 136</b> |

### PROGRAM OF STUDY

#### POLITICAL SCIENCE CURRICULUM

#### FIRST YEAR

##### First Semester

| Number            | Credits  | Course                                       |
|-------------------|----------|--|
| INGL 3101 or 3103 | 3        | 1st year course in Eng.                      |
| ESPA 3101         | 3        | Basic course in Spanish I                    |
| HUMA 3111         | 3        | Intro. to Western Culture I                  |
| CIPO 3011         | 3        | Principles and problems of Political Science |
| MATE 3171         | 3        | Pre-Calculus I                               |
| or                |          |  |
| MATE 3086         | 3        | Mathematical Reasoning                       |
| EDFI ----         | <u>1</u> | Course in Physical Education                 |
|                   | 16       |  |

##### Second Semester

| Number            | Credits  | Course                       |
|-------------------|----------|------------------------------|
| INGL 3102 or 3104 | 3        | 1st year course in English   |
| ESPA 3102         | 3        | Basic course in Spanish II   |
| HUMA 3112         | 3        | Intro. to Western Culture II |
| CIPO 3035         | 3        | Government of Puerto Rico    |
| ESMA 3101         | 3        | Applied Statistics I         |
| or                |          |                              |
| ESMA3015          | 3        | ElementaryStatistics         |
| EDFI ----         | <u>1</u> | Course in Physical Education |
|                   | 16       |                              |

#### SECOND YEAR

##### First Semester

| Number    | Credits  | Course                                |
|-----------|----------|---------------------------------------|
| INGL 3--- | 3        | 2nd year course in English            |
| ESPA 3--- | 3        | Course above level of basic Spanish   |
| +ELECTIVE | 3        | Elective in Social Sciences           |
| CIBI 3031 | 3        | Intro. to the Biological Sciences I   |
| CIPO 3025 | 3        | Political System of the United States |
| HIST 3201 | <u>3</u> | Hist. of the Modern World I           |
|           | 18       |                                       |

##### Second Semester

| Number                                       | Credits  | Course                               |
|--|----------|--------------------------------------|
| ^INGL 3---                                   | 3        | 2nd year course in English           |
| ESPA 3216                                    | 3        | Formal Expositive Writing            |
| +ELECTIVE                                    | 3        | Elective in Social Sciences          |
| CIBI 3032                                    | 3        | Intro. to the Biological Sciences II |
| ESMA 3102, COMP 3057, MATE 3172 or MATE 3000 | 3        | Recommended course in Mathematics    |
| HIST 3202                                    | <u>3</u> | Modern World History II              |
|  | 18       |                                      |

#### THIRD YEAR

##### First Semester

| Number             | Credits  | Course                                    |
|--------------------|----------|---|
| CIPO 3065          | 3        | International Relations                   |
| CIPO 4051          | 3        | Political Theory I                        |
| ELECTIVE CIPO      | 3        | Elective in Political Sciences            |
| FISI, QUIM or GEOL | 3 or 4   | Elective in Physics, Chemistry or Geology |
| ECON 3021          | 3        | Principles of Economics: Microeconomics   |
| ELECTIVES          | <u>3</u> | Free Elective                             |
|                    | 18-19    |   |

##### Second Semester

| Number        | Credits | Course                              |
|---------------|---------|-------------------------------------|
| CIPO 4015     | 3       | Comparative Government and Politics |
| CIPO 4052     | 3       | Political Theory II                 |
| ELECTIVE CIPO | 3       | Elective in Political Sciences      |
| FISI, QUIM    | 3 or 4  | Elective in Physics,                |

|                      |          |  |
|----------------------|----------|--|
| or GEOL<br>ECON 3022 | 3        | Chemistry or Geology<br>Principles of Economy:<br>Macroeconomics |
| ELECTIVES            | <u>3</u> | Free Elective  |
|                      | 18-19    |  |

#### FOURTH YEAR

##### First Semester

| Number        | Credits  | Course                        |
|---------------|----------|-------------------------------|
| CIPO 4145     | 3        | Research in Political Science |
| HIST 3241     | 3        | History of Puerto Rico I      |
| ELECTIVE CIPO | 3        | Elective in Political Science |
| ELECTIVE CIPO | 3        | Elective in Political Science |
| ELECTIVES     | <u>3</u> | Free Elective                 |
|               | 15       |                               |

##### Second Semester

| Number        | Credits  | Course                                |
|---------------|----------|---------------------------------------|
| CIPO 4155     | 3        | Research Seminar in Political Science |
| HIST 3242     | 3        | History of Puerto Rico II             |
| ELECTIVE CIPO | 3        | Electives in Political Science        |
| ELECTIVES     | 3        | Recommended Electives                 |
| ELECTIVES     | <u>3</u> | Free Elective                         |
|               | 15       |                                       |

**Total credits required: 134 or 136**

\*Refer to the Academic Regulations section for information on Advanced Placement.

+Social Sciences students will choose six credits in courses which are not included in their specialized area or any of the following Economics courses: ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

The following sequence in math and statistics courses cannot be changed: MATE 3171-ESMA3101; MATE 3086-ESMA 3015.

#### BACHELOR OF ARTS IN SOCIOLOGY

Sociology is the study of society through the functions and power struggles performed by human groups and how they impact our lives without destroying our individuality. Sociology majors are prepared to understand collective behavior through a combination of theoretical perspectives and scientific research. It helps us understand the existing social relations and impacting forces that changes across time. Sociology

is closely related to other academic fields and professionals who study group behavior and cultural phenomena. Sociology majors develop skills to work in judicial studies, social research, human relations, human-environment relations, public and private administration, journalism, demographic studies, family planning, community empowerment projects, climate change issues, and social planning, including energy transitions and coastal areas risk mitigation, among others. A large segment of the academic offerings in Sociology integrates in-classroom discussions with experiential learning through research projects, practicum in governmental agencies, student travel programs, workshops and seminars. A Bachelor of Arts in Sociology must complete 134/136 credits. Thirty-six of those are required in Sociology and twelve in free electives.

#### Summary of Credits in Program

|                           |                   |
|---------------------------|-------------------|
| Faculty requirements      | 59/61             |
| Departmental requirements |                   |
| Major area                | 36                |
| Non-major area            | 12                |
| Recommended electives     | 15                |
| Free electives            | <u>12</u>         |
| <b>Total</b>              | <b>134 or 136</b> |

#### PROGRAM OF STUDY

##### SOCIOLOGY CURRICULUM

##### FIRST YEAR

##### First Semester

| Number             | Credits  | Course                       |
|--------------------|----------|------------------------------|
| *INGL 3101 or 3103 | 3        | 1st year course in Eng.      |
| *ESPA 3101         | 3        | Basic course in Spanish I    |
| HUMA 3111          | 3        | Intro. to Western Culture I  |
| *SOCI 3261         | 3        | Intro. to Sociology          |
| *MATE 3086         | 3        | Mathematical Reasoning       |
| or                 |          |                              |
| MATE 3171          | 3        | Pre-Calculus I               |
| EDFI ----          | <u>1</u> | Course in Physical Education |
|                    | 16       |                              |

##### Second Semester

| Number             | Credits | Course                     |
|--------------------|---------|----------------------------|
| *INGL 3102 or 3104 | 3       | 1st year course in Eng.    |
| *ESPA 3102         | 3       | Basic course in Spanish II |

|           |          |                              |
|-----------|----------|------------------------------|
| HUMA 3112 | 3        | Intro. to Western Culture II |
| SOCI 3262 | 3        | Intro. to Sociology          |
| ESMA 3015 | 3        | Elementary Statistics        |
| EDFI ---- | <u>1</u> | Course in Phys. Edu.         |
|           | 16       |                              |

## SECOND YEAR

### First Semester

| Number                                 | Credits  | Course                                  |
|--|----------|---|
| INGL 3---or4---                        | 3        | 2nd year course in English              |
| ESPA 3---or4---or<br>LING 3---or4---   | 3        | Course above level of basic Spanish     |
| CIBI 3031                              | 3        | Intro. to the Biological Sciences I     |
| HIST 3---                              | 3        | Any course in Hist.                     |
| COMP 3057 or MATE<br>3172 or MATE 3000 | 3        | Math course                             |
| GEOG 3--- or<br>ANTR 3---              | <u>3</u> | Any course of Geography or Anthropology |
|  | 18       |   |

### Second Semester

| Number                                    | Credits  | Course                                 |
|---|----------|--|
| ^INGL 3--- or 4---                        | 3        | 2nd year course in English             |
| ESPA 3--- or 4--- or<br>LING 3--- or 4--- | 3        | Course above level of basic Spanish    |
| CIBI 3032                                 | 3        | Intro. to the Biological Sciences II   |
| HIST 3---                                 | 3        | Any course in History                  |
| SOCI 3276                                 | 3        | Sociological writing and documentation |
| GEOG 3---<br>or<br>ANTR 3--- or 4---      | <u>3</u> | Course on Geography or Anthropology    |
|   | 18       |  |

## THIRD YEAR

### First Semester

| Number                                    | Credits  | Course                                    |
|---|----------|---|
| HIST 3241                                 | 3        | History of Puerto Rico I                  |
| +ELECTIVE CISO                            | 3        | Elective in Social Sciences               |
| SOCI 4115                                 | 3        | Contemporary Social Theory I              |
| SOCI 3265                                 | 3        | Research Methods in the Social Sciences   |
| CIFI 3011, QUIM 3131<br>3133 or GEOL_____ | 3 or 4   | Elective in Physics, Chemistry or Geology |
| ELECTIVES                                 | <u>3</u> | Free Elective                             |
|   | 18       |   |

## Second Semester

| Number                                     | Credits  | Course  |
|--|----------|---|
| HIST 3242 or<br>HIST 4345                  | 3<br>3   | History of Puerto Rico II<br>Twentieth Century Puerto Rican History |
| +ELECTIVE CISO                             | 3        | Elective in Social Sciences   |
| SOCI 4116                                  | 3        | Contemporary Social Theory II                                       |
| SOCI 4206                                  | 3        | Qualitative Research Methods in the Social Sciences                 |
| CIFI 3012, QUIM 3132-<br>3134 or GEOL_____ | 3 or 4   | Elective in Physics, Chemistry or Geology                           |
| ELECTIVES                                  | <u>3</u> | Free Elective   |
|  | 18       |   |

## FOURTH YEAR

### First Semester

| Number                                   | Credits  | Course  |
|--|----------|---|
| SOCI 4231                                | 3        | Research in Sociology I   |
| ECON 3021 or<br>ANTR3---<br>or GEOG 3--- | 3        | Principles of Economics: Micro-economics, any course in Anthropology or geography |
| ELECTIVE SOCI                            | 3        | Elective in Sociology   |
| ELECTIVE SOCI                            | 3        | Elective in Sociology   |
| ELECTIVES                                | <u>3</u> | Free Elective   |
|  | 15       |   |

### Second Semester

| Number        | Credits  | Course                   |
|---------------|----------|--------------------------|
| SOCI 4232     | 3        | Research in Sociology II |
| ELECTIVE SOCI | 3        | Elective in Sociology    |
| ELECTIVE SOCI | 3        | Elective in Sociology    |
| ELECTIVE SOCI | 3        | Elective in Sociology    |
| ELECTIVES     | <u>3</u> | Free Elective            |
|               | 15       |                          |

## Total credits required: 134 or 136

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*Choose from the alternatives defined by the Department: COMP 3057, MATE 3172, MATE 3000.

+Social Sciences students will choose six credits in courses which are not included in their specialized area or any of the following Economics courses: ECON 3021-3022, ECON 3091-3092, ECON 4037 or ECON 4056.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## BACHELOR OF ARTS IN HISTORY

The Bachelor of Arts degree in History has been designed to allow students understand history as a dynamic and coherent process; to know and apply critical and analytical thinking to the study of human reality and to clarify, enjoy and contribute to the preservation of the Puerto Rican cultural milieu through an unbiased understanding of history.

History graduates are prepared to pursue graduate studies in law, education, literature, communications, journalism, tourism and work in civil service, local and federal, the private sector and a wide array of different professional and academic fields.

The Bachelor of Arts Degree is awarded after the completion of 134 credits. Forty-eight credits are required exclusively in the History area, twelve in free electives and six credits in recommended electives.

### Summary of Credits in Program

|                           |                   |
|---------------------------|-------------------|
| Faculty requirements      | 56 or 58          |
| Departmental requirements |                   |
| Major area                | 48                |
| Non-major area            | 12                |
| Recommended electives     | 6                 |
| Free electives            | <u>12</u>         |
| <b>Total</b>              | <b>134 or 136</b> |

### PROGRAM OF STUDY

#### HISTORY CURRICULUM

#### FIRST YEAR

##### First Semester

| Number             | Credits  | Course                              |
|--------------------|----------|-------------------------------------|
| *INGL 3101 or 3103 | 3        | 1st year course in Eng.             |
| *ESPA 3101         | 3        | Basic course in Spanish I           |
| CIBI 3031          | 3        | Intro. to the Biological Sciences I |
| HUMA 3111          | 3        | Intro. to Western Culture I         |
| HIST 3201          | 3        | History of the Modern World I       |
| EDFI ----          | <u>1</u> | Course in Physical Education        |
|                    | 16       |                                     |

##### Second Semester

| Number             | Credits | Course                  |
|--------------------|---------|-------------------------|
| *INGL 3102 or 3104 | 3       | 1st year course in Eng. |

|            |          |                                      |
|------------|----------|--------------------------------------|
| *ESPA 3102 | 3        | Basic course in Spanish II           |
| CIBI 3032  | 3        | Intro. to the Biological Sciences II |
| HUMA 3112  | 3        | Intro. to Western Culture II         |
| HIST 3202  | 3        | Modern World History II              |
| EDFI ----  | <u>1</u> | Course in Phys. Edu.                 |
|            | 16       |                                      |

#### SECOND YEAR

##### First Semester

| Number                  | Credits  | Course                              |
|-------------------------|----------|-------------------------------------|
| INGL 3---               | 3        | 2nd year course in Eng.             |
| ESPA 3---               | 3        | Course above level of basic Spanish |
| *MATE 3086 or MATE 3171 | 3        | Mathematical Reasoning              |
| +ELECTIVE               | 3        | Pre-Calculus I                      |
| HIST 3241               | 3        | Elective in Social Sciences         |
| HIST 3195               | <u>3</u> | History of Puerto Rico I            |
|                         | 18       | History of the Ancient World        |

##### Second Semester

| Number     | Credits  | Course                              |
|------------|----------|-------------------------------------|
| ^INGL 3--- | 3        | 2nd year course in English          |
| ESPA 3---  | 3        | Course above level of basic Spanish |
| MATE ----  | 3        | **Recommended course in Mathematics |
| +ELECTIVE  | 3        | Elective in Social Sciences         |
| HIST 3242  | 3        | History of Puerto Rico II           |
| HIST 3185  | <u>3</u> | The Medieval World                  |
|            | 18       |                                     |

#### THIRD YEAR

##### First Semester

| Number             | Credits  | Course   |
|--------------------|----------|--|
| HIST 3141          | 3        | History of Spain I                                     |
| FISI, QUIM or GEOL | 3 or 4   | Elective in Physics, Chemistry or Geology              |
| ECON 3021          | 3        | Principles of Economics: Microeconomics                |
| HIST 4221          | 3        | Historiography and Approaches to History               |
| CISO 3145          | 3        | Bibliography & Library Research in the Social Sciences |
| ELECTIVES          | <u>3</u> | Elective in European History                           |
|                    | 18       |  |

## Second Semester

| Number                | Credits  | Course   |
|-----------------------|----------|--|
| HIST 3142             | 3        | History of Spain II                              |
| FISI, QUIM<br>or GEOL | 3 or 4   | Elective in Physics,<br>Chemistry or Geology     |
| ECON 3022             | 3        | Principles of Economy:<br>Macroeconomics         |
| HIST 4222             | 3        | Historiography and<br>Approaches to History II   |
| CIPO 3011             | 3        | Principles and Problems<br>of Political Sciences |
| ELECTIVE              | <u>3</u> | Elective in European<br>History                  |
|                       | 18       |  |

## FOURTH YEAR

### First Semester

| Number    | Credits  | Course                                 |
|-----------|----------|--|
| HIST 4226 | 3        | Historical Research                    |
| ELECTIVE  | 3        | Elective in History of<br>the Americas |
| ELECTIVES | 6        | Free Electives                         |
| ELECTIVES | <u>3</u> | Recommended Elective                   |
|           | 15       |  |

### Second Semester

| Number    | Credits  | Course                                 |
|-----------|----------|--|
| HIST 4228 | 3        | Themes in History                      |
| ELECTIVE  | 3        | Elective in History of<br>the Americas |
| ELECTIVES | 6        | Free Electives                         |
| ELECTIVES | <u>3</u> | Recommended Elective                   |
|           | 15       |  |

### Total credits required: 134 or 136

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*Choose from the alternatives defined by the Department: MATE 3000, MATE 3172, COMP 3057, ESMA 3015, ESMA 3101.

+Social Sciences students will choose six credits in courses which are not included in their specialized area or any of the following courses: CISO 3121, CISO 3122, SOCI 3261, SOCI 3262, ECON 3091, ECON 3092, ECON 4037 or ECON 4056, ANTR 3015, ANTR 3005, PSIC 3001, PSIC 3002.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## CURRICULAR SEQUENCE IN ENVIRONMENTAL SOCIOLOGY AND POLICY DEPARTMENT OF SOCIAL SCIENCES

The Curricular Sequence in Environmental Sociology and Policy, ascribed to the Department of Social Sciences at the College of Arts and Sciences, promotes an integrated analysis of environmental issues by combining natural, social and technical aspects of the relationship between humans and the environment. The curricular proposes that environmental problems and issues are not only physical/natural phenomena, but also social in their causes and consequences. Therefore, the resolution of environmental problems and issues, and the management of natural resources require the integration of multiple knowledges including the social and natural sciences, business administration and engineering. The curricular sequence seeks to diversify and enrich the student's professional formation by exposing him/her to the sociological analysis of environmental problems and issues, to develop the necessary skills to collaborate in multi and interdisciplinary environments and to insert themselves in environmental policy processes, and to develop skills in applied social research in topics related to environmental problems, natural resources management and environmental policy.

### Courses in the sequence

The curricular sequence includes 15 credits, divided into 9 credits of core courses and 6 credits of recommended electives. The core courses will provide the theoretical and methodological foundation in the fields of environmental sociology and public policy. The last course of the sequence, SOCI 4991 or SOCI 4992, provides the integrative research experience about an environmental issue.

| Code                                | Title   | Credits | Pre-requisites  |
|-------------------------------------|---|---------|---|
| SOCI 3007                           | Environmental Sociology   | 3       | none  |
| CISO/CIPO 3046                      | Introduction to Public Policy Analysis                                | 3       | none  |
| SOCI 4991 or SOCI 4992 <sup>3</sup> | Independent Study in Sociology I or Independent Study in Sociology II | 3       | 12 credits in Sociology, Psychology or Political Sciences, or the authorization of the Department's Chair |

<sup>3</sup> The student can take one or the other and the topic of the research must be aligned with the topic of the sequence.

The student must take two elective courses: (1) one about the relationship between humans and the environment (those that address knowledge, attitudes and/or beliefs regarding how nature works or how humans interact with their environment) and (2) one related to the management of natural resources (those that describe socially established practices to transform or manage the environment). The recommended electives are:

| Code      | Title  | Credits | Pre-requisites          |
|-----------|--|---------|-------------------------|
| ANTR 4007 | Culture and Energy                           | 3       | CISO 3122               |
| BIOL 4025 | Man and the Ecosystem                        | 3       | BIOL 3125               |
| GEOG 3185 | Physical Geography                           | 3       | None                    |
| GEOG 3155 | Human Geography                              | 3       | None                    |
| GEOL 3027 | Geological Aspects of Environmental Sciences | 3       | None                    |
| PSIC 3060 | Environmental Psychology                     | 3       | PSIC 3002               |
| Quim 3085 | Environmental Chemistry                      | 3       | QUIM 3002 or QUIM 3042. |
| SOCI 5008 | Sociology of Disasters                       | 3       | None                    |
| SOCI 5015 | Energy, Society and Environment              | 3       | None                    |

The recommended electives on natural resources management are:

| Codification | Title  | Credits | Pre-requisite(s)   |
|--------------|--|---------|--|
| AGRO 4005    | Soil Conservation  | 3       | AGRO 3005  |
| AGRO 4010    | Silviculture   | 3       | CFIT 3005 or BIOL 3435 or BIOL 3051                                      |
| AGRO 4035    | Introduction to Conservation of Natural Resources              | 3       | Authorization of Department Chair  |
| AGRO 5010    | Management of Natural Forests                                  | 3       | BIOL 3435 or BIOL 3051 or CFIT 3005 or authorization of Department Chair |
| AGRO 5015    | Conservation, development and management of natural resources. | 3       | AGRO 4035 or authorization of Department Chair                           |
| ECAG 4015    | Introduction to Resources Economics                            | 3       | ECON 3021 or ECAG 3005   |

|                |   |   |  |
|----------------|---|---|--|
| PROC 4019      | Pesticides and their use in agriculture                               | 3 | QUIM 3061  |
| PROC 4030      | Integrated pest management  | 3 | PROC 4008 and PROC 4006  |
| TMAG 4035      | Water and soil management   | 4 | AGRO 3005 and INCI 4005  |
| TMAG 4038      | Agricultural Hydrology  | 3 | FISI 3171 or FISI 3151 or FISI 3091                                      |
| TMAG 4501      | Renewable energy in agriculture                                       | 3 | FISI 3091 or FISI 3172 or FISI 3052                                      |
| TMAG 5008      | Geographic Information Systems and management of natural resources    | 3 | MATE 3172 or authorization of Department Chair                           |
| INQU 5015      | Fundamentals of air pollution   | 3 | INCI 4008 or authorization of Department Chair. Corerequisite: INQU 4002 |
| CISO/CIPO 3027 | Schemes of Public Participation                                       | 3 | None   |
| ECON 4056      | Environmental Economics   | 3 | ECON 3021  |
| SOCI 5006      | Social analysis of natural resources management                       | 3 | None   |
| SOCI 5007      | Socio-cultural perspectives of fisheries management at a global scale | 3 | None   |

### Requirement to apply

The minimal requirements to apply to the curricular sequence in Environmental Sociology and Policy are:

- 24 credits with a GPA of 2.5 or more.
- Academic progress in his/her program.
- If re-admitted to UPRM, readmission must follow the dates established by the Administrative Board. In the case of internal or external transfer, the student must comply with UPRM's requisites.
- Submit an application to the sequence to the Chair of the Social Science Department.
- An interview with the coordinator of the curricular sequence for the program's individualized design and the selection of electives most appropriate to the student's interest.

## Curricular Sequence in International Relations

The Sequence in International Relations is an opportunity to gain a better understanding of the broad range of interactions between the different actors in the international arena. States are a major component in the global system, but there are a number of non-state actors whose role is vital on the modern world stage. Non-governmental organizations (NGOs) interact with states, sub-state actors, MNCs, and other NGOs. Topics such as the proliferation of nuclear weapons, globalization, environmental protection, human rights, and the role of international organizations, terrorism, foreign policy decision-making and the prospects for peace in the 21<sup>st</sup> century are discussed. Every field has an international dimension. For this reason, this structured yet flexible interdisciplinary sequence is pertinent to students from any discipline.

### Requirements:

- Be an active student at the UPRM.
- Submit the application for admission to the Curricular Sequence in the Registrar's Office according with the dates established by the Academic Calendar.
- A minimum GPA of 2.50 at the moment of requesting entrance to this sequence is required.

### Minimum Course Requirements

This sequence consists of 15 credits, 9 of which are common to all interested students:

| Code      | Title                            | Credits | Pre-requisites |
|-----------|----------------------------------|---------|----------------|
| CIPO 3065 | International Relations          | 3       | CIPO 3011      |
| CIPO 4065 | International Law                | 3       | CIPO 3011      |
| CIPO 4127 | Globalization and World Politics | 3       | Ninguno        |

The remaining 6 credits needed to complete the sequence are chosen among these courses:

| Code      | Title   | Credits | Pre-requisites        |
|-----------|---|---------|-----------------------|
| CIPO 3045 | International Organizations                           | 3       | CIPO 3011             |
| CIPO 4015 | Comparative Politics and Government                   | 3       | CIPO 3011             |
| CIPO 4016 | Government and Politics of the Middle East            | 3       | Ninguno               |
| CIPO 4017 | The European Union in International Law and Diplomacy | 3       | Ninguno               |
| CIPO 4075 | The Politics of Developing Areas                      | 3       | CIPO 3011             |
| CIPO 4085 | American Foreign Policy                               | 3       | CIPO 3025             |
| CIPO 4115 | Latin American International Relations                | 3       | CIPO 3065 ó CIPO 4105 |
| CIPO 4735 | United Nations Model                                  | 3       | Permiso del Director  |
| ECON 4015 | Economic Development                                  | 3       | ECON 3021 y ECON 3022 |
| ECON 4085 | International Economics                               | 3       | ECON 3021 y ECON 3022 |
| ECON 4185 | Economic Problems of Latin America                    | 3       | ECON 3021 y ECON 3022 |
| ECON 4045 | Comparative Economic Systems                          | 3       | ECON 3021 y ECON 3022 |
| ECON 4056 | Environmental Economics                               | 3       | ECON 3021 y ECON 3022 |
| ECON 4038 | Ecological Economics                                  | 3       | ECON 3021 y ECON 3022 |
| ECON 4028 | Economics of Natural Resources                        | 3       | ECON 3021 y ECON 3022 |
| SOCI 4165 | Social Problems in the Contemporary World             | 3       | SOCI 3265             |
| SOCI 5005 | Sociology of Latin America                            | 3       | Permiso del Director  |
| ECAG 4015 | Introduction to Resource Economics                    | 3       | ECON 3021 ó ECAG 3005 |

## DEPARTMENTAL FACULTY

**JOSÉ ANAZAGASTY-RODRÍGUEZ**, *Professor*, Ph.D., 2004, Washington State University.

**ANIBAL APONTE**, *Professor*, Ph.D., 1993, University of Chicago.

**WALDEMAR ARROYO-ROJAS**, *Professor*, Ph.D., 2000, Universidad Complutense de Madrid.

**EDWIN ASECIO PAGÁN**, *Associate Professor*, Ph.D., 2006, Universidad Complutense de Madrid.

**MARÍA I. BARBOT**, *Professor*, M.A., 1974, State University of New York.

**RAFAEL A. BOGLIO**, *Associate Professor*, Ph.D., 2011, University of Michigan.

**MARIO CANCEL**, *Professor*, M.A., 1989, Centro de Estudios Avanzados de Puerto Rico y el Caribe.

**MICHAEL GONZÁLEZ**, *Associate Professor*, Ph.D., 2005, State University of New York at Binghamton.

**CARLOS I. HERNÁNDEZ-HERNÁNDEZ**, *Professor*, Ph.D., 2005, University of Puerto Rico, Río Piedras Campus.

**TANIA DEL MAR LOPEZ-MARRERO**, *Associate Professor*, Ph.D., 2008, Pennsylvania State University.

**ILEANA MATÍAS-DEL TORO**, *Professor*, M.A., 1987, George Washington University.

**LUIS ERNESTO NIEVES-ROSA**, *Professor*, Ph.D., 2007, University of Puerto Rico, Río Piedras.

**CECILIO ORTIZ**, *Professor*, Ph.D., 1999, Arizona State University.

**MARLA PÉREZ**, *Professor*, Ph.D., 2003, Rutgers University.

**ÁNGEL R. ROSA-RODRÍGUEZ**, *Professor*, Ph.D., 1998, Boston University.

**JORGE SCHMIDT-NIETO**, *Professor*, Ph.D., 2000, Rutgers University, New Brunswick, New Jersey.

**LUISA SELJO-MALDONADO**, *Associate Professor*, M.A., 1972, University of Puerto Rico, Río Piedras.

**RAMONITA VEGA-LUGO**, *Professor*, Ph.D., 2001, University of Puerto Rico, Río Piedras Campus.

**ÁNGEL VIERA-TIRADO**, *Professor*, Ph.D., 2004, Purdue University.

## COURSES OF INSTRUCTION

### DEPARTMENT OF SOCIAL SCIENCES

#### Undergraduate Courses

#### ANTHROPOLOGY

**ANTR 3005.** INTRODUCTION TO CULTURAL ANTHROPOLOGY. Three credit hours. Three hours of lecture per week.

The concept of culture: socio-cultural evolution, language technology, economy, social stratification, types of association, law, magic, religion, art, social change. The role of applied anthropology.

**ANTR 3015.** INTRODUCTION TO PHYSICAL ANTHROPOLOGY. Three credit hours. Three hours of lecture per week.

Concepts of biological and cultural evolution, mechanisms of evolution, the evolutionary history of the human being, the fossil record, socioeconomic adaptations in prehistory.

**ANTR/CISO 4066.** POLITICAL AND CULTURAL ASPECTS OF INDIGENOUS PEOPLES OF LATIN AMERICA. Three credit hours. Three hours of lecture per week. Prerequisite: CISO 3121 o ANTR 3005.

Indigenous peoples of Latin America: culture areas; history; "indigenismo" and identity; political, economic, and civil rights.

**ANTR 4007.** CULTURE AND ENERGY. Three credit hours. Three hours of lecture per week. Prerequisite: CISO 3122.

Energy and cultural advancement; technological means of adjustment, control, security and sustenance; culture as a mechanism of harnessing energy for the benefit of mankind; social and philosophical systems influenced by technological processes.

#### GEOGRAPHY

**GEOG 3155.** HUMAN GEOGRAPHY. Three credit hours. Three hours of lecture per week.

The study of human society in its natural environmental background throughout the world.

**GEOG 3185.** PHYSICAL GEOGRAPHY. Three credit hours. Three hours of lecture per week.



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Study of the earth as a planet; mountain building, erosion and other characteristic natural processes which produce its surface features; study of the factors which produce weather, and of the various types of climate found on the earth.

## HISTORY

**HIST 3091. HISTORY OF FRANCE.** Three credit hours. Three hours of lecture per week.

An intensive study of the history of France from its origins to 1789 with special emphasis on the religious wars, the Enlightenment, and the French Revolution.

**HIST 3092. HISTORY OF FRANCE.** Three credit hours. Three hours of lecture per week.

The political, economic and constitutional history of France from 1789 to the present with emphasis on the effects of the French Revolution upon the history of the country; origins and fall of the Third Republic; Charles De Gaulle's regime.

**HIST 3111. HISTORY OF THE UNITED STATES OF AMERICA.** Three credit hours. Three hours of lecture per week.

Historical development of the United States of America from the colonial period to the Civil War.

**HIST 3112. HISTORY OF THE UNITED STATES OF AMERICA.** Three credit hours. Three hours of lecture per week.

Historical development of the United States of America from the reconstruction period to the present, with emphasis on the impact of economic and social forces on national policies.

**HIST 3121. HISTORY OF THE FOREIGN POLICY OF THE UNITED STATES OF AMERICA.** Three credit hours per semester. Three hours of lecture per week each semester.

The development of American foreign policy from 1775 to the present, within the context of the changing patterns of American interests and those of the world, as foreign relations grow in complexity and significance.

**HIST 3122. HISTORY OF THE FOREIGN POLICY OF THE UNITED STATES OF AMERICA.** Three credit hours per semester. Three hours of lecture per week each semester.

The development of American foreign policy from 1775 to the present, within the context of the changing patterns

of American interests and those of the world, as foreign relations grow in complexity and significance.

**HIST 3141. HISTORY OF SPAIN I.** Three credit hours. Three hours of lecture per week.

Cultural influence of the various people that settled the Iberian Peninsula on the history and civilization of the different Spanish Kingdoms from the beginning to the period of national unity under Ferdinand and Isabella.

**HIST 3142. HISTORY OF SPAIN II.** Three credit hours. Three hours of lecture per week.

The evolution of the Spanish Empire and the causes leading to its downfall; analysis of the cultural, social and political development of Spain from the 16th Century to the present.

**HIST 3155. HISTORY OF NINETEENTH CENTURY EUROPE.** Three credit hours. Three hours of lecture per week.

Development of the major European countries, and their international relations within Europe. Emphasis will be given to nationalism, imperialism, and their impact upon Europe and the non-European world.

**HIST 3158. HISTORY OF TWENTIETH CENTURY EUROPE.** Three credit hours. Three hours of lecture per week.

Development of the major European countries, and their international relations within Europe. Emphasis will be given to the First World War, the Peace Conferences, the rise of Fascism and National Socialism, the Second World War, and the Reconstruction of Europe.

**HIST 3165. HISTORY OF THE RENAISSANCE.** Three credit hours. Three hours of lecture per week.

A study of the transition from medieval times to modern civilization in Western Europe; origin and development of the Renaissance; the Protestant and Catholic reformations.

**HIST 3185. THE MEDIEVAL WORLD.** Three credit hours. Three hours of lecture per week.

The history of Europe from the collapse of the Roman Empire in the West to the Renaissance.

**HIST 3195. HISTORY OF THE ANCIENT WORLD.** Three credit hours. Three hours of lecture per week.

The origins of mankind; the civilization of the Near East, India and China; the rise and decline of the Greek and Roman cultures.

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**HIST 3201. HISTORY OF THE MODERN WORLD I.** Three credit hours. Three hours of lecture per week.

Study of the political, socio-cultural, economic and religious development of the World from 1500 to 1815.

**HIST 3202. MODERN WORLD HISTORY II.** Three credit hours. Three hours of lecture per week.

The contemporary world from the Congress of Vienna to the present, with emphasis on the First and Second World Wars, the Cold War and the Third World.

**HIST 3211. HISTORY OF LATIN AMERICA.** Three credit hours. Three hours of lecture per week.

The historical development of Latin America from its origins to the wars of independence, with emphasis on the Spanish Conquest and the development of the colonial society.

**HIST 3212. HISTORY OF LATIN AMERICA.** Three credit hours. Three hours of lecture per week.

History of Latin America from the national period to the present, with emphasis on its economic, social and political development.

**HIST 3221. HISTORY OF THE ANTILLES.** Three credit hours. Three hours of lecture per week.

A comparative study of the historical development in the Antilles of Spanish, English, French and Dutch colonial institutions through the 18th century.

**HIST 3222. HISTORY OF THE ANTILLES.** Three credit hours. Three hours of lecture per week.

A comparative study of the social, economic and political development of the Antilles in the 19th and 20th centuries.

**HIST 3241. HISTORY OF PUERTO RICO.** Three credit hours. Three hours of lecture per week.

History of Puerto Rico from the discovery and colonization to the middle of the nineteenth century.

**HIST 3242. HISTORY OF PUERTO RICO.** Three credit hours. Three hours of lecture per week.

History of Puerto Rico from the second half of the nineteenth century to the present.

**HIST 4005. HISTORY OF MEXICO.** Three credit hours. Three hours of lecture per week.

History of Mexico from Pre-Colombian times to the present; the political, social, cultural, and economic development of the country.

**HIST 4055. THEMES IN EUROPEAN HISTORY.** Three credit hours. Three hours of lecture per week. Prerequisite: HIST 3201 or 3202.

Advanced study of the most significant movements in modern European history, readings, research, and report writing.

**HIST 4066. THEMES IN THE HISTORY OF THE AMERICAS.** Three credit hours. Three hours of lecture per week. Prerequisite: HIST 3111 or HIST 3112 or HIST 3211 or HIST 3212.

Advanced study of the most significant movements in the historical development of the Americas, readings, research, and report writing.

**HIST 4075. SPECIAL PROBLEMS.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Under the guidance of a member of the staff, the student will be required to organize and carry out a project of historical research.

**HIST 4111. SOCIAL HISTORY OF THE UNITED STATES OF AMERICA.** Three credit hours per semester. Three hours of lecture per week each semester.

A history of the development of the American people from early colonial days to the present. The expansion and changes in the general patterns of living, thinking and culture will be covered, with emphasis on economic and political factors.

**HIST 4112. SOCIAL HISTORY OF THE UNITED STATES OF AMERICA.** Three credit hours per semester. Three hours of lecture per week each semester.

A history of the development of the American people from early colonial days to the present. The expansion and changes in the general patterns of living, thinking and culture will be covered, with emphasis on economic and political factors. Prerequisite: HIST 4111.

**HIST 4117. HISTORY OF LABOR IN THE UNITED STATES OF AMERICA.** Three credit hours. Three hours of lecture per week.

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The development of the patterns and institutions of labor in the United States of America from colonial times to the present, with emphasis on the post-Civil War period. Includes discussions on indentured servitude, slavery and the development of free labor, the origins and development of unionism, and the labor-oriented theories of social reform.

**HIST 4165. HISTORY OF BRAZIL.** Three credit hours. Three hours of lecture per week.

A historical survey of Brazil through the colonial and national periods, with special attention to economic, social and political development, cultural conflicts, and foreign relations.

**HIST 4171. HISTORY OF RUSSIA.** Three credit hours. Three hours of lecture per week.

Study of Russian history from its origins to the reign of Peter the Great.

**HIST 4172. HISTORY OF RUSSIA NINETEENTH CENTURY.** Three credit hours. Three hours of lecture per week.

Introductory course on the History of Russia since the reign of Alexander I to the present, from a political and economic standpoint. Includes analysis of primary sources and readings of well known researchers to discuss local affairs as well as international relations. Emphasis can be given to the Nineteenth or Twentieth Century, according to the readings selected.

**HIST 4220. HISTORY OF GERMANY SINCE 1871.** Three credit hours. Three hours of lecture per week.

History of Germany emphasizing the period from its unification in 1871 to the present.

**HIST 4221. HISTORIOGRAPHY AND APPROACHES TO HISTORY.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: HIST 3202.

A study of the methods and techniques of historical research; a survey of the development of History as a discipline; and an analysis of the theories, approaches and contributions of the most noted modern historians.

**HIST 4222. HISTORIOGRAPHY AND APPROACHES TO HISTORY.** Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: HIST 4221.

A study of the methods and techniques of historical research; a survey of the development of History as

a discipline; and an analysis of the theories, approaches and contributions of the most noted modern historians.

**HIST 4226. HISTORICAL RESEARCH.** Three credit hours. Three hours of lecture per week. Prerequisite: Twelve credit hours in History and authorization of the Director of the Department.

A study of the methods in historical research and of the most important historical currents, with the purpose of preparing the student to make intensive studies in his major field.

**HIST 4228. THEMES IN HISTORY.** Three credit hours. Three hours of lecture per week. Prerequisite: HIST 4226.

Lectures and directed readings on selected topics.

**HIST 4235. REVOLUTIONS IN TWENTIETH CENTURY LATIN AMERICA.** Three credit hours. Three hours of lecture per week.

Comparative historical analysis of the origins and development of Latin American revolutions in the 20th Century, with emphasis on the nature and direction of social change attendant to revolutions in Mexico, Bolivia, Cuba and Chile.

**HIST 4345. TWENTIETH CENTURY PUERTO RICAN HISTORY.** Three credit hours. Three hours of lecture per week.

The historical development of Puerto Rico in the twentieth century: constitutional history, political movements, economic development, and socio-cultural changes.

## **POLITICAL SCIENCES**

**CIPO 3011. PRINCIPLES AND PROBLEMS OF POLITICAL SCIENCE.** Three credit hours. Three hours of lecture per week.

Introduction to basic concepts and differing perspectives of Political Science. Analysis of ideologies, government systems, elections and political parties in the global, comparative as well as the local context. Overview of interest groups, social movements, international relations and political economy.

**CIPO 3025. POLITICAL SYSTEM OF THE UNITED STATES.** Three credit hours. Three hours of lecture per week.

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A study of the historical background of the American government including the framing of its constitution and the political theory on which the American system of government is based. An analysis of the structure of that government at the national level and its political process with emphasis on separation of powers, federalism and the functions of interest groups and political parties, among other actors.

**CIPO/CISO 3026. INTRODUCTION TO PUBLIC POLICY ANALYSIS.** Three credit hours. Three hours of lecture per week.

Identification and study of state institutions and civil society with respect to their role as stakeholders in the establishment of public policy. Discussion of the process of creating public policy including issue definition, agenda establishment, formulation and adoption of said policy, program implementation and methods of evaluation.

**CIPO/CISO 3027. CITIZEN PARTICIPATION IN PUBLIC DECISION-MAKING.** Three credit hours. Three hours of lecture per week.

Study of citizen participation and its role in planning and public decision-making. Analysis of current participation strategies with emphasis on effective citizen participation in public decision-making at the state and federal levels. In addition, theoretical administrative, sociopolitical and scientific fundamentals of citizen participation will be explored. Case studies concerning the location of infrastructural projects, managing natural resources and environmental protection will be discussed.

**CIPO 3035. GOVERNMENT OF PUERTO RICO.** Three credit hours. Three hours of lecture per week.

Historical and analytical survey of the Government of Puerto Rico from 1898 to the present; governmental institutions developed during United States rule, 1898-1952; the Constitution of the Commonwealth of Puerto Rico; the political process in Puerto Rico; the Legislature, the Executive, the Judiciary, local governments, and relations between Puerto Rico and the United States of America.

**CIPO 3045. INTERNATIONAL ORGANIZATION AND ADMINISTRATION.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 3011.

A study and analysis of the functional as well as the constitutional bases of international organization and administration, with emphasis on the dynamics and functions of the United Nations.

**CIPO 3065. INTERNATIONAL RELATIONS.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 3011.

Analysis of concepts and theories of international relations within the international system from a historical and contemporary perspective. Emphasis on continuity and change, the role of international organizations, globalization, terrorism, the prospects for peace in the 21<sup>st</sup> century and foreign policy decision-making at the different levels of analysis.

**CIPO 3095. MUNICIPAL GOVERNMENT.** Three credit hours. Three hours of lecture per week.

Historical and legal background, organization, and functions of the municipal system. Emphasis on the municipal governments of Puerto Rico.

**CIPO 3175. INTRODUCTION TO LAW.** Three credit hours. Three hours of lecture per week.

Principal theories and rules in Law including those of the United States and Puerto Rico; the history of Law and the most common research methods in the field.

**CIPO 4005. CONSTITUTIONAL LAW.** Three credit hours. Three hours of lecture per week.

A study of the constitutional design of the government of the United States and its application to Puerto Rico through the analysis of cases of the Supreme Courts of the U.S. and Puerto Rico. It exposes the student to the criteria of judiciability and topics such as judicial review, separation of powers, the territories clause, constitutional amendments, among others.

**CIPO 4015. COMPARATIVE GOVERNMENT AND POLITICS.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 3011.

A study of various major political systems; discussion of current theoretical approaches to comparative political analysis. Designed to give the student a general picture of the political process and governmental institutions.

**CIPO 4016. GOVERNMENT AND POLITICS OF THE MIDDLE EAST.** Three credit hours. Three hours of lecture per week.

Historical and analytical study of the political development in Middle Eastern countries. It includes Arab and non-Arab states such as Israel and Iran. The Arab-Israeli Wars and the Oslo process are discussed as well as recent developments in the region.

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**CIPO 4017. THE EUROPEAN UNION IN INTERNATIONAL LAW AND DIPLOMACY.** Three credit hours. Three hours of lecture per week.

Analysis of the European Union as a legal and political community and study of EU law. Explanation of the structure, functions and legal personality as well as its evolution in International Law. Discussion of diplomatic implications and the capacity to engage in relations with diverse subjects in the international system, culminating in the European Union Common Security and Foreign Policy (CSFP).

**CIPO 4025. PUBLIC OPINION.** Three credit hours. Three hours of lecture per week.

Analysis of the factors influencing the formation of citizens' opinions. Emphasis on the impact of mass media communications of public affairs. Discourse analysis, surveys, polling, and their relationship to election campaigns and other issues of public interest. It explores the interactions between civil society and the political elite from a multidimensional cognitive and affective perspective.

**CIPO 4035. POLITICAL PARTIES.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 3011.

The nature and functions of political parties: origin, development, structure, economics and composition, internal management and controls; the relation of political parties and pressure groups to legislation and administration.

**CIPO 4036. GOVERNMENT AND POLITICS OF COMMUNIST STATES.** Three credit hours. Three hours of lecture per week.

Development of governmental and political institutions of communist states; the structure and processes of these institutions, especially in the Soviet Union and China.

**CIPO 4045. ELEMENTS OF PUBLIC ADMINISTRATION.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 3011.

The role of public administration in modern society; principles of organization, budgeting, management techniques, the public service, and the control of administration.

**CIPO 4046. SPECIAL TOPICS IN POLITICAL SCIENCE.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Research of selected topics in Political Science.

**CIPO 4051. POLITICAL THEORY.** Three credit hours per semester. Three hours of lecture per week per semester. Prerequisite: CIPO 3011.

Systematic and critical exposition of political thought from the beginning of history to modern times. Political doctrines such as democracy, liberalism, socialism and communism will be analyzed. Emphasis will be given to comparison of different political beliefs, and also to the relationships between the different theories, considered as historic heritage which contribute to contemporary circumstances.

**CIPO 4052. POLITICAL THEORY.** Three credit hours per semester. Three hours of lecture per week per semester. Prerequisite: CIPO 4051.

Systematic and critical exposition of political thought from the beginning of history to modern times. Political doctrines such as democracy, liberalism, socialism and communism will be analyzed. Emphasis will be given to comparison of different political beliefs, and also to the relationships between the different theories, considered as historic heritage which contribute to contemporary circumstances.

**CIPO 4056. INTRODUCTION TO CRIMINAL LAW.** Three credit hours. Three hours of lecture per week.

Introduction to the general principles, as well as the elements which constitute crimes according to Puerto Rico's Criminal Code.

**CIPO 4065. INTERNATIONAL LAW.** Three credit hours. Three hours of lecture per week.

Study of the legal relations among states and other international subjects such as international organizations.

**CIPO 4075. THE POLITICS OF THE DEVELOPING AREAS.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 3011.

Comparative analysis of the political systems of selected world areas in which racial, social, and political changes are actually taking place.

**CIPO 4085. AMERICAN FOREIGN POLICY.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 3011.

An outline of the modern policy of the United States of America; how it is formulated; the relationship between the American democratic processes and the

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demands of a global foreign policy; and the basic factors shaping it.

**CIPO 4095. GOVERNMENT AND POLITICS OF THE CARIBBEAN.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 3011.

Study and analysis of the government, political processes and political groups in the Caribbean area, including their relations with outside countries.

**CIPO 4105. LATIN AMERICAN GOVERNMENT AND POLITICS.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 3011.

Latin American parties and politics; governmental activities and problems, the structure of government. Emphasis is placed on political realities rather than on formal constitutional provisions.

**CIPO 4115. LATIN AMERICAN INTERNATIONAL RELATIONS.** Three credit hours. Three hours of lecture per week.

Survey of relations among Latin American states and with North America, Europe and Asia. Analysis of Latin America's integration processes and participation in international institutions.

**CIPO 4125. COMMUNIST IDEOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 3011.

A critical historical analysis of the Marxist movement and ideology, including the social and philosophical origins of Marxism; the major economic and political theories of Marx and Engels, the development of Marxism in Tzarist Russia; the theoretical contributions of Lenin and Trotsky, the rise of the Stalinist state, and the interpretations of Tito, Mao Tse-Tung, Khrushchev, Castro and others.

**CIPO 4127. GLOBALIZATION AND WORLD POLITICS.** Three credit hours. Three hours of lecture per week.

The impact of globalization on contemporary world politics. Topics include, among others: the crisis of the capitalist state, the Great Depression, imperialism, regional blocks, and the new economic world order.

**CIPO 4145. RESEARCH METHODS IN POLITICAL SCIENCE.** Three credit hours. Three hours of lecture per week. Prerequisite: 12 credits in Political Science and ESMA 3015 or ESMA 3101.

Quantitative and qualitative research methods in Political Science. Emphasis on the development of

research questions, justification, literature reviews, theoretical framework, concepts, variables, hypotheses, measurement, and research designs. The presentation of oral and written reports and the preparation of a research proposal are required.

**CIPO 4155. RESEARCH SEMINAR IN POLITICAL SCIENCE.** Three credit hours. Three hours of lecture per week. Prerequisite: CIPO 4145.

Application of theories and research methods to Political Science. A scientific, structured and systematic research project is required. Presentation of oral and written reports related to the dissemination of results is also required.

**CIPO 4236. REVOLUTIONS IN TWENTIETH CENTURY LATIN AMERICA.** Three credit hours. Three hours of lecture per week.

Comparative historical analysis of the origins and development of Latin American revolutions in the 20th Century, with emphasis on the nature and direction of social change attendant to revolutions in Mexico, Bolivia, Cuba and Chile.

**CIPO 4735. UNITED NATIONS MODEL.** Five credit hours. Three hours of lecture per week and a United Nations trip.

Study and participation in the Model United Nations through the simulation of the proceedings of the UN. This simulation will be accomplished through the representation of an assigned role on different UN committees. This participation requires travel to the Model UN in New York.

**CIPO/PSIC/SOCI 4991. INDEPENDENT STUDY I.** One to three credit hours. Two to four hours of research per week per credit. Prerequisites: 12 credit hours in psychology or sociology or political science, respectively, and authorization of the Director of the Department.

Research project under the supervision of a faculty member.

**CIPO/PSIC/SOCI 4992. INDEPENDENT STUDY II.** One to three credit hours. Two to four hours of research per week per credit. Prerequisites: PSIC 4991 or SOCI 4991 or CIPO 4991, respectively, and authorization of the Director of the Department.

Research project under the supervision of a faculty member.

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## SOCIAL SCIENCES

### Undergraduate Courses

**CISO/CIPO 3026.** INTRODUCTION TO PUBLIC POLICY ANALYSIS. Three credit hours. Three hours of lecture per week.

Identification and study of state institutions and civil society with respect to their role as stakeholders in the establishment of public policy. Discussion of the process of creating public policy including issue definition, agenda establishment, formulation and adoption of said policy, program implementation and methods of evaluation.

**CISO/CIPO 3027.** CITIZEN PARTICIPATION IN PUBLIC DECISION-MAKING. Three credit hours. Three hours of lecture per week.

Study of citizen participation and its role in planning and public decision-making. Analysis of current participation strategies with emphasis on effective citizen participation in public decision-making at the state and federal levels. In addition, theoretical administrative, sociopolitical and scientific fundamentals of citizen participation will be explored. Case studies concerning the location of infrastructural projects, managing natural resources and environmental protection will be discussed.

**CISO 3121.** AN INTRODUCTION TO THE STUDY OF THE SOCIAL SCIENCES. Three credit hours per semester. Three hours of lecture per week each semester.

This course is directed toward a better understanding of the social forces that have produced the world in which we live. It introduces the student to the basic problems of man in contemporary society, such as the incorporation of the individual in society, population pressure, wealth and freedom.

**CISO 3122.** AN INTRODUCTION TO THE STUDY OF THE SOCIAL SCIENCES. Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: CISO 3121.

This course is directed toward a better understanding of the social forces that have produced the world in which we live. It introduces the student to the basic problems of man in contemporary society, such as the incorporation of the individual in society, population pressure, wealth and freedom.

**CISO 3145.** BIBLIOGRAPHY AND LIBRARY RESEARCH IN THE SOCIAL SCIENCES. Three credit hours. Three hours of lecture per week.

Introduction to the uses of the library: the card catalogue, periodical, indexes, encyclopedias, dictionaries, and other reference reports, and term papers in the social sciences.

**CISO 4056.** PSYCHO-SOCIAL ASPECTS OF GENDER. Three credit hours. Three hours of lecture per week. Prerequisite: CISO 3121.

Psycho-social aspects of behavior in women and men in response to the changing perception of their roles.

**CISO/ANTR 4066.** POLITICAL AND CULTURAL ASPECTS OF INDIGENOUS. Three credit hours. Three hours of lecture per week. Prerequisite: CISO 3121 or ANTR 3005.

Indigenous peoples of Latin America: culture areas; history, "indigenismo," and identity; political, economic, and civil rights.

**CISO 4116.** HUMAN NEEDS AND WELFARE. Three credit hours. Three hours of lecture per week. Prerequisite: CISO 3121.

A critical analysis of how the state has responded to human needs starting with the historical development of social welfare systems in different contexts. Exposition to different theoretical perspectives and to different possible solutions to social problems and situations which guide the available programs and services within the Puerto Rican social context.

**CISO 4117.** FIELD WORK TECHNIQUES. Three credit hours. Three hours of lecture per week. Prerequisite: CISO 3121.

Strategies and techniques to work at different situations in governmental agencies and non governmental organizations, as it's related to social welfare will be studied. The observation, interview and qualitative analysis techniques are applied in field work and through individual and group interventions.

**CISO 4118.** INTERVENTION STRATEGIES WITH FAMILIES. Three credit hours. Three hours of lecture per week. Prerequisites: CISO 3121 and CISO 3145.

Will study approaches and techniques toward the work with families as a human group and with their integrant as individuals. All helping process requires skills in the design and implementation of strategies for facilitating change in the family members. Transforming the family members' relationships. The course will expose

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students to the different theoretical perspectives most used in the work with families. Recent research about the most common problems confronted by families and the strategies to work with it in today's Puerto Rico will be discussed.

**CISO 4119. INTRODUCTION TO MEDIATION AND NON-VIOLENT MANAGEMENT OF CONFLICTS.** Three credit hours. Three hours of lecture per week. Prerequisite: CISO 3121.

Mediation is presented as one of the alternative non adversarial and non-violent ways of conflicts resolution. The role of mediation in resolving conflicts and disputes, be them pertaining to families, commerce, the workplace, or the international arena, among others, is examined. Mediation theories, principles and skills are incorporated and students are provided with opportunities to practice said skills. Current research involving mediation is also discussed, and the way mediation is regulated in Puerto Rico is explained. Other conflict management methods, such as negotiation, facilitation, and arbitration are described.

**CISO 4120. HUMAN WELFARE SEMINAR.** Three credit hours. Three hours of lecture per week. Co-requisites: CISO 4116 or CISO 4117 or CISO 4118 or CISO 4119.

Planning and development of a research or an intervention program/project that promotes human wellness. A research or project proposal, a final written paper and an oral presentation are required.

## **SOCIOLOGY**

**SOCI 3007. ENVIROMENTAL SOCIOLOGY.** Three credit hours. Three hours of lecture per week.

Study of the relationship between humans and the environment with emphasis on the social factors that affect it. Discussion of environmental law and public policy, environmental justice and environmental movements from a Puerto Rican and global perspective. Analysis of the decision-making process at the governmental, group and individual levels with respect to natural resources and the environment in general.

**SOCI 3016. SOCIOLOGY OF HEALTH.** Three credit hours. Three hours of lecture per week.

Social problems and variables related to health delivery systems; structure and functions of health services.

**SOCI 3047. SOCIOLOGY OF RELIGION.** Three credit hours. Three hours of lecture per week.

Bases of the religious phenomenon; social functions; organizational phases; religion in preliterate and civilized societies.

**SOCI 3261. INTRODUCTION TO SOCIOLOGY I.** Three credit hours. Three hours of lecture per week.

Methods and basic concepts in sociology. Relations of the individual with society; social inequality.

**SOCI 3262. INTRODUCTION TO SOCIOLOGY II.** Three credit hours. Three hours of lecture per week. Prerequisite: SOCI 3261.

Study of basic social institutions, processes of social change, and collective behavior.

**SOCI 3265. RESEARCH METHODS IN THE SOCIAL SCIENCES.** Three credit hours. Three hours of lecture per week. Prerequisite: SOCI 3262 or PSIC 3002 or CIPO 3011 or CISO 3122 or ANTR 3015 or ECON 3021.

Critical analysis of the principles and techniques of research in the fields of the various social sciences; discussion of the historical development of these up to the present time; practical application of basic research methods in field work; tabulation, analysis and report writing.

**SOCI 3285. SOCIAL DYNAMICS.** Three credit hours. Three hours of lecture per week. Prerequisite: CISO 3122 or SOCI 3262 or PSIC 3002 or CIPO 3011 or ANTR 3015 or ECON 3021.

Analysis of the social interaction between personalities and the group which they form.

**SOCI 3295. HISTORY OF SOCIAL THOUGHT.** Three credit hours. Three hours of lecture per week.

Detailed analysis of the history of social thought from antiquity to 19th Century Europe.

**SOCI 3305. PRINCIPLES OF POPULATION.** Three credit hours. Three hours of lecture per week. Prerequisite: SOCI 3262 or PSIC 3002 or CISO 3122.

An introduction to theories, concepts, and aspects related to population.



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**SOCI 3315. MARRIAGE AND THE FAMILY.** Three credit hours. Three hours of lecture per week.

The development of the family from primitive to modern times. Special attention is given to the problems confronting the modern family, including those of the Puerto Rican family.

**SOCI 3325. URBAN SOCIOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: CISO 3122 or SOCI 3262 or PSIC 3002.

Study of the theoretical formulation of urban life, with emphasis on the process of urban growth; discussion of topics such as social structure and function of the modern city, ecology, integration between city and country, urban personality, and social aspects of urban renewal.

**SOCI 3337. JUVENILE DELINQUENCY.** Three credit hours. Three hours of lecture per week. Prerequisite: CISO 3121 or SOCI 3261.

Juvenile delinquency as a social phenomenon: its nature, causes, prevention, and treatment. The role of government and community agencies.

**SOCI 3345. SOCIAL ORGANIZATION.** Three credit hours. Three hours of lecture per week. Prerequisites: CISO 3121 or SOCI 3261 or PSIC 3002 or ANTR 3015 or ECON 3021 or HIST 3202.

Discussion of major theories of social structure, change, adjustment and social disorganization.

**SOCI 3355. SOCIETY AND CULTURE IN LATIN AMERICA AND THE CARIBBEAN.** Three credit hours. Three hours of lecture per week.

Introduction to the study of Latin America and the Caribbean. Examines its colonial and postcolonial history, including its political transitions, economic models, racial and ethnic diversity and social-cultural change. Analyzes the creolization of European, African and indigenous institutions, practices and ideas including languages, religions, musical genres, cuisines, and political ideologies. Discusses globalization, and its impact on the region: social movements, migrations and diasporas.

**SOCI /EDFI 4000. SOCIOLOGICAL FUNDAMENTALS OF RECREATION AND SPORTS.** Three credit hours. Three hours of lecture per week.

The interaction among society, sports, and recreation.

**SOCI 4006. SPECIAL TOPICS IN SOCIOLOGY.** Three credit hours. Three hours of lecture per week.

This course highlights special topics in the field of sociology. The thematic content of this course will vary according to the specialty and interests of professors teaching the course and the needs of students.

**SOCI 4095. SOCIAL WORK PRINCIPLES.** Three credit hours. Three hours of lecture per week.

Presentation of the basic principles of social work as they are illustrated in group and community case studies. The student will become acquainted with the work of the social service agencies of Puerto Rico.

**SOCI 4101. CRIMINOLOGY.** Three credit hours per week.

Basic terminology; the legal, sociological and cultural aspects of criminality; factors determining delinquency; psychological and psychophysical aspects of crime; classification of crimes, and penology.

**SOCI 4115. CONTEMPORARY SOCIAL THEORY.** Three credit hours. Three hours of lecture per week. Prerequisite: SOCI 3262.

Consideration of major themes in theory and methodology of selected areas of specialization within sociology and related disciplines.

**SOCI 4125. PUERTO RICAN SOCIOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: SOCI 3262 or PSIC 3002 or CIPO 3011 or ANTR 3015.

A comprehensive course on the structures, institutions, processes and social, political, economic and cultural changes of Puerto Rican society from a sociological perspective. It examines aspects of Puerto Rico's historical and contemporary reality using such categories as social class, gender, race, family, national identity, religion, population processes, land use, social movements, among others.

**SOCI 4145. SOCIAL PLANNING.** Three credit hours. Three hours of lecture per week.

A comprehensive analysis of the principles of social planning and the special problems inherent to planning in a democratic society.

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**SOCI 4155. SOCIAL AND CULTURAL CHANGE.** Three credit hours. Three hours of lecture per week. Prerequisite: SOCI 3262 or PSIC 3002 or CIPO 3011 or ANTR 3015.

An examination of the basic sociological principles of social change. The major points of view will be presented, and data will be used from the fields of anthropology, sociology, psychology and history. Special attention will be given to problems of cultural contact and several specific areas of change which involve fundamental social institutions.

**SOCI 4165. SOCIAL PROBLEMS IN THE CONTEMPORARY WORLD.** Three credit hours. Three hours of lecture per week. Prerequisite: SOCI 3265.

Discussion and special reports on theoretical and methodological approaches to human group behavior, with emphasis on acquainting the student with the work of social agencies. Participation in an original research project is required.

**SOCI 4206. QUALITATIVE RESEARCH METHODS AND TECHNIQUES.** Three credit hours. One and a half hours of lecture and one and a half hours of discussion per week. Prerequisites: SOCI 3262 or authorization of the Director of the Department.

Introduction to the fundamental concepts and debates, as well as the basic techniques of qualitative research in the Social Sciences. Critical analysis of the epistemological debates associated with the search for scientific knowledge by means of various qualitative research methodologies, including structured observation of behavior, ethnography, oral history, discourse analysis, as well as ethical considerations. The relation between social research and qualitative research design will be explored, with emphasis on the formulation of appropriate research questions, the documentation of social phenomena and the discussion, interpretation and analysis of data.

**SOCI 4231. RESEARCH IN SOCIOLOGY I.** Three credit hours. Three hours of lecture per week. Prerequisites: 15 credits in sociology and SOCI 3265.

Discussion regarding the research process, with emphasis on the development of a research proposal.

**SOCI 4232. RESEARCH IN SOCIOLOGY II.** Three credit hours. Three hours of conference per week. Prerequisite: SOCI 4231.

Development and presentation of a research project in the field of sociology.

**SOCI/PSIC/CIPO 4991. INDEPENDENT STUDY I.** One to three credit hours. Two to four hours of research per week per credit. Prerequisites: 12 credit hours in psychology or sociology or political science, respectively, and authorization of the Director of the Department.

Research project under the supervision of a faculty member.

**SOCI/PSIC/CIPO 4992. INDEPENDENT STUDY II.** One to three credit hours. Two to four hours of research per week per credit. Prerequisites: PSIC 4991 or SOCI 4991 or CIPO 4991, respectively, and authorization of the Director of the Department.

Research project under the supervision of a faculty member.

### **Advanced Undergraduate Course**

**SOCI 5005. SOCIOLOGY OF LATIN AMERICA.** Three credit hours. Three hours of lecture per week.

Introduction to sociological concepts and theories as applied to Latin America and the contribution of Latin American studies to the field of sociology. It explores theories of development, poverty and inequality, migration, nation-and-state building, social movements and mobilization, class, gender, race and ethnicity, among other social theories.

**SOCI 5015. ENERGY, ENVIRONMENT, AND SOCIETY.** Three credit hours. Three hours of lecture per week.

Sociological analysis of energy production, distribution and consumption, with emphasis on the global dependency on non-renewable sources and its social and environmental consequences. Discussion of the interrelationship between the public energy policy and contemporary issues at the local and global levels such as climate change, environmental pollution, depletion of natural resources, environmental justice, international tensions and conflicts, and public health.

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## **COLLEGE OF BUSINESS ADMINISTRATION**

### **Educational Objectives**

#### **LEARNING OBJECTIVES**

1. Identify ethical and global issues embodied in realistic scenarios or cases.
2. Make quality contributions in a responsible manner when working in a team.
3. Apply management practices of core business functions to improve the overall performance of a business.
4. Analyze data to make business decisions.
5. Apply technological resources as a business working tool using a computer exercise.
6. Prepare and deliver well organized oral presentations.
7. Communicate effectively in writing using proper grammar and observing business style norms.

#### **Mission**

Prepare qualified graduates for the business world through excellence in education and the advancement of locally and internationally recognized research.

#### **Vision**

To be Puerto Rico's best option in Business Administration with the best students, professors and recruiters.

#### **Culture**

With the purpose of creating a culture that supports our vision and mission, the College of Business Administration:

- Promotes pedagogical approaches that facilitate teaching and learning.
- Maintains undergraduate and graduate curricula that encourage practical experience and are up-to-date with technological and global changes, allowing for competitive differentiation.
- Sponsors active student organizations that encourage leadership and participative citizenship.
- Develops a learning community with common goals, willing to support and serve other faculties within the UPR system and the Caribbean.

- Encourages processes that promote effective communication with our stakeholders.
- Values honesty, service and quality.
- Encourages an organizational culture that procures excellence through a responsive administration with minimum bureaucratic processes, with an environmental conscience for business.
- Supports teamwork.
- Encourages the continuous improvement of our faculty.

### **ACADEMIC PROGRAMS**

The College of Business Administration offers a program of studies leading to a **Bachelor of Science** degree in Business Administration with concentrations in the fields of **Accounting, Computerized Information Systems, Finance, Operations Management, Marketing, and Human Resources Management**. It also offers a Bachelor's degree in **Office Administration**.

The curriculum is divided into three main areas: general education, core courses in business administration and courses in the concentration of choice. The first two areas are applicable to most business concentrations while the last one aims to provide students with an in-depth study in the preferred area of study within the College of Business.

The program is designed with the basic idea that at the undergraduate level it is necessary to expose the student to as many areas of business knowledge as possible. Following this philosophy, the program requires 55 credits in business core subjects.

#### **ACCOUNTING**

The academic concentration is focused on training professionals in public and private accounting. It offers courses that emphasize on procedures and principles for recording business transactions, preparing State and Federal income tax returns, auditing, planning and cost control. The concentration also provides adequate training towards the CPA certification.

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### **Curriculum Requirements**

|                           | <b>Credits</b> |
|---------------------------|----------------|
| General Education Courses | 50             |
| Business Core Courses     | 55             |
| Concentration Courses     | 23             |
| Free Elective Courses     | <u>12</u>      |
|                           | <b>140</b>     |

### **COMPUTERIZED INFORMATION SYSTEMS**

The academic concentration provides students with basic understanding of operational systems and control languages, knowledge of actual business data processing applications, high level languages for program codification, algorithms and systems design, office automation design, management of information resources, and understanding of decision systems. The concentration seeks to prepare an individual to develop and manage a computerized information system oriented towards the needs of any organization. It also provides the opportunity to specialize in other areas such as computer systems, auditing, consulting, sales and marketing of hardware and software, and users' training.

### **Curriculum Requirements**

|                           | <b>Credits</b> |
|---------------------------|----------------|
| General Education Courses | 50             |
| Business Core Courses     | 55             |
| Concentration Courses     | 18             |
| Professional Electives    | 3              |
| Free Elective Courses     | <u>12</u>      |
|                           | <b>138</b>     |

### **FINANCE**

Students who choose this academic concentration will learn financial analysis techniques, international financial mechanisms, the role of financial institutions, how to make sound investment decisions, the impact of the public sector on business firms, current financial trends, and corporate financial management. This concentration is designed for students pursuing a career in banking, government, corporate finance or brokerage firms.

### **Curriculum Requirements**

|                           | <b>Credits</b> |
|---------------------------|----------------|
| General Education Courses | 50             |
| Business Core Courses     | 55             |
| Concentration Courses     | 14             |
| Professional Electives    | 6              |
| Free Elective Courses     | <u>12</u>      |
|                           | <b>137</b>     |

### **OPERATIONS MANAGEMENT**

The academic concentration emphasizes planning, organizing and supervising operational activities in production environments. Skills in decision-making, production-planning and scheduling, inventory control, allocation of resources, and systems analysis are developed. The option qualifies a student to manage operations in manufacturing and service environments.

### **Curriculum Requirements**

|                           | <b>Credits</b> |
|---------------------------|----------------|
| General Education Courses | 50             |
| Business Core Courses     | 55             |
| Concentration Courses     | 14             |
| Professional Electives    | 6              |
| Free Elective Courses     | <u>12</u>      |
|                           | <b>137</b>     |

### **MARKETING**

Marketing students acquire basic knowledge of techniques, policies and procedures required for working with the distribution of products and services in manufacturing and commercial institutions as well as profit and non-profit organizations. Students develop skills needed for selling, planning and controlling inventories, understanding consumer behavior and concepts within the international markets, and the basic principles of personnel and physical distribution.

### **Curriculum Requirements**

|                           | <b>Credits</b> |
|---------------------------|----------------|
| General Education Courses | 50             |
| Business Core Courses     | 55             |
| Concentration Courses     | 14             |
| Professional Electives    | 6              |
| Free Elective Courses     | <u>12</u>      |
|                           | <b>137</b>     |

### **HUMAN RESOURCES MANAGEMENT**

In this academic concentration students acquire knowledge of managerial functions, types of organizations, styles of management; human resources administration and industrial relations; development and management of compensation systems; and an understanding of local and federal statutes affecting employees and businesses. Students develop skills

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needed to work in the management of human resources in a business or government environment.

### **Curriculum Requirements**

|                           | <b>Credits</b> |
|---------------------------|----------------|
| General Education Courses | 50             |
| Business Core Courses     | 55             |
| Concentration Courses     | 17             |
| Professional Electives    | 3              |
| Free Elective Courses     | <u>12</u>      |
|                           | <b>137</b>     |

## **BACHELOR IN OFFICE ADMINISTRATION**

Students will acquire knowledge of accurate administrative procedures, master the use of technology in a modern office and experience a hands-on approach in an office environment. This degree prepares students to perform required tasks in private and business offices, as well as, in government agencies.

### **Curriculum Requirements**

|                           | <b>Credits</b> |
|---------------------------|----------------|
| General Education Courses | 44             |
| Business Core Courses     | 19             |
| Concentration Courses     | 31             |
| Professional Electives    | 12             |
| Recommended Electives     | 6              |
| Free Elective Courses     | <u>12</u>      |
|                           | <b>124</b>     |

## **ACADEMIC REGULATIONS**

The College of Business Administration requires a minimum grade of “C” in each course within each option.

### **COOPERATIVE EDUCATION PROGRAM**

The Cooperative Education Program is a way of combining classroom work and job experience. Each year a selected group of students is allowed to participate in this program. Students selected are employed by different firms and government agencies in Puerto Rico and in the United States. This enables students to obtain work experience as they complete their academic degree.

In this program, a student has the opportunity to apply concepts learned at the university in practical business situations.

Students who wish to participate must obtain authorization from the Dean of Business Administration.

Students selected will be required to comply with the following conditions:

- Work at the assigned firm for a specified period of time.
- Be enrolled at the University in the cooperative education course.

## **INTERNSHIP PROGRAM**

The Internship Program provides each student with supervised work experience in a business enterprise or government agency under the supervision of a faculty member in coordination with an immediate supervisor at the work site. Students receive academic credit and the opportunity to apply acquired knowledge.

To participate in this program, a student must fulfill the following requirements:

- Work a minimum of 4 hours per week, per credit, during 15 weeks.
- Register in the course for up to a maximum of 6 credits.
- Meet the prerequisites of the specific academic program.
- Authorization from the Dean of Business Administration.
- Third year status.
- Minimum 2.50 GPA.

## **MINOR CONCENTRATIONS**

### **General Requirements:**

- Submit the application for the curricular sequence in the Registrar's Office.
- The Minor Concentration will be granted once the student completes graduation requirements.
- Students will declare their intention to obtain this minor concentration on or before passing fifty (50) percent of the credits required in their core curriculum, by using the form provided for this purpose.
- Students complete the Minor Concentration with the requirements of the Bachelor's Degree in which it is officially registered, and within one hundred fifty (150) percent of the time set for completing the degree.
- If the student has passed more than fifty (50) percent of the credits required in their curriculum, they must obtain

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permission from the Dean of the College of Business Administration.

- Students interested in completing this Minor Concentration must be in good standing, cannot be on academic probation or suspended when applying.

### **MINOR CONCENTRATION IN BUSINESS ADMINISTRATION**

Through the completion of this Minor Concentration students from Arts and Sciences, Engineering or Agricultural Sciences can acquire basic knowledge on how a business operates and the relation between its main components.

#### **Learning Goals:**

After completing this minor concentration, students will be able to perform more efficiently and effectively within the organization by applying basic knowledge in the essential areas of business administration such as:

- Management
  - Describe basic principles of management.
- Marketing
  - Discuss the marketing process, and explain consumer behavior.
  - Determine competitive advantage.
  - Apply social responsibility and ethical practices in marketing.
- Financial Accounting
  - Work through the accounting cycle and prepare basic accounting statements.
- Environment of Organizations
  - Contrast and compare the change forces that affect organizations and apply ethical concepts and corporate responsibility

#### **Requirements:**

- Be an active student in Arts and Sciences, Engineering or Agricultural Sciences Faculty.
- Minimum grade point average of 2.20
- Pass five required courses and three or four credits with a minimum grade of "C" on each course.
- The Minor Concentration will be granted once the student completes graduation requirements.

#### **REQUIRED COURSES**

|           |   |  |
|-----------|---|--|
| ADMI 3009 | 4 | Introduction to Business, Management, and Ethics |
| CONT 3011 | 3 | Financial Accounting Principles I                |
| CONT 3012 | 3 | Financial Accounting Principles II               |

|           |   |                            |
|-----------|---|----------------------------|
| GERH 4008 | 3 | Human Resources Management |
| MERC 3115 | 3 | Principles of Marketing    |

#### **ELECTIVE COURSES (3 or 4 credits)**

|           |   |  |
|-----------|---|--|
| ADMI 3010 | 2 | Computer Competencies for Managerial Decision Making |
| ADMI 3017 | 2 | Introduction to Enterprise Development               |
| ADMI 4001 | 3 | Introduction to Law                                  |
| ADOF 3016 | 3 | Keyboarding and Applications I                       |
| GERH 4025 | 3 | Organizational Behavior                              |
| FINA 3016 | 4 | Business Analysis Using Financial Reports            |
| MERC 3117 | 3 | Selling and Sales Management                         |

### **MINOR CONCENTRATION IN ENTREPRENEURIAL DEVELOPMENT**

The College of Business Administration, through this minor concentration provides the students the necessary skills and knowledge to establish their own business. Students completing this curricular sequence will be able to identify opportunities that could become new enterprises, develop a business plan which will enable them to obtain the required initial capital, and manage change and develop growth opportunities. The student will also develop interpersonal skills, which are required to work efficiently with other people in the development and administration of the new business.

#### **Learning Goals:**

After completing this sequence, the student will be able to:

- Identify opportunities to create new products or services.
- Analyze all the important elements to decide the viability of a new business.
- Explain the importance of developing a comprehensive business plan for the establishment of a small or medium size business in Puerto Rico.
- Identify financial resources needed to establish and develop a business.
- Analyze the effects that the changing environment has upon the business, and evaluate techniques to adjust, adapt and grow.

**Requirements:**

- Be an active student in the Arts and Sciences, Business Administration, Engineering, or Agricultural Sciences Faculty.
- Submit the application for the curricular sequence in the Registrar's Office.
- Minimum grade point average of 2.0.
- Pass four required courses and two elective courses with a minimum grade of "C" on each course.
- The Certificate will be granted once the student completes graduation requirements.

**REQUIRED COURSES****(For Business Administration Students)**

|           |   |   |
|-----------|---|---|
| ADMI 3100 | 3 | New Business Development                  |
| ADMI 3150 | 3 | Business Plan Development                 |
| ADMI 3155 | 3 | Creativity and Entrepreneurial Innovation |

**REQUIRED COURSES****(For students of College of Arts and Sciences, College of Agricultural Sciences, College of Engineering and Office Administration Institute)**

|           |   |   |
|-----------|---|---|
| ADMI 3017 | 3 | Introduction to Enterprise Development    |
| ADMI 3100 | 3 | New Business Development                  |
| ADMI 3150 | 3 | Business Plan Development                 |
| ADMI 3155 | 3 | Creativity and Entrepreneurial Innovation |

**ELECTIVE COURSES****(1 elective course)**

|           |   |  |
|-----------|---|--|
| ADMI 3125 | 3 | Technology Based Entrepreneurship                                |
| ADMI 4335 | 3 | Change and Growth Strategies for Small and Midsize Businesses    |
| ADMI 4996 | 3 | Small Business Advising  |
| FINA 3035 | 3 | Personal Financial Management                                    |
| FINA 3037 | 3 | Financial Analysis and Financing of Small and Medium Enterprises |
| CONT 5006 | 3 | Tax Liabilities for Businesses in Puerto Rico                    |

**MINOR CONCENTRATION IN  
OFFICE ASSISTANT**

The Institute of Office Administration of the College of Business Administration offers a minor concentration to enable its participants to learn to manage office processes efficiently using the most recent and advanced techniques in office administration.

**Learning Goals:**

After completing this minor concentration, students will be able to:

- Operate high tech office equipment.
- Operate the keyboard applying the correct techniques.
- Create office documents.
- Process and apply correct filing techniques.
- Develop procedures to handle office processes efficiently.

**Specific Requirements:**

- Be an active student in the Arts and Sciences, Business Administration, Engineering, or Agricultural Sciences Faculty.
- Minimum grade point average of 2.20.
- Pass four required courses and two elective courses with a minimum grade of "C" on each course

**REQUIRED COURSES**

|              |   |                                  |
|--------------|---|----------------------------------|
| ADOF 3016 or | 3 | Keyboarding and Applications I   |
| CISE 3049    | 3 | Keyboarding and Typewriting      |
| ADOF 3017    | 3 | Keyboarding and Applications II  |
| ADOF 3009    | 3 | Records Management               |
| ADOF 4019    | 3 | Administrative Office Procedures |

**ELECTIVE COURSES****(Select two of the following courses)**

|           |   |  |
|-----------|---|--|
| ADOF 3036 | 3 | Information Processing and Billing Services in Medical Offices |
| ADOF 3107 | 3 | Office Concepts, Systems and technology                        |
| ADOF 3115 | 3 | Telecommunications in the Modern Office                        |
| ADOF 3125 | 3 | Legal Office Administration                                    |
| ADOF 4075 | 4 | Integration of Information Processing Programs                 |
| ADOF 4065 | 3 | Introduction of Word Processing                                |

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## MINOR CONCENTRATION IN PROJECT MANAGEMENT

The minor concentration in project management provides the fundamentals of planning, management, and control of projects through theoretical concepts and practical experience.

### Learning Goals:

After completing this minor concentration, the student will be able to:

- Explain the strategic nature of project management to contemporary organizations
- Compare different types of organizational structures in project management
- Develop the project plan, including the work breakdown structure and the schedule for the project activities
- Discuss the importance of budget planning, management and control within a project's context
- Explain the effect of ethics, planning, communication, group work, conflict management, and negotiation on the success of a project
- Apply computer software to the planning, management, and control of a project
- Discuss the importance of activities such as monitoring, control, auditing, and completion in the process of continuous improvement of project management
- Apply the best practices of project management to the different areas of study

### Specific Requirements:

- Be an active student in the University of Puerto Rico at Mayaguez Campus.
- Minimum grade point average of 2.20.
- Pass three required courses with a minimum grade of "C" on each course.

### REQUIRED COURSES (For Business Administration students)

|           |   |  |
|-----------|---|--|
| ADMI 4116 | 3 | The Human Dimension of Project Management          |
| GERE 4085 | 3 | Project Management Applications in Business        |
| INGE 4008 | 3 | Interdisciplinary Approaches to Project Management |

### REQUIRED COURSES (For students of College of Arts and Sciences, College of Agricultural Sciences, College of Engineering and Office Administration Institute)

|            |   |  |
|------------|---|--|
| ADMI 4085* | 3 | Fundamentals of Project Management                 |
| GERE 4085* | 3 | Project Management Applications in Business        |
| INGE 4008  | 3 | Interdisciplinary Approaches to Project Management |

\*Engineering students must substitute this course for one of the courses of the following table:

|           |  |
|-----------|--|
| ININ 4018 | Discrete-Event System Simulation           |
| ININ 5575 | Sequencing and Scheduling of Resources     |
| ININ 5006 | Systems Engineering and Analysis           |
| INCI 4055 | Construction Engineering and Management I  |
| INCI 4056 | Construction Engineering and Management II |
| INCI 5010 | Sustainable Construction                   |
| INCI 5029 | Principles of City Planning                |
| INCI 4998 | Undergraduate Research                     |
| INCI 5995 | Special Topics                             |
| INCI 5996 | Special Problems                           |

## MINOR CONCENTRATION IN ACCOUNTING

This Minor Concentration is intended to give the opportunity to expand their Accounting skills to students who are not majoring in Accounting.

### Learning Goals:

After completing this minor concentration, the students will be able to:

- Understand more rigorously the processes of recording, summarizing, analyzing and disclosing financial information of organizations;
- Ensure compliance with fiscal responsibility with knowledge of the Puerto Rico and USA tax systems.

### Specific Requirements:

- Be an active student of the College of Arts and Sciences, Engineering, Agricultural Sciences or Business Administration, except the students majoring in Accounting.
- Minimum general grade point average of 2.20.



- Pass three required courses and one elective courses with a minimum grade of “C” on each course.

### REQUIRED COURSES

|           |    |                            |
|-----------|----|----------------------------|
| CONT 3007 | 4  | Intermediate Accounting I  |
| CONT 3008 | 4  | Intermediate Accounting II |
| CONT 4009 | 3  | Income Tax of Puerto Rico  |
| or        | or |                            |
| CONT4007  | 3  | Federal Income Tax         |

### Elective courses (Select one of the following courses)

|           |    |   |
|-----------|----|---|
| CONT 4078 | 3  | Cost Accounting   |
| CONT 4009 | 3  | Income Tax of Puerto Rico   |
| or        | or |   |
| CONT 4007 | 3  | Federal Income Tax  |
| CONT 4016 | 3  | Recent Developments in Accounting                                     |
| CONT 4017 | 3  | Auditing  |
| CONT 4037 | 3  | Accounting Information Systems  |
| CONT 4045 | 3  | Advanced Accounting I   |
| CONT 4046 | 3  | Accounting for Governmental Entities and Not for Profit Organizations |
| CONT 5006 | 3  | Tax Liabilities for Businesses in Puerto Rico                         |

### MINOR CONCENTRATION IN COMPUTERIZED INFORMATION SYSTEMS

This Minor Concentration is intended for students who are not majoring in Computerized Information Systems and wish to increase their knowledge in information systems with a managerial emphasis. The purpose is to give the student the skills for the effective communication between management and the information system in an organization.

#### Learning Goals:

After completing this minor concentration, the student will be able to:

- Describe the importance of information systems, their relationship with the structure of an organization and how information systems support various business functions.
- Analyze, design and develop computer applications to meet business needs.

- Use the tools and techniques of life cycle of systems development.
- Develop the ability to be self-taught to learn and apply new technologies to the working environment.

#### Specific Requirements:

- Be an active student of the College of Arts and Sciences, Engineering, Agricultural Sciences or Business Administration, except the students majoring in the Computerized Information Systems.
- Minimum general grade point average of 2.20.
- Pass four required courses with a minimum grade of “C” on each course.

### REQUIRED COURSES

|           |   |   |
|-----------|---|---|
| SICI 3018 | 2 | Fundamentals of Information Systems     |
| SICI 3029 | 3 | Programming Fundamentals for Business   |
| SICI 4046 | 3 | Information Systems Analysis and Design |
| SICI 4095 | 3 | Data Base Development                   |

### MINOR CONCENTRATION IN OPERATIONS MANAGEMENT

The purpose of this minor concentration is to provide students with basic knowledge of an operating system that specializes in the production of goods or performance of services in the context of a modern organization. Students learn to use quantitative techniques that allow them to analyze problems and make decisions.

#### Learning Goals:

After completing this minor concentration, the student will be able to:

- Manage properly inventory in businesses
- Control the quality in the manufacturing process or service delivery
- Determining the amount of material to be acquired for the manufacturing process while keeping costs to the lowest possible level
- Determining the demand for the product on the market and the resources needed to provide excellent service to consumers

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**Specific Requirements:**

- Be an active student of the Faculty of Arts and Sciences, Engineering, Agricultural Sciences or Business Administration, except the students majoring in Operations Management.
- Minimum general grade point average of 2.50.
- Pass four required courses with a minimum grade of "C" on each course.

**REQUIRED COURSES**

|           |   |   |
|-----------|---|---|
| GERE 4008 | 3 | Quantitative Methods in Operations Management |
| GERE 4009 | 3 | Production Planning and Control               |
| GERE 4045 | 3 | Supply Chain Management                       |
| GERE 4055 | 3 | Service Operations Management                 |

**MINOR CONCENTRATION IN FINANCE**

This Minor Concentration is intended for students who are not majoring in Finance and wish to increase their knowledge in this area with a managerial emphasis. Corporate finance concepts in both private and public companies will be taught.

**Learning Goals:**

After completing this minor concentration, the student will be able to:

- Know the theories and understand the operation of our macro - economic environment, creating and managing money and financial markets
- Manage the financial tasks of both private enterprise and the public sector
- Understand the role of financial institutions and market trends

**Specific Requirements:**

- Be an active student of the College of Arts and Sciences, Engineering, Agricultural Sciences or Business Administration, except the students majoring in Finance.
- Minimum general grade point average of 2.50.
- Pass three required courses with a minimum grade of "C" on each course.

**REQUIRED COURSES**

|           |   |                                      |
|-----------|---|--------------------------------------|
| FINA 4028 | 3 | International Finance                |
| FINA 4036 | 3 | Management of Financial Institutions |
| FINA 4037 | 3 | Financial Investment Management      |

**MINOR CONCENTRATION IN MARKETING**

This Minor Concentration is intended for students who are not majoring in Marketing and wish to increase their knowledge in Marketing with a managerial emphasis.

**Learning Goals:**

After completing this minor concentration, the student will:

- Have the skills necessary to study and understand the consumer on a local and international market.
- Understand consumer behavior to make decisions about the product, price, promotion strategies and distribution.

**Specific Requirements:**

- Be an active student of the College of Arts and Sciences, Engineering, Agricultural Sciences or Business Administration, except the students majoring in Marketing.
- Minimum general grade point average of 2.0.
- Pass three required courses and one elective course with a minimum grade of "C" on each course.

**REQUIRED COURSES**

|           |   |                                     |
|-----------|---|-------------------------------------|
| MERC 4065 | 3 | Global Marketing Strategies         |
| MERC 4217 | 3 | Consumer Behavior                   |
| MERC 4230 | 3 | Integrated Marketing Communications |

**ELECTIVE COURSES**

(Select one of the following courses)

|           |   |                                     |
|-----------|---|-------------------------------------|
| MERC 3117 | 3 | Selling and Sales Management        |
| MERC 4215 | 3 | Retail Management                   |
| MERC 4218 | 3 | Management of Physical Distribution |

### MINOR CONCENTRATION IN HUMAN RESOURCES MANAGEMENT

The student will better understand the role of human resources in a public or private company and its strategic importance in making management decisions.

#### Learning Goals:

After completing the minor concentration, the student will be able to:

- Make recommendations that impact the design of the organizational structure of an entity.
- Create and manage compensation and benefits structures in public or private companies.
- Assist in the development and formulation of policies and other issues in the area of Human Resources aligned to the strategic plan of the organization.

#### Specific Requirements:

- Be an active student of the College of Arts and Sciences, Engineering, Agricultural Sciences or Business Administration, except the students majoring in Human Resources Management.
- Minimum general grade point average of 2.20.
- Pass three required courses with a minimum grade of "C" on each course.

### REQUIRED COURSES

|                              |   |                                   |
|------------------------------|---|-----------------------------------|
| ESOR 4007<br>or<br>GERH 4007 | 3 | Organizational Design             |
| GERH 4015                    | 3 | Workforce Planning and Employment |
| ESOR 4019<br>or<br>GERH 4019 | 3 | Compensation Management           |

## PROGRAMS OF STUDY

### ACCOUNTING CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits  | Course                                 |
|------------|----------|--|
| *MATE 3171 | 3        | <b>Pre-Calculus I</b>                  |
| *INGL ---- | 3        | <b>First year course in English</b>    |
| *ESPA 3101 | 3        | <b>Basic course in Spanish I</b>       |
| ADMI 3017  | 2        | Introduction to Enterprise Development |
| CONT 3011  | 3        | Financial Accounting Principles I      |
| EDFI ----  | <u>2</u> | <b>Physical Education Elective</b>     |
|            | 16       |  |

##### Second Semester

| Number     | Credits  | Course   |
|------------|----------|--|
| MATE 3049  | 3        | <b>Mathematical Analysis for Management Sciences</b> |
| *INGL ---- | 3        | <b>First year course in English</b>                  |
| *ESPA 3102 | 3        | <b>Basic course in Spanish II</b>                    |
| ADMI 3009  | 4        | Introduction to Business, Management, and Ethics     |
| CONT 3012  | 3        | Financial Accounting Principles II                   |
| ADMI 3010  | <u>2</u> | Computer Competence for Managerial Decision Making   |
|            | 18       |  |

#### SECOND YEAR

##### First Semester

| Number     | Credits | Course   |
|------------|---------|--|
| CONT 3007  | 4       | INTERMEDIATE ACCOUNTING I                      |
| *INGL ---- | 3       | <b>Second year course in English</b>           |
| ESTA 3001  | 3       | Business Statistics I                          |
| ECON 3021  | 3       | <b>Principles of Economics: Microeconomics</b> |
| FINA 3016  | 4       | Business Analysis Using Financial Reports      |
|            | 17      |  |

## Second Semester

| Number                 | Credits  | Course                                       |
|------------------------|----------|--|
| CONT 3008              | 4        | INTERMEDIATE ACCOUNTING II                   |
| <b>^*INGL ----</b>     | 3        | <b>Second year course in English</b>         |
| ESTA 3002              | 3        | Business Statistics II                       |
| <b>ECON 3022</b>       | <b>3</b> | <b>Principles of Economy: Macroeconomics</b> |
| ESOR 4008 or GERH 4008 | <u>3</u> | Human Resources Management                   |
|                        | 16       |  |

## THIRD YEAR

### First Semester

| Number                 | Credits  | Course                       |
|------------------------|----------|------------------------------|
| CONT 4078              | 3        | COST ACCOUNTING              |
| CONT 4045              | 3        | ADVANCED ACCOUNTING I        |
| MERC 3115              | 3        | Principles of Marketing      |
| ESPA 3215              | 3        | Expression and Communication |
| ESOR 4025 or GERH 4025 | 3        | Organizational Behavior      |
| GERE 4046              | <u>4</u> | Operations Management        |
|                        | 19       |                              |

### Second Semester

| Number          | Credits  | Course                                  |
|-----------------|----------|---|
| CONT 4009       | 3        | INCOME TAX OF PUERTO RICO               |
| ADMI 4039       | 3        | Business Research Methods               |
| ADMI 4085       | 3        | Fundamentals of Project Management      |
| FINA 3017       |          | Money, Banking, and Economic Conditions |
| <b>ELECTIVE</b> | <b>3</b> | <b>Elective in Natural Sciences</b>     |
| CONT 4016       | <u>3</u> | RECENT DEVELOPMENTS IN ACCOUNTING       |
|                 | 18       |   |

## FOURTH YEAR

### First Semester

| Number           | Credits  | Course  |
|------------------|----------|---|
| ADMI 4001        | 3        | Introduction to Law                                   |
| <b>ECON 3085</b> | <b>3</b> | <b>Economic and Social Development of Puerto Rico</b> |
| <b>+ELECTIVE</b> | 3        | <b>Elective in Social Sciences</b>                    |
| <b>+ELECTIVE</b> | 3        | <b>Elective in Humanities</b>                         |
| <b>ELECTIVE</b>  | 3        | <b>Free Elective</b>                                  |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>                                  |
|                  | 18       |   |

## Second Semester

| Number           | Credits  | Course   |
|------------------|----------|--|
| CONT 4017        | 3        | AUDITING AND SYSTEM                              |
| ADMI 4002        | 3        | Business Law                                     |
| ADMI 4018        | 3        | Strategic Management                             |
| <b>+ELECTIVE</b> | <b>3</b> | <b>Elective in Social Sciences or Humanities</b> |
| <b>ELECTIVE</b>  | 3        | <b>Free Elective</b>                             |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>                             |
|                  | 18       |  |

## COURSES IN CAPITAL LETTERS WILL BE CONSIDERED IN COMPUTING MAJOR GPA

General Education Requirements are identified in Bold.

Total credits required for program: 140

\*Refer to the Academic Regulations section for information on Advanced Placement.

^ \*Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

+The nine (9) credits hours of Social Sciences or Humanities Electives will be selected by the student with the advisor's approval, from a list of recommended courses

## PROFESSIONAL ELECTIVES

|           |   |
|-----------|---|
| ADMI 4997 | Business Practice for Coop Students                                   |
| CONT 4007 | Federal Income Tax  |
| CONT 4027 | Analysis and Cost Control   |
| CONT 4037 | Accounting Information Systems  |
| CONT 4046 | Accounting for Governmental Entities and Not for Profit Organizations |
| CONT 4048 | Advanced Accounting II  |
| CONT 4995 | Accounting Internship   |

## COMPUTERIZED INFORMATION SYSTEMS CURRICULUM

### FIRST YEAR

#### First Semester

| Number            | Credits | Course   |
|-------------------|---------|--|
| <b>*MATE 3171</b> | 3       | <b>Pre-Calculus I</b>                              |
| <b>*INGL ----</b> | 3       | <b>First year course in English</b>                |
| <b>*ESPA 3101</b> | 3       | <b>Basic course in Spanish I</b>                   |
| ADMI 3010         | 2       | Computer Competence for Managerial Decision Making |

|                  |   |  |
|------------------|---|--|
| <b>ECON 3021</b> | 3 | <b>Principles of Economics: Microeconomics</b> |
| <b>EDFI ----</b> | 1 | <b>Physical Education Elective</b>             |

15

#### Second Semester

| Number            | Credits | Course   |
|-------------------|---------|--|
| <b>MATE 3049</b>  | 3       | <b>Mathematical Analysis for Management Sciences</b> |
| <b>*INGL ----</b> | 3       | <b>First year course in English</b>                  |
| <b>*ESPA 3102</b> | 3       | <b>Basic course in Spanish II</b>                    |
| SICI 3018         | 2       | Fundamentals of Information Systems                  |
| <b>ECON 3022</b>  | 3       | <b>Principles of Economy: Macroeconomics</b>         |
| ADMI 3009         | 4       | Introduction to Business, Management, and Ethics     |

18

#### SECOND YEAR

##### First Semester

| Number            | Credits | Course                                 |
|-------------------|---------|--|
| SICI 3029         | 3       | PROGRAMMING FUNDAMENTALS FOR BUSINESS  |
| <b>*INGL ----</b> | 3       | <b>Second year course in English</b>   |
| ESTA 3001         | 3       | Business Statistics I                  |
| ADMI 3017         | 2       | Introduction to Enterprise Development |
| CONT 3011         | 3       | Financial Accounting Principles I      |
| ADMI 4085         | 3       | Fundamentals of Project Management     |

17

##### Second Semester

| Number                 | Credits | Course                                  |
|------------------------|---------|---|
| SICI 4046              | 3       | INFORMATION SYSTEMS ANALYSIS AND DESIGN |
| <b>^*INGL ----</b>     | 3       | <b>Second year course in English</b>    |
| ESTA 3002              | 3       | Business Statistics II                  |
| ESOR 4008 or GERH 4008 | 3       | Human Resources Management              |
| CONT 3012              | 3       | Financial Accounting Principles II      |
| MERC 3115              | 3       | Principles of Marketing                 |

18

#### THIRD YEAR

##### First Semester

| Number          | Credits  | Course                              |
|-----------------|----------|-------------------------------------|
| SICI 4095       | 3        | DATABASE DEVELOPMENT                |
| ESPA 3215       | 3        | Expression and Communication        |
| ESOR 4025       | or       |                                     |
| GERH 4025       | 3        | Organizational Behavior             |
| GERE 4046       | 4        | Operations Management               |
| ADMI 4001       | 3        | Introduction to Law                 |
| <b>ELECTIVE</b> | <u>3</u> | <b>Elective in Natural Sciences</b> |

19

##### Second Semester

| Number          | Credits  | Course  |
|-----------------|----------|---|
| SICI 4146       | 2        | HARDWARE AND SOFTWARE TECHNOLOGY IN INFORMATION SYSTEMS |
| ADMI 4039       | 3        | Business Research Methods                               |
| FINA 3016       | 4        | Business Analysis Using Financial Reports               |
| FINA 3017       | 3        | Money, Banking, and Economic Conditions                 |
| ADMI 4002       | 3        | Business Law  |
| <b>ELECTIVE</b> | <u>3</u> | <b>Free Elective</b>                                    |

18

#### FOURTH YEAR

##### First Semester

| Number           | Credits  | Course  |
|------------------|----------|---|
| SICI 4089        | 3        | DATA COMMUNICATIONS AND NETWORKING                    |
| <b>ECON 3085</b> | 3        | <b>Economic and Social Development of Puerto Rico</b> |
| <b>EDFI ----</b> | 1        | <b>Physical Education Elective</b>                    |
| <b>+ELECTIVE</b> | 3        | <b>Elective in Humanities</b>                         |
| <b>+ELECTIVE</b> | 3        | <b>Elective in Social Sciences</b>                    |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>                                  |

16

##### Second Semester

| Number           | Credits  | Course   |
|------------------|----------|--|
| SICI 4097        | 2        | SYSTEMS DEVELOPMENT                              |
| ADMI 4018        | 3        | Strategic Management                             |
| <b>+ELECTIVE</b> | <b>3</b> | <b>Elective in Social Sciences or Humanities</b> |
| <b>ELECTIVE</b>  | 3        | Professional Elective                            |
| <b>ELECTIVE</b>  | 3        | <b>Free Elective</b>                             |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>                             |

17

**COURSES IN CAPITAL LETTERS WILL BE CONSIDERED IN COMPUTING MAJOR GPA**  
**General Education Requirements are identified in Bold.**

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**Total credits required for program: 138**

\*Refer to the Academic Regulations section for information on Advanced Placement.

^\*Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

+The nine (9) credits hours of Social Sciences or Humanities Electives will be selected by the student with the advisor's approval, from a list of recommended courses

**PROFESSIONAL ELECTIVES**

|           |   |
|-----------|---|
| ADMI 4997 | Business Practice for Coop Students                                 |
| COMP 3010 | Introduction to Computer Programming I                              |
| COMP 3075 | Introduction to Data Structures                                     |
| COMP 3110 | Introduction to Computer Programming II                             |
| SICI 3058 | Programming in C Language   |
| SICI 4096 | Management of Contemporary Issues in Management Information Systems |
| SICI 4144 | Business Programming Languages                                      |
| SICI 4155 | Decision Making Support Systems                                     |
| SICI 4157 | Advanced Data Base Concepts   |
| SICI 4168 | Electronic Data Processing  |
|           | Auditing  |
| SICI 4175 | Introduction to Java Programming                                    |
| SICI 4308 | Networking and Routing Fundamentals                                 |
| SICI 4995 | Computerized Information Systems Internship                         |
| SICI 5318 | Intermediate Routing, Switching and Wide Area Networks              |

**FINANCE CURRICULUM****FIRST YEAR****First Semester**

| Number     | Credits  | Course                                 |
|------------|----------|--|
| *MATE 3171 | 3        | <b>Pre-Calculus I</b>                  |
| *INGL ---- | 3        | <b>First year course in English</b>    |
| *ESPA 3101 | 3        | <b>Basic course in Spanish I</b>       |
| ADMI 3017  | 2        | Introduction to Enterprise Development |
| CONT 3011  | 3        | Financial Accounting Principles I      |
| EDFI ----  | <u>2</u> | <b>Physical Education Elective</b>     |
|            | 16       |  |

**Second Semester**

| Number     | Credits  | Course   |
|------------|----------|--|
| MATE 3049  | 3        | <b>Mathematical Analysis for Management Sciences</b> |
| *INGL ---- | 3        | <b>First year course in English</b>                  |
| *ESPA 3102 | 3        | <b>Basic course in Spanish II</b>                    |
| ADMI 3009  | 4        | Introduction to Business, Management, and Ethics     |
| CONT 3012  | 3        | Financial Accounting Principles II                   |
| ADMI 3010  | <u>2</u> | Computer Competence for Managerial Decision Making   |
|            | 18       |  |

**SECOND YEAR****First Semester**

| Number     | Credits  | Course   |
|------------|----------|--|
| *INGL ---- | 3        | <b>Second year course in English</b>           |
| ESTA 3001  | 3        | Business Statistics I                          |
| MERC 3115  | 3        | Principles of Marketing                        |
| ECON 3021  | 3        | <b>Principles of Economics: Microeconomics</b> |
| FINA 3016  | <u>4</u> | Business Analysis Using Financial Reports      |
|            | 16       |  |

**Second Semester**

| Number                 | Credits  | Course                                       |
|------------------------|----------|--|
| ^*INGL ----            | 3        | <b>Second year course in English</b>         |
| ESTA 3002              | 3        | Business Statistics II                       |
| FINA 4046              | 3        | CORPORATE FINANCE                            |
| GERE 4046              | 4        | Operations Management                        |
| ECON 3022              | <b>3</b> | <b>Principles of Economy: Macroeconomics</b> |
| ESOR 4025 or GERH 4025 | <u>3</u> | Organizational Behavior                      |
|                        | 19       |  |

**THIRD YEAR****First Semester**

| Number                 | Credits  | Course                                  |
|------------------------|----------|---|
| FINA 3017              | 3        | Money, Banking, and Economic Conditions |
| ELECTIVE               | <b>3</b> | <b>Elective in Natural Sciences</b>     |
| ESPA 3215              | 3        | Expression and Communication            |
| ADMI 4001              | 3        | Introduction to Law                     |
| ADMI 4085              | 3        | Fundamentals of Project Management      |
| ESOR 4008 or GERH 4008 | <u>3</u> | Human Resources Management              |
|                        | 18       |   |

**Second Semester**

| Number           | Credits  | Course                                   |
|------------------|----------|--|
| FINA 4036        | 3        | ADMINISTRATION OF FINANCIAL INSTITUTIONS |
| ADMI 4039        | 3        | Business Research Methods                |
| ADMI 4002        | 3        | Business Law                             |
| <b>+ELECTIVE</b> | 3        | <b>Elective in Social Sciences</b>       |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>                     |
|                  | 15       |  |

**FOURTH YEAR****First Semester**

| Number           | Credits  | Course  |
|------------------|----------|---|
| FINA 4037        | 3        | FINANCIAL INVESTMENT MANAGEMENT                       |
| <b>ECON 3085</b> | 3        | <b>Economic and Social Development of Puerto Rico</b> |
| <b>+ELECTIVE</b> | 3        | <b>Elective in Humanities</b>                         |
| <b>ELECTIVE</b>  | 3        | Professional Elective                                 |
| <b>ELECTIVE</b>  | 3        | <b>Free Elective</b>                                  |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>                                  |
|                  | 18       |   |

**Second Semester**

| Number           | Credits  | Course   |
|------------------|----------|--|
| FINA 4028        | 3        | INTERNATIONAL FINANCE                            |
| FINA 4069        | 2        | INTEGRATIVE FINANCE                              |
| ADMI 4018        | 3        | Strategic Management                             |
| <b>+ELECTIVE</b> | 3        | <b>Elective in Social Sciences or Humanities</b> |
| <b>ELECTIVE</b>  | 3        | Professional Elective                            |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>                             |
|                  | 17       |  |

**COURSES IN CAPITAL LETTERS WILL BE CONSIDERED IN COMPUTING MAJOR GPA**

**General Education Requirements are identified in Bold.**  
**Total credits required for program: 137**

\*Refer to the Academic Regulations section for information on Advanced Placement.

^\*Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

+The nine (9) credits hours of Social Sciences or Humanities Electives will be selected by the student with the advisor's approval, from a list of recommended courses

**PROFESSIONAL ELECTIVES**

|           |  |
|-----------|--|
| ADMI 4997 | Business Practice for Coop Students                              |
| FINA 3018 | Working Capital Management                                       |
| FINA 3035 | Personal Financial Management                                    |
| FINA 3037 | Financial Analysis and Financing of Small and Medium Enterprises |
| FINA 4047 | Investment Analysis and Portfolio Selection                      |
| FINA 4048 | Credit and Collection Management                                 |
| FINA 4055 | Financial Derivatives  |
| FINA 4995 | Finance Internship   |

**OPERATIONS MANAGEMENT CURRICULUM****FIRST YEAR****First Semester**

| Number            | Credits  | Course   |
|-------------------|----------|--|
| <b>*MATE 3171</b> | 3        | <b>Pre-Calculus I</b>                            |
| <b>*INGL ----</b> | 3        | <b>First year course in English</b>              |
| <b>*ESPA 3101</b> | 3        | <b>Basic course in Spanish I</b>                 |
| ADMI 3009         | 4        | Introduction to Business, Management, and Ethics |
| <b>ECON 3021</b>  | <u>3</u> | <b>Principles of Economics: Microeconomics</b>   |
|                   | 16       |  |

**Second Semester**

| Number            | Credits  | Course   |
|-------------------|----------|--|
| <b>MATE 3049</b>  | 3        | <b>Mathematical Analysis for Management Sciences</b> |
| <b>*INGL ----</b> | 3        | <b>First year course in English</b>                  |
| <b>*ESPA 3102</b> | 3        | <b>Basic course in Spanish II</b>                    |
| ADMI 3010         | 2        | Computer Competence for Managerial Decision Making   |
| ADMI 3017         | 2        | Introduction to Enterprise Development               |
| <b>ECON 3022</b>  | <u>3</u> | <b>Principles of Economy: Macroeconomics</b>         |
|                   | 16       |  |

**SECOND YEAR****First Semester**

| Number            | Credits  | Course                               |
|-------------------|----------|--------------------------------------|
| <b>*INGL ----</b> | 3        | <b>Second year course in English</b> |
| ESTA 3001         | 3        | Business Statistics I                |
| CONT 3011         | 3        | Financial Accounting Principles I    |
| MERC 3115         | 3        | Principles of Marketing              |
| <b>EDFI ----</b>  | 2        | <b>Physical Education Elective</b>   |
| <b>ELECTIVE</b>   | <u>3</u> | <b>Elective in Natural Sciences</b>  |
|                   | 17       |                                      |

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**Second Semester**

| Number                    | Credits  | Course                               |
|---------------------------|----------|--------------------------------------|
| <b>^*INGL ----</b>        | 3        | <b>Second year course in English</b> |
| ESTA 3002                 | 3        | Business Statistics II               |
| GERE 4046                 | 4        | Operations Management                |
| CONT 3012                 | 3        | Financial Accounting Principles II   |
| ESOR 4008 or<br>GERH 4008 | <u>3</u> | Human Resources Management           |
|                           | 16       |                                      |

**THIRD YEAR****First Semester**

| Number                    | Credits  | Course  |
|---------------------------|----------|---|
| GERE 4008                 | 3        | QUANTITATIVE METHODS IN OPERATIONS MANAGEMENT |
| ADMI 4001                 | 3        | Introduction to Law                           |
| <b>ESPA 3215</b>          | 3        | <b>Expression and Communication</b>           |
| FINA 3016                 | 4        | Business Analysis Using Financial Reports     |
| ADMI 4085                 | 3        | Fundamentals of Project Management            |
| ESOR 4025 or<br>GERH 4025 | <u>3</u> | Organizational Behavior                       |
|                           | 19       |   |

**Second Semester**

| Number           | Credits  | Course                                  |
|------------------|----------|---|
| GERE 4055        | 3        | SERVICE OPERATIONS MANAGEMENT           |
| ADMI 4002        | 3        | Business Law                            |
| GERE 4009        | 3        | Production Planning and Control         |
| FINA 3017        | 3        | Money, Banking, and Economic Conditions |
| <b>+ELECTIVE</b> | 3        | <b>Elective in Social Sciences</b>      |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>                    |
|                  | 18       |   |

**FOURTH YEAR****First Semester**

| Number           | Credits  | Course                        |
|------------------|----------|-------------------------------|
| GERE 4045        | 3        | SUPPLY CHAIN MANAGEMENT       |
| ADMI 4039        | 3        | Business Research Methods     |
| <b>+ELECTIVE</b> | 3        | <b>Elective in Humanities</b> |
| <b>ELECTIVE</b>  | 3        | Professional Elective         |
| <b>ELECTIVE</b>  | 3        | <b>Free Elective</b>          |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>          |
|                  | 18       |                               |

**Second Semester**

| Number           | Credits  | Course  |
|------------------|----------|---|
| <b>ECON 3085</b> | 3        | <b>Economic and Social Development of Puerto Rico</b> |
| ADMI 4056        | 2        | SEMINAR   |
| ADMI 4018        | 3        | Strategic Management                                  |
| <b>+ELECTIVE</b> | 3        | <b>Elective in Social Sciences or Humanities</b>      |
| <b>ELECTIVE</b>  | 3        | Professional Elective                                 |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>                                  |
|                  | 17       |   |

**COURSES IN CAPITAL LETTERS WILL BE CONSIDERED IN COMPUTING MAJOR GPA****General Education Requirements are identified in Bold.****Total credits required for program: 137**

\*Refer to the Academic Regulations section for information on Advanced Placement.

^\*Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

+The nine (9) credits hours of Social Sciences or Humanities Electives will be selected by the student with the advisor's approval, from a list of recommended courses

**PROFESSIONAL ELECTIVES**

|           |   |
|-----------|---|
| ADMI 4116 | The Human Dimension of Project Management   |
| ADMI 4997 | Business Practice for Coop Students         |
| GERE 4036 | Assurance Sciences                          |
| GERE 4085 | Project Management Applications in Business |
| GERE 4995 | Operations Management Internship            |

**MARKETING CURRICULUM****FIRST YEAR****First Semester**

| Number            | Credits  | Course   |
|-------------------|----------|--|
| <b>*MATE 3171</b> | 3        | <b>Pre-Calculus I</b>                              |
| <b>*INGL ----</b> | 3        | <b>First year course in English</b>                |
| <b>*ESPA 3101</b> | 3        | <b>Basic course in Spanish I</b>                   |
| ADMI 3010         | 2        | Computer Competence for Managerial Decision Making |
| <b>ECON 3021</b>  | 3        | <b>Principles of Economics: Microeconomics</b>     |
| <b>EDFI ----</b>  | <u>1</u> | <b>Physical Education Elective</b>                 |
|                   | 15       |  |



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**Second Semester**

| Number            | Credits  | Course   |
|-------------------|----------|--|
| <b>MATE 3049</b>  | 3        | <b>Mathematical Analysis for Management Sciences</b> |
| <b>*INGL ----</b> | 3        | <b>First year course in English</b>                  |
| <b>*ESPA 3102</b> | 3        | <b>Basic course in Spanish II</b>                    |
| ADMI 3009         | 4        | Introduction to Business, Management, and Ethics     |
| <b>ECON 3022</b>  | 3        | <b>Principles of Economy: Macroeconomics</b>         |
| <b>EDFI ----</b>  | <u>1</u> | <b>Physical Education Elective</b>                   |
|                   | 17       |  |

**SECOND YEAR****First Semester**

| Number            | Credits  | Course                               |
|-------------------|----------|--------------------------------------|
| <b>*INGL ----</b> | 3        | <b>Second year course in English</b> |
| ESTA 3001         | 3        | Business Statistics I                |
| <b>ESPA 3215</b>  | 3        | <b>Expression and Communication</b>  |
| MERC 3115         | 3        | Principles of Marketing              |
| CONT 3011         | 3        | Financial Accounting Principles I    |
| <b>ELECTIVE</b>   | <u>3</u> | <b>Elective in Natural Sciences</b>  |
|                   | 18       |                                      |

**Second Semester**

| Number                 | Credits  | Course                                 |
|------------------------|----------|--|
| <b>^*INGL ----</b>     | 3        | <b>Second year course in English</b>   |
| ESTA 3002              | 3        | Business Statistics II                 |
| ADMI 3017              | 2        | Introduction to Enterprise Development |
| ESOR 4008 or GERH 4008 | 3        | Human Resources Management             |
| CONT 3012              | 3        | Financial Accounting Principles II     |
| ESOR 4025 or GERH 4025 | <u>3</u> | Organizational Behavior                |
|                        | 17       |  |

**THIRD YEAR****First Semester**

| Number           | Credits  | Course                                    |
|------------------|----------|---|
| MERC 4217        | 3        | CONSUMER BEHAVIOR                         |
| ADMI 4001        | 3        | Introduction to Law                       |
| GERE 4046        | 4        | Operations Management                     |
| FINA 3016        | 4        | Business Analysis Using Financial Reports |
| <b>+ELECTIVE</b> | <u>3</u> | <b>Elective in Social Sciences</b>        |
|                  | 17       |   |

**Second Semester**

| Number          | Credits  | Course                                  |
|-----------------|----------|---|
| MERC 4230       | 3        | INTEGRATED MARKETING COMMUNICATIONS     |
| ADMI 4002       | 3        | Business Law                            |
| ADMI 4085       | 3        | Fundamentals of Project Management      |
| FINA 3017       | 3        | Money, Banking, and Economic Conditions |
| <b>ELECTIVE</b> | 3        | <b>Elective in Humanities</b>           |
| <b>ELECTIVE</b> | <u>3</u> | <b>Free Elective</b>                    |
|                 | 18       |   |

**FOURTH YEAR****First Semester**

| Number           | Credits  | Course  |
|------------------|----------|---|
| MERC 4218        | 3        | MANAGEMENT OF PHYSICAL DISTRIBUTION                   |
| ADMI 4039        | 3        | Business Research Methods                             |
| <b>ECON 3085</b> | 3        | <b>Economic and Social Development of Puerto Rico</b> |
| <b>+ELECTIVE</b> | <b>3</b> | <b>Elective in Social Sciences or Humanities</b>      |
| <b>ELECTIVE</b>  | 3        | Professional Elective                                 |
| <b>ELECTIVE</b>  | <u>3</u> | <b>Free Elective</b>                                  |
|                  | 18       |   |

**Second Semester**

| Number          | Credits  | Course                      |
|-----------------|----------|-----------------------------|
| MERC 4065       | 3        | GLOBAL MARKETING STRATEGIES |
| ADMI 4056       | 2        | SEMINAR                     |
| ADMI 4018       | 3        | Strategic Management        |
| <b>ELECTIVE</b> | 3        | Professional Elective       |
| <b>ELECTIVE</b> | 3        | <b>Free Elective</b>        |
| <b>ELECTIVE</b> | <u>3</u> | <b>Free Elective</b>        |
|                 | 17       |                             |

**COURSES IN CAPITAL LETTERS WILL BE CONSIDERED IN COMPUTING MAJOR GPA****General Education Requirements are identified in Bold. Total credits required for program: 137**

\*Refer to the Academic Regulations section for information on Advanced Placement.

^\*Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

+The nine (9) credits hours of Social Sciences or Humanities Electives will be selected by the student with the advisor's approval, from a list of recommended courses

## PROFESSIONAL ELECTIVES

|           |   |
|-----------|---|
| ADMI 3100 | New Business Development                                      |
| ADMI 3150 | Business Plan Development                                     |
| ADMI 3155 | Creativity and Entrepreneurial Innovation                     |
| ADMI 3315 | Fundamentals of E-Commerce                                    |
| ADMI 4335 | Change and Growth Strategies for Small and Midsize Businesses |
| ADMI 4997 | Business Practice for Coop Students                           |
| MERC 3117 | Selling and Sales Management                                  |
| MERC 4215 | Retail Management   |
| MERC 4236 | Services Marketing  |
| MERC 4995 | Marketing Internship  |

## HUMAN RESOURCES MANAGEMENT CURRICULUM

### FIRST YEAR

#### First Semester

| Number            | Credits  | Course   |
|-------------------|----------|--|
| <b>*MATE 3171</b> | 3        | <b>Pre-Calculus I</b>                            |
| <b>*INGL ----</b> | 3        | <b>First year course in English</b>              |
| <b>*ESPA 3101</b> | 3        | <b>Basic course in Spanish I</b>                 |
| ADMI 3009         | 4        | Introduction to Business, Management, and Ethics |
| <b>ECON 3021</b>  | 3        | <b>Principles of Economics: Microeconomics</b>   |
| <b>EDFI ----</b>  | <u>1</u> | <b>Physical Education Elective</b>               |
|                   | 17       |  |

#### Second Semester

| Number                 | Credits  | Course   |
|------------------------|----------|--|
| <b>MATE 3049</b>       | 3        | <b>Mathematical Analysis for Management Sciences</b> |
| <b>*INGL ----</b>      | 3        | <b>First year course in English</b>                  |
| <b>*ESPA 3102</b>      | 3        | <b>Basic course in Spanish II</b>                    |
| ESOR 4008 or GERH 4008 | 3        | Human Resources Management                           |
| <b>ECON 3022</b>       | 3        | <b>Principles of Economy: Macroeconomics</b>         |
| <b>EDFI ----</b>       | <u>1</u> | <b>Physical Education Elective</b>                   |
|                        | 16       |  |

## SECOND YEAR

### First Semester

| Number                 | Credits  | Course   |
|------------------------|----------|--|
| <b>*INGL ----</b>      | 3        | <b>Second year course in English</b>               |
| ESTA 3001              | 3        | Business Statistics I                              |
| ADMI 3010              | 2        | Computer Competence for Managerial Decision Making |
| ESOR 4015 or GERH 4015 | 3        | WORKFORCE PLANNING AND EMPLOYMENT                  |
| CONT 3011              | 3        | Financial Accounting Principles I                  |
| ADMI 4001              | <u>3</u> | Introduction to Law                                |
|                        | 17       |  |

### Second Semester

| Number            | Credits  | Course                                 |
|-------------------|----------|--|
| <b>*INGL ----</b> | 3        | <b>Second year course in English</b>   |
| ADMI 3017         | 2        | Introduction to Enterprise Development |
| ESTA 3002         | 3        | Business Statistics II                 |
| <b>ELECTIVE</b>   | 3        | <b>Elective in Natural Sciences</b>    |
| CONT 3012         | 3        | Financial Accounting Principles II     |
| ADMI 4002         | <u>3</u> | Business Law                           |
|                   | 17       |  |

## THIRD YEAR

### First Semester

| Number                 | Credits  | Course                                    |
|------------------------|----------|---|
| ESOR 4025 or GERH 4025 | 3        | Organizational Behavior                   |
| <b>+ELECTIVE</b>       | 3        | <b>Elective in Social Sciences</b>        |
| ESPA 3215              | 3        | Expression and Communication              |
| FINA 3016              | 4        | Business Analysis Using Financial Reports |
| ADMI 4085              | 3        | Fundamentals of Project Management        |
| <b>+ELECTIVE</b>       | <u>3</u> | <b>Elective in Humanities</b>             |
|                        | 19       |   |

### Second Semester

| Number                 | Credits | Course  |
|------------------------|---------|---|
| ESOR 4017 or GERH 4017 | 3       | COMPARATIVE LABOR LAW                                 |
| ESOR 4007 or GERH 4007 | 3       | ORGANIZATIONAL DESIGN                                 |
| <b>ECON 3085</b>       | 3       | <b>Economic and Social Development of Puerto Rico</b> |

|                 |          |  |
|-----------------|----------|--|
| MERC 3115       | 3        | Principles of Marketing                    |
| FINA 3017       | 3        | Money, Banking, and<br>Economic Conditions |
| <b>ELECTIVE</b> | <u>3</u> | <b>Free Elective</b>                       |
|                 | 18       |  |

|           |  |
|-----------|--|
| GERH 4037 | Managing Diversity in Organizations      |
| GERH 4995 | Human Resources Management<br>Internship |

#### FOURTH YEAR

##### First Semester

| Number  | Credits  | Course   |
|---|----------|--|
| ESOR 4019 or<br>GERH 4019<br><b>+ELECTIVE</b> | 3        | COMPENSATION<br>MANAGEMENT                           |
| ADMI 4039                                     | 3        | <b>Elective in Social<br/>Sciences or Humanities</b> |
| GERE 4046                                     | 4        | Business Research<br>Methods                         |
| <b>ELECTIVE</b>                               | <u>3</u> | Operations Management                                |
|   | 16       | <b>Free Elective</b>                                 |

##### Second Semester

| Number                    | Credits  | Course                |
|---------------------------|----------|-----------------------|
| ESOR 4016 or<br>GERH 4016 | 3        | LABOR RELATIONS       |
| ADMI 4056                 | 2        | SEMINAR               |
| ADMI 4018                 | 3        | Strategic Management  |
| <b>ELECTIVE</b>           | 3        | <b>Free Elective</b>  |
| <b>ELECTIVE</b>           | 3        | <b>Free Elective</b>  |
| <b>ELECTIVE</b>           | <u>3</u> | Professional Elective |
|                           | 17       |                       |

**COURSES IN CAPITAL LETTERS WILL BE  
CONSIDERED IN COMPUTING MAJOR GPA**

**General Education Requirements are identified in Bold.**

**Total credits required for program: 137**

\*Refer to the Academic Regulations section for information  
on Advanced Placement.

^\*Only for students who are in the Basic Sequence; choose  
from the following courses: INGL 3191, INGL 3202 or  
INGL 3209.

+The nine (9) credits hours of Social Sciences or Humanities  
Electives will be selected by the student with the advisor's  
approval, from a list of recommended courses

#### PROFESSIONAL ELECTIVES

|           |   |
|-----------|---|
| ADMI 4997 | Business Practice for Coop Students             |
| GERH 4010 | Women and Work                                  |
| GERH 4027 | Leadership in Organizations                     |
| GERH 4030 | Human Resources Development                     |
| GERH 4035 | Innovation and Organizational Change            |
| GERH 4036 | Interpersonal Communication in the<br>Workplace |

#### CURRICULUM IN OFFICE ADMINISTRATION

##### FIRST YEAR

##### First Semester

| Number            | Credits  | Course                              |
|-------------------|----------|-------------------------------------|
| ADOF 3016         | 3        | KEYBOARDING AND<br>APPLICATIONS I   |
| <b>ELECTIVE</b>   | 3        | <b>Elective in Natural Sciences</b> |
| <b>+ELECTIVE</b>  | 3        | <b>Elective in Social Science</b>   |
| <b>ESPA 3101</b>  | 3        | <b>Basic course in Spanish I</b>    |
| <b>INGL _____</b> | <u>3</u> | <b>First year course in English</b> |
|                   | 15       |                                     |

##### Second Semester

| Number            | Credits  | Course                                     |
|-------------------|----------|--|
| ADOF 3017         | 3        | KEYBOARDING AND<br>APPLICATIONS II         |
| ADOF 3107         | 3        | Office Concepts, Systems and<br>Technology |
| <b>ELECTIVE</b>   | 3        | <b>Elective in Natural Sciences</b>        |
| <b>+ELECTIVE</b>  | 3        | <b>Elective in Social Science</b>          |
| <b>ESPA 3102</b>  | 3        | <b>Basic course in Spanish II</b>          |
| <b>INGL _____</b> | <u>3</u> | <b>First year course in English</b>        |
|                   | 18       |  |

##### SECOND YEAR

##### First Semester

| Number            | Credits  | Course                                |
|-------------------|----------|---------------------------------------|
| ESPA 3215         | 3        | Expression and Communication          |
| ADOF 4020         | 3        | TRAINING IN ELECTRONIC<br>EQUIPMENT   |
| ADOF 4005         | 3        | ELECTRONIC PRODUCTION<br>OF DOCUMENTS |
| <b>INGL _____</b> | 3        | <b>Second year course in English</b>  |
| <b>ELECTIVE</b>   | <u>3</u> | <b>PROFESSIONAL ELECTIVE</b>          |
|                   | 15       |                                       |

##### Second Semester

| Number                               | Credits  | Course  |
|--------------------------------------|----------|---|
| ADOF 3009                            | 3        | RECORDS MANAGEMENT                                  |
| <b>^INGL _____</b>                   | 3        | <b>Second year course in English</b>                |
| <b>ELECTIVE</b>                      | 3        | <b>PROFESSIONAL ELECTIVE</b>                        |
| <b>MATE 3086</b> or <b>MATE 3171</b> | <b>3</b> | <b>Mathematical Reasoning or<br/>Pre-Calculus I</b> |
| ADMI 3009                            | <u>4</u> | Introduction to Business,<br>Management, and Ethics |
|                                      | 16       |   |

## THIRD YEAR

### First Semester

| Number            | Credits  | Course                                |
|-------------------|----------|---------------------------------------|
| ADOF 4065         | 3        | INTRO. OF WORD PROCESSING             |
| CONT 3011         | 3        | Financial Accounting Principles I     |
| <b>EDFI _____</b> | 2        | <b>Elective in Physical Education</b> |
| <b>ELECTIVE</b>   | 3        | <b>PROFESSIONAL ELECTIVE</b>          |
| <b>ELECTIVE</b>   | <u>3</u> | <b>Free Elective</b>                  |
|                   | 14       |                                       |

### Second Semester

| Number          | Credits  | Course                           |
|-----------------|----------|----------------------------------|
| ADOF 4019       | 3        | ADMINISTRATIVE OFFICE PROCEDURES |
| <b>ELECTIVE</b> | 3        | <b>Free Elective</b>             |
| <b>ELECTIVE</b> | 3        | <b>PROFESSIONAL ELECTIVE</b>     |
| <b>ELECTIVE</b> | 3        | <b>RECOMMENDED ELECTIVE</b>      |
| <b>ELECTIVE</b> | <u>3</u> | <b>Elective in English</b>       |
|                 | 15       |                                  |

## FOURTH YEAR

### First Semester

| Number               | Credits  | Course                        |
|----------------------|----------|-------------------------------|
| ADOF 4080            | 3        | TRAINING AND SEMINAR PLANNING |
| MERC 3115            | 3        | Principles of Marketing       |
| ADMI 4001            | 3        | Introduction to Law           |
| <b>&amp;ELECTIVE</b> | 3        | <b>Elective in Humanities</b> |
| <b>ELECTIVE</b>      | <u>3</u> | <b>Free Elective</b>          |
|                      | 15       |                               |

### Second Semester

| Number               | Credits  | Course                                  |
|----------------------|----------|---|
| ADOF 4025            | 4        | OFFICE ADMINISTRATION PRACTICUM         |
| ECON 3021            | 3        | Principles of Economics: Microeconomics |
| <b>&amp;ELECTIVE</b> | 3        | <b>Elective in Humanities</b>           |
| <b>ELECTIVE</b>      | 3        | <b>RECOMMENDED ELECTIVE</b>             |
| <b>ELECTIVE</b>      | <u>3</u> | <b>Free Elective</b>                    |
|                      | 16       |   |

## COURSES IN CAPITAL LETTERS WILL BE CONSIDERED IN COMPUTING MAJOR GPA

General Education Requirements are identified in Bold.  
Total credits required for program: 124

\*Refer to the Academic Regulations section for information on Advanced Placement.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

+The six (6) credits hours of Social Sciences Electives will be selected by the student with the advisor's approval, from a list of recommended courses

&The six (6) credits hours of Humanities Electives will be selected by the student with the advisor's approval, from a list of recommended courses

## COURSES IN ENGLISH

Undergraduate students can meet their 12 credit English requirement by completing one of the following course sequences:

- **INGL 3101, 3102, 3201,** and **3202** (or, alternatively, **3209** and **3289**).
- **INGL 3103, 3104,** 3XXX, and 3XXX (but **not** 3201, 3201, 3211, 3212).
- **INGL 3211** and **3212** (6 credits already being approved by getting a 4 or 5 on the Advanced Placement Exam)

The elective course in English will be selected by the student with the advisor's approval, from a list of recommended courses.

## PROFESSIONAL ELECTIVES

|           |   |
|-----------|---|
| ADOF 3005 | Abbreviated Writing System in Spanish                             |
| ADOF 3007 | Abbreviated Writing System in English                             |
| ADOF 3036 | Information Processing and Billing Services in Medical Offices    |
| ADOF 3105 | Introduction to Office Administration                             |
| ADOF 3115 | Telecommunications in the Modern Office                           |
| ADOF 3125 | Legal Office Administration                                       |
| ADOF 3135 | Introduction to Business Translation                              |
| ADOF 4006 | Review for the CPS Certificate (Certified Professional Secretary) |
| ADOF 4015 | Electronic Transcription of Documents in Spanish                  |
| ADOF 4017 | Electronic Transcription of Documents in English                  |
| ADOF 4055 | Interpersonal Relations   |
| ADOF 4075 | Integration of Information Processing Programs                    |
| ADOF 4077 | Design and Processing of Documents                                |

## RECOMMENDED ELECTIVES

|           |   |
|-----------|---|
| ADMI 3015 | Introduction to International Business    |
| ADMI 3100 | New Business Development                  |
| ADMI 3155 | Creativity and Entrepreneurial Innovation |
| ADMI 4002 | Business Law                              |

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|           |   |
|-----------|---|
| ADMI 4016 | The Environment of Organizations  |
| ADMI 4085 | Fundamentals of Project Management  |
| CONT 3006 | Elementary Accounting II  |
| CONT 4006 | Managerial Accounting   |
| EDFU 3011 | Foundations of Human Development  |
| EDFU 3012 | Foundations of Educational Psychology   |
| EDFU 3007 | Social Foundations of Education   |
| EDFU 4019 | Philosophical Foundations of Education  |
| ESPA 3208 | Composition   |
| ESPA 3295 | Spanish Grammar   |
| FILO 3178 | Business Ethics   |
| FINA 3005 | Principles of Insurance   |
| GERH 4007 | Organizational Design   |
| GERH 4008 | Human Resources Management  |
| ESOR 4009 | Human Resources Administration  |
| GERH 4010 | Women and Work  |
| GERH 4025 | Organizational Behavior   |
| GERH 4028 | Interpersonal Communication Applied to Engineering, Science, and Business Careers |
| MERC 3117 | Selling and Sales Management  |
| PSIC 3001 | Principles of Psychology I  |
| PSIC 3002 | Principles of Psychology II   |
| SOCI 3261 | Introduction to Sociology I   |
| SOCI 3262 | Introduction to Sociology II  |

## FACULTY

**MARÍA AMADOR-DUMOIS**, *Professor*, Ph.D., 2005, George Washington University.

**MILAGROS CASTRO-MARTÍNEZ**, *Professor*, M.A., 1991, New York University; CPS.

**MARIO CÓRDOVA-CLAUDIO**, *Professor*, Ph.D., 1998, Rutgers State University; J.D., 2004, University of Puerto Rico.

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**LUZ E. QUIÑONES GONZÁLEZ**, *Associate Professor*, Ph.D., 2014, Interamerican University.

**BELKYS REYES GONZÁLEZ**, *Assistant Professor*, Ph.D., 2012, NOVA Southeastern University.

**ROBERTO RIVERA-SANTIAGO**, *Professor*, Ph.D., 2010, University of California-Santa Barbara.

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**MARITZA SOTO GARCÍA**, *Professor*, Ph.D., 1993, Walden University, JD, Interamerican University.

**EDGAR SOTO-RODRÍGUEZ**, *Associate Professor*, Ph.D., 2007, Argosy University at Sarasota, Florida.

**PATRICIA VALENTÍN CASTILLO**, *Assistant Professor*, Ph.D., 2015, Interamerican University.

**MARI LUZ ZAPATA-RAMOS**, *Associate Professor*, Ph.D., 2012, University of Florida.

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## ADMINISTRATION

**ADMI 3007. INTRODUCTION TO COMPUTER DATA PROCESSING.** (I, II) Three credit hours. Two hours of lecture and one two-hour laboratory per week.

Introductory microcomputer course that provides a basic understanding of what a computer is, what it can do, and how it can serve the manager in his or her professional endeavors. The components of a computerized information system will be studied. The integration and application of MIS (Management Information Systems) concepts to a business environment will be explored. The students will acquire practical experience in the use of microcomputers and software packages for various applications such as work processing, electronic spreadsheets and graphics as a tool to solve managerial problems.

**ADMI 3008. FUNDAMENTALS OF WEB DESIGN.** Two credit hours. One hour of lecture and two hours of laboratory per week. Prerequisites: ADMI 3007 or ADMI 3010 or COMP 3057 or ECAG 3007 or INGE 3016.

Study of concepts and techniques for design and development of websites with business applications. Discussion of concepts and development of technical skills required to design, build and implement interactive websites, including coding a Web page, optimizing images, and creating tables. Use of tools to control the style and layout of multiple Web pages, and use of graphical Web development tools.

**ADMI 3009. INTRODUCTION TO BUSINESS, MANAGEMENT, AND ETHICS.** (I, II) Four credit hours. Four hours of lecture per week.

Study of the nature of business and its social, legal, ethical, economic, and political interactions within society. Discussion of traditional and emergent management principles, functions, and theories in a global context. Study of the major functional areas of business.

**ADMI 3010. COMPUTER COMPETENCE FOR MANAGERIAL DECISION MAKING.** (I, II) Two credit hours. One hour of lecture and two hours of laboratory per week.

Introduction to the basic understanding of what a computer is, what it can do, and how it can serve managers in their professional endeavors. Use of software packages for various applications such as word processing, electronic spreadsheets, and presentation tools in a computer laboratory.

**ADMI 3015. INTRODUCTION TO INTERNATIONAL BUSINESS.** Three credit hours. Three hours of lecture per week.

Problems and possibilities of doing business in an international context. Provides perspectives required for successful management and planning of international enterprises. Identification of opportunities and difficulties inherent in international business. Major features of the world economy, of the multinational corporation (mnc), of current international economic issues, and how international business deals with these problems.

**ADMI 3017. INTRODUCTION TO ENTERPRISE DEVELOPMENT.** (I, II) Two credit hours. Two hours of lecture per week.

Introduction to the overall process of developing enterprises, from the recognition of an opportunity to the implementation of the business. Emphasis on the particular needs of the enterprise as it moves through the various stages of the business life cycle.

**ADMI 3018. ADVANCED SPREADSHEET TECHNIQUES.** Two credit hours. One hour of lecture and two hours of laboratory per week. Prerequisites: ADMI 3007 or ADMI 3010.

Study focused on the use of advanced spreadsheet functions for solving complex problems, including data integration, data analysis, and development of macros.

**ADMI 3028. ADVANCED SPREADSHEET TECHNIQUES.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: ADMI 3007 or ADMI 3010 or ECAG 3007 or COMP 3057 or INGE 3016.

Study focused on the use of advanced spreadsheet commands and functions for solving simple and complex problems, including importing data from other platforms and formats, data filtering, data validation, advanced logic functions, advanced charts, data manipulation, creating and using range names, data lookup, pivot tables, data integration, data analysis, data security and recording basic macros.

**ADMI 3100. NEW BUSINESS DEVELOPMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: ADMI 3155.

Theory and practice for the establishment of a small business. Study of the process of developing firms: formulation and clarification of the business idea, product development, definition of market, development of an operational organization, and major problems and obstacles in creating a successful small business.

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**ADMI 3125. TECHNOLOGY BASED ENTREPRENEURSHIP.** (II) Three credit hours. Three hours of lecture per week.

Process of starting a business based on technology, emphasizing the management of existing enterprises. It includes topics such as: market analysis, proposal preparation product design specification (PDS), prototype design, product cost, strategic management, manufacturing facilities design, and business plan.

**ADMI 3150. BUSINESS PLAN DEVELOPMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: ADMI 3100.

Development of a business plan for a small or medium-sized enterprise. Components of a business plan, its importance, and its use as an administrative tool will be discussed.

**ADMI 3155. CREATIVITY AND ENTREPRENEURIAL INNOVATION.** (I) Three credit hours. Three hours of lecture per week.

Study of the creativity process and ways to use it as tools for entrepreneurial innovation. Evaluates creative and innovative ideas of products and services in terms of the risks and opportunities involved. Creation and innovation of products and services that could be developed into a business.

**ADMI 3315. FUNDAMENTALS OF E-COMMERCE.** Three credit hours. One hour of lecture and two hours of laboratory per week. Prerequisites: MERC 3115 and (ADMI 3007 or ADMI 3010).

Study of the technological and strategic aspects of internet-based electronic commerce. Discussion of topics such as planning, marketing strategies, security, and international, legal, and ethical issues.

**ADMI 4001. INTRODUCTION TO LAW.** Three credit hours. Three hours of lecture per week.

An introduction to the nature and source of the Law, its fundamental principles, and the Judicial System. Emphasis will be given to basic principles of Constitutional, Administrative and Penal Law as well as the Law of Torts and Contracts and their relationship with business organizations. The course will provide the basis for future study of commercial contracts and relationships.

**ADMI 4002. BUSINESS LAW.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: ADMI 4001.

The study of the law applicable to business contracts and the formation, organization, and administration of entities.

**ADMI 4016. ENVIRONMENT ORGANIZATIONS.** (I, II) Three credit hours. Three hours of lecture per week.

Study of the legal and socio-political environment within which the business system operates in order to be able to analyze and understand the basic problems and issues the organization is facing in today's world.

**ADMI 4018. STRATEGIC MANAGEMENT.** (I, II) Three credit hours. Three hours of lecture per week. Prerequisites: CONT 4045 or FINA 4037 or SICI 4089 or ESOR 4019 or (MERC 4230 and MERC 4218) or (GERE 4009 and GERE 4008).

Integrative capstone course in which management skills are applied to analyze and formulate effective strategies for multifunctional business situations confronted by top management. Includes the use of case studies and business simulations to experience the impact of implementing diverse business strategies.

**ADMI 4026. International Organizations and Entrepreneurship** Three credit hours. Three hours of lecture per week. Prerequisite: ADMI 3009.

Description of the challenges and opportunities of entrepreneurship from an international perspective. Analysis of local entrepreneurial challenges in light of entrepreneurial indexes and reports published by international organizations such as the Organization for Economic Co-operation and Development (OECD), the World Economic Forum (WEF), the World Trade Organization (WTO), the International Monetary Fund (IMF), the United Nations (UN), the Global Entrepreneurship Monitor (GEM), and the World Bank, using an outside-in approach.

**ADMI 4039. BUSINESS RESEARCH METHODS.** Three credit hours. Three hours of lecture per week. Prerequisite: ESTA 3002.

Study of fundamentals of research design and their applications in business. Introduction to survey design and its statistical analysis. Application of research skills in an individual or team project. Exposure to the concepts of ethics and social responsibility in research and reporting.

**ADMI 4040. BUSINESS DOCUMENTS.** (OD) Three credit hours. Three hours of lecture per week. Prerequisite: ESPA 3102.

The study and use of language in oral and written communication. Application of the principles of logic and psychology in the editing of commercial and official documents commonly used in business. Use of principles of editing in letters of reference, claims, and collections. Analysis of publicity as a mass communication media and its effective use in the business world.

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**ADMI 4056. SEMINAR.** (I, II) Two credit hours. One hour of lecture and two hours of supervised practice per week. Prerequisites: ADMI 4039 and [(GERE 4045 and GERE 4009) or (MERC 4230 and MERC 4218) or (GERH 4007 or ESOR 4007 and GERH 4019 or ESOR 4019)].

Capstone course that integrates philosophies, practices, and research of current business problems. Students are required to work in groups to submit and present a research report in their field of study.

**ADMI 4057. SEMINAR.** (I, II) Three credit hours. Three hours of lecture per week. Prerequisites: ESTA 3002 and ((MERC 4215) or (GERE 4008 and GERE 4009) or (GERH 4009 and GERH 4016) or (FINA 4036 and FINA 4037) or (CONT 4016 or CONT 4017)).

An advanced and integrated course for business students. Philosophies, practices, and investigation of current problems in the field. Every student is required to submit an original dissertation on a subject or a current problem for the business manager, in a partial fulfillment of the course requirements.

**ADMI 4058. COMPARISON OF ADMINISTRATIVE SYSTEMS AMONG ENTERPRISES IN PUERTO RICO AND OTHER COUNTRIES.** Three credit hours. Fifteen hours of conference and a minimum of eighteen hours of visits to enterprises in Puerto Rico and a trip of at least twelve days to the selected countries. Prerequisite: authorization of the Dean of Business Administration.

Comparative analysis of administrative and industrial practices among different enterprises in Puerto Rico and the other countries. Managerial functions, processes, and organizational structures of enterprises will be highlighted. Includes conferences; and plant tours of enterprises.

**ADMI 4085. FUNDAMENTALS OF PROJECT MANAGEMENT.** (I, II) Three credit hours. Three hours of lecture per week.

Analysis of the project as a means to achieve an organization's strategic plan, as well as the role of the project manager. Study of the application and integration of the project management processes of initiating, planning, executing, monitoring and controlling, and closing. Includes the management of the competing requirements of scope, time and cost.

**ADMI 4116. THE HUMAN DIMENSION OF PROJECT MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: ADMI 4085.

Study of principles and theoretical concepts to provide a general frame to understand, analyze and manage the human aspects in the project management context. Discussion of the development of effective work teams, negotiation and conflicts management, and crisis management among others.

**ADMI 4335. STRATEGIES FOR CHANGE AND GROWTH OF SMALL AND MIDSIZE BUSINESSES.** Three credit hours. Three hours of lecture per week. Prerequisite: ADMI 3100.

Study of the alternatives of growth, downsizing, and diversification for effective business decision-making in a changing, competitive environment.

**ADMI 4995. SPECIAL PROBLEMS.** One to six credit hours. Prerequisite: authorization of the Director of the Department.

Individual studies, investigations, or special problems in any of the various aspects of Business Administration. Problems or topics will be assigned according to the interests and need of individual students. Work will be carried out under the supervision of a faculty member.

**ADMI 4996. SMALL BUSINESS ADVISING.** (OD) One to three credit hours. Two to six hours of consultation and advising per week to participating enterprises. Prerequisite: authorization of the Dean of the Faculty.

Students will be assigned to small business administration cases, Junior Achievement mini-companies, and other appropriate organizations to develop perspective and analytical insight about operations, decision-making processes, and interpersonal, group and intergroup relations. Supervision will be in charge of a Faculty member.

**ADMI 4997. BUSINESS PRACTICE FOR COOP STUDENTS.** Three to six credit hours. A maximum of three work periods will be permitted. Prerequisite: authorization of the Dean of the Faculty.

Supervised work experience in a government agency, private enterprise or foundation, in accordance with the student's academic background and the requirements of the work.

## OFFICE ADMINISTRATION

**ADOF 3005. ABBREVIATED WRITING SYSTEM IN SPANISH.** (I) Four credit hours. Four hours of lecture per week. Prerequisite: ESPA 3102.



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Principles of the abbreviated writing system in Spanish. Use of a fast and legible abbreviated reading and writing system at a reasonable speed rate. Review of essential rules for the abbreviated writing system: grammar, punctuation, spelling, and word division.

**ADOF 3007. ABBREVIATED WRITING SYSTEM IN ENGLISH. (I)** Four credit hours. Four hours of lecture per week. Prerequisites: INGL 3102 or INGL 3104.

Principles of the abbreviated writing system in english. Development of a fast and legible abbreviated reading and writing system. Review of essential rules for the abbreviated writing system: grammar, punctuation, spelling, and word division.

**ADOF 3009. RECORDS MANAGEMENT. (II)** Three credit hours. Three hours of lecture per week.

Introduction to records management system. Emphasis on the complete process of records management: creation, distribution, use, maintenance, and disposition. Filing operations and retrieval of documents using manual, mechanical, and automated systems.

**ADOF 3016. KEYBOARDING AND ITS APPLICATIONS I. (I)** Three credit hours. Three hours of lecture with practice per week. Prerequisite: student of Office Administration or authorization of the Chairperson of the Institute.

Introduction to the touch method of typewriting. Demonstration of the mastering of basic techniques. Development of the basic skills of speed and accuracy at an acceptable level of performance. Writing of simple office documents.

**ADOF 3017. KEYBOARDING AND ITS APPLICATIONS II. (II)** Three credit hours. Three hours of lecture per week. Prerequisite: ADOF 3016.

Further development of keyboarding skills in the production of office documents at an acceptable level of performance.

**ADOF 3036. INFORMATION PROCESSING AND BILLING SERVICES IN MEDICAL OFFICES.** Three credit hours. Three hours of lecture per week.

Study of the terminology, format, documents, laws, and ethical aspects related to processing information in medical offices. Application of computer programs in the medical services billing process.

**ADOF 3105. INTRODUCTION TO OFFICE ADMINISTRATION. (I)** Three credit hours. Three hours of lecture per week.

Application of the basic principles to administrate, plan, organize, direct and control the administrative and operational phase of an office. Basic concepts of supervision: preparation of reports, buying processes and development of systems for office administration.

**ADOF 3107. OFFICE CONCEPTS, SYSTEMS AND TECHNOLOGY. (II)** Three credit hours. Three hours of lecture per week.

Global vision and general background of the modern office. Study of concepts related to the role of the office as a support system to a company. Analysis of the effects of technology in the equipment, procedures, environment and human factors in the modern office. Study of the key role played by professional specialized in the office systems administration.

**ADOF 3115. TELECOMMUNICATIONS IN THE MODERN OFFICE.** Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3007 or ADOF 3107.

Introduction to the telecommunications in the business environment: telephony, local computer networks, communication channels, hardware, and software. Emphasis in the application of telecommunications to facilitate the exchange of all kind of information: voice, data, text, and images.

**ADOF 3125. LEGAL OFFICE ADMINISTRATION. (I, II)** Four credit hours. Four hours of lecture per week. Prerequisite: ADOF 3017.

Study of selected articles of the Civil Code, Notary Law and the Civil Law Procedures of Puerto Rico and their application for the preparation of documents. Study of the legal terminology and the functioning of the General Court of Justice in order to better understand the cases submitted. Preparation of legal documents, such as: deeds, promissory notes, contracts of bargain and sales, law suits, sentences, resolutions, sworn declarations, appeal documents and summon regulations.

**ADOF 3135. INTRODUCTION TO BUSINESS TRANSLATION.** Three credit hours. Three hours of lecture per week. Prerequisites: (INGL 3102 or INGL 3104 or INGL 3212) and ESPA 3102.

Introduction to business translation with special attention given to idiomatic expressions in English and Spanish used in business.

**ADOF 4005. ELECTRONIC PRODUCTION OF DOCUMENTS. (I)** Three credit hours. Three hours of lecture per week. Prerequisite: ADOF 3017.

Application of previously learned typewriting techniques for the production of office documents to an expert level.

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**ADOF 4015. ELECTRONIC TRANSCRIPTION OF DOCUMENTS IN SPANISH.** (OD) Four credit hours. Four hours of lecture per week. Prerequisites: ADOF 3005, ADOF 3017. Corequisite: ADOF 4005.

Improvement of the alphabetic writing system and keyboarding skills, and language usage skills: punctuation, spelling, and word division using different equipment. Letters, memorandum and reports of simple to average degree of difficulty will be dictated in Spanish at a reasonable speed simulating an office environment.

**ADOF 4017. ELECTRONIC TRANSCRIPTION OF DOCUMENTS IN ENGLISH.** (OD) Four credit hours. Four hours of lecture per week. Prerequisites: ADOF 3007 and ADOF 3017 and ADOF 4005 and (INGL 3102 or INGL 3104).

Improvement of the alphabetic writing system and keyboarding skills, and language usage skills: punctuation, spelling, and word division using different equipment. Letters, memorandum and reports of simple to average degree of difficulty will be dictated in English at a reasonable speed simulating an office environment.

**ADOF 4019. ADMINISTRATIVE OFFICE PROCEDURES.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: ADOF 3017.

The study of the procedures, techniques, and protocols utilized in the office to accomplish different tasks. Communication and human relation problems.

**ADOF 4020. TRAINING IN ELECTRONIC EQUIPMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: ADOF 3017 and (ADMI 3007 or ADOF 3107).

Theoretical and practical study of different types of electronic equipment in the modern office.

**ADOF 4025. OFFICE ADMINISTRATION PRACTICUM.** Four credit hours. Eight hours of practice per week. Prerequisites: ADOF 3009, ADOF 3107, ADOF 4005, ADOF 4019, ADOF 4020, ADOF 4065, ADOF 4080 and 12 credits of professional electives or authorization of the Director of the Department.

Training in office techniques through the practice and performance of tasks pertaining to the office administration area in internship centers selected and supervised by the professor. Round-up and refine knowledge, techniques, skills, and attitudes desirable in a professional specialized in the office administration field.

**ADOF 4055. INTERPERSONAL RELATIONS.** Three credit hours. Three hours of lecture per week.

Prerequisites: ESOR 4006 or GERH 4006 or ADMI 3009.

Study of the interpersonal relations and its impact on the work setting: structure and organization of the work setting and the skills required for human interaction.

**ADOF 4065. INTRODUCTION OF WORD PROCESSING.** (I) Three credit hours. Three hours of lecture with practice per week. Prerequisites: ADOF 3016 or CISE 3049.

Basic concepts of word and information processing systems and their applications. Utilization of different word processing programs in a microcomputer.

**ADOF 4075. INTEGRATION OF INFORMATION PROCESSING PROGRAMS.** Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3007 or ADOF 3107.

Advanced concepts, special applications, and integration of different programs with word processing software.

**ADOF 4077. DESIGN AND PROCESSING OF DOCUMENTS.** (I) Three credit hours. Three hours of lecture per week. Prerequisite: ADOF 4005.

Design, composition and production of legal, governmental, medical, and industrial documents, among others, using the computer.

**ADOF 4080. TRAINING AND SEMINAR PLANNING.** Three credit hours. Three hours of lecture per week. Prerequisites: ADOF 4019 and (ADMI 3009 or ESOR 4006 or GERH 4006).

Development of competitions and coordination in the areas of office administration and supervision of personnel. Study and application of the basic concepts of planning and organization of trainings and seminars for the office personnel. Emphasis on the identification of necessities, selection of human and technological resources and the presentation of training proposals.

**ADOF 4126. MULTIDISCIPLINARY BUSINESS SEMINAR.** Three credit hours. Three hours of lecture-laboratory per week. Prerequisites: CONT 3011 and (ADOF 4005 or ADOF 4020) and (MATE 3086 or MATE 3171).

Introduction to the basics of financial management. Discussion of concepts and principles of descriptive statistics and discussion of the basics of entrepreneurship. Application of concepts in the preparation of an integrated plan in the business context.

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**ADOF 4995. OFFICE ADMINISTRATION INTERNSHIP.** Zero to six credit hours. Prerequisites: ADOF 4005 and ADOF 3009 and ADOF 4020.

Work experience in the area of office administration, in an office or business enterprise, under the supervision of a faculty member and in coordination with an immediate supervisor at the workplace.

**CISE 3049. KEYBOARDING AND TYPEWRITING.** (I, II) Three credit hours. Three hours of lecture per week.

Development of typewriting skills and the use of the keyboard on touch. Input of information to computers. Preparation of documents such as letters, memorandum, reports, tables, etc.

## ACCOUNTING

**CONT 3005. ELEMENTARY ACCOUNTING I.** (I, II) Four credit hours. Four hours of lecture per week.

The study of the basic procedures and principles of accounting related to recording business transactions and preparing and using financial statements of an enterprise. The following topics will be discussed: the accounting cycle, financial statements, accounting and valuation of assets and current liabilities.

**CONT 3006. ELEMENTARY ACCOUNTING II.** (II, S) Four credit hours. Four hours of lecture per week. Prerequisite: CONT 3005.

Continuation of the study of the basic procedures and principles of accounting relative to the recording of business transactions, preparation and use of the financial statements of an enterprise. The following topics are discussed: accounting and valuation of assets, liabilities accounting, organization forms, and elements of cost accounting.

**CONT 3007. INTERMEDIATE ACCOUNTING I.** (I) Four credit hours. Four hours of lecture per week. Prerequisites: CONT 3006 or CONT 3012.

Study of the principles and procedures of financial accounting at the intermediate level applied to problems of recording and valuation of assets, liabilities, corporate capital, and income determination. Includes the presentation and correction of financial statements.

**CONT 3008. INTERMEDIATE ACCOUNTING II.** (II) Four credit hours. Four hours of lecture per week. Prerequisite: CONT 3007.

Continuation of the study of the principles and procedures of financial accounting at the intermediate level applied to problems of recording and valuation of assets, liabilities, corporate capital, and income determination. Includes the presentation and correction of financial statements.

**CONT 3011. FINANCIAL ACCOUNTING PRINCIPLES I.** (I, II) Three credit hours. Three hours of lecture per week.

Study of the basic principles of accounting, procedures related to the accounting cycle, and the preparation and use of financial statements of service and merchandising enterprises. Includes topics such as: analysis, recording and posting of transactions, financial statements, accounting and valuation problems of cash, accounts receivable, and inventories. Use of software related to the accounting cycle.

**CONT 3012. FINANCIAL ACCOUNTING PRINCIPLES II.** (II, S) Three credit hours. Three hours of lecture per week. Prerequisite: CONT 3011 or CONT 3005.

Study of the basic principles and procedures of accounting related to the recording of business transactions and the preparation and use of financial statements. Includes topics such as: accounting for plant assets, liabilities, capital structure of business organizations, investments, and the statement of cash flow. Use of software related to the accounting cycle.

**CONT 4006. MANAGERIAL ACCOUNTING.** (I, II) Three credit hours. Three hours of lecture per week. Prerequisite: CONT 3006.

This course is required for non-accounting major students. The aspects and techniques of accounting that are useful to managers in the performance of their basic functions of planning, organizing, directing and controlling are analyzed and interpreted. The course also includes three basic areas: analysis and interpretation of financial statements, costing procedures in manufacturing enterprises and accounting, and planning techniques useful to the decision-making process.

**CONT 4007. FEDERAL INCOME TAX.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: FINA 3016 or CONT 4018.

Study of the necessary principles and procedures to prepare an income tax return for individuals, partnerships and corporations according to the United States of America income tax law. Special attention is given to the computation of gross income and deductions to determine taxable net income.

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**CONT 4009. INCOME TAX OF PUERTO RICO.** Three credit hours. Three hours of lecture per week. Prerequisites: FINA 3016 or CONT 4006 or CONT 4018 or CONT 3007 or CONT 4035 or CONT 4078.

Study of principles and procedures necessary to prepare an income tax return according to the Income Tax Law of the Commonwealth of Puerto Rico, for individuals, partnerships and corporations. Special attention is given to the computation of gross income and deductions according to the law to determine taxable net income.

**CONT 4015. ADVANCED ACCOUNTING PROBLEMS I.** (I) Four credit hours. Four hours of lecture per week. Prerequisite: CONT 4019.

Study and discussion of special problems in the field of accounting. Includes the study of partnership, home office and branch relationships, business combinations, and consolidated financial statements, among other topics.

**CONT 4016. RECENT DEVELOPMENTS IN ACCOUNTING.** (II) Three credit hours. Three hours of lecture per week. Prerequisites: CONT 4019 or CONT 4045.

Study and analysis of the fundamentals and developments of accounting theory. Recent developments in the private as well as the public sector will be discussed. The historical development and content of selected fundamentals and current issues in the field will be emphasized.

**CONT 4017. AUDITING AND SYSTEM.** (II) Three credit hours. Three hours of lecture per week. Prerequisites: CONT3008 or CONT4019.

Study of the principles of auditing and their application in the audit of financial statements and contemporary developments in the field. Detailed discussion of the steps required to perform an audit engagement with emphasis in risk assessment, internal control structure, audit procedures, and the different audit reports used to communicate the findings. Discussion of the Code of Professional Ethics.

**CONT 4018. INTERMEDIATE ACCOUNTING I.** (I)/(II) Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: CONT 3006.

Study of the principles and procedures of financial accounting at the intermediate level applied to problems of recording and valuation of assets, liabilities and corporate capital, income determination, and expenditures. Includes the presentation, analysis, interpretation, and correction of financial statements.

**CONT 4019. INTERMEDIATE ACCOUNTING II.** (I)/(II) Three credit hours per semester. Three hours of lecture per week each semester. Prerequisite: CONT 4018.

Study of the principles and procedures of financial accounting at the intermediate level applied to problems of recording and valuation of assets, liabilities and corporate capital, income determination, and expenditures. Includes the presentation, analysis, interpretation, and correction of financial statements.

**CONT 4027. ANALYSIS AND COST CONTROL.** (OD) Three credit hours. Three hours of lecture per week. Prerequisites: CONT 4078 or CONT4035.

Study of the quantitative techniques for solving accounting problems in the areas of planning and cost control. The course includes budgets, standard cost, variable cost, distribution cost analysis, gross margin analysis, and other selected topics in advanced costs and managerial accounting.

**CONT 4035. COST ACCOUNTING.** Three credit hours. Three hours of lecture per week. Prerequisite: FINA 3016.

Study of the methods and procedures of accounting in the determination of the cost of a product. Accounting procedures for the main elements of the cost of a product using job-costing and process-costing systems for cost accumulation. Special emphasis is placed on the discussion for managerial analysis and control of production costs.

**CONT 4037. ACCOUNTING INFORMATION SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3007 y (FINA 3016 o CONT 4035 o CONT 4006).

A study of accounting information systems and their role in management planning and decision-making. Data processing considerations in the design and operation of accounting information systems and principles of internal control with emphasis in computerized accounting systems. Apply accounting applications using software packages.

**CONT 4045. ADVANCED ACCOUNTING I.** (I) Three credit hours. Three hours of lecture per week. Prerequisites: CONT 4019 or CONT 3008.

Study and discussion of special problems in the field of accounting. Includes the study of partnership, home office and branch relationships, business combinations, and consolidated financial statements, among other topics.

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**CONT 4046. ACCOUNTING FOR GOVERNMENTAL ENTITIES AND NOT FOR PROFIT ORGANIZATIONS.** Three credit hours. Three hours of lecture per week. Prerequisites: CONT 4045 or CONT 4015.

Study of the accounting standards and financial reports of governmental entities and not-for-profit organizations.

**CONT 4048. ADVANCED ACCOUNTING II.** Four credit hours. Four hours of lecture per week. Prerequisites: CONT3008 or CONT4019.

Study of the accounting aspects related to multinational enterprises. Topics such as restructuring and bankruptcies, personal financial statements, estates and trusts, franchises, financial derivatives, and disclosure requirements of the Securities and Exchange Commission will be discussed among other topics.

**CONT 4078. COST ACCOUNTING.** Three credit hours. Three hours of lecture per week. Prerequisite: FINA 3016.

Study of the methods and procedures of accounting in the determination of the cost of a cost object. It includes the accounting procedures for the three main elements of the cost of a product (raw materials, direct labor, and manufacturing overhead) using job-costing and process-costing system for cost accumulation. Special emphasis is placed on the discussion for managerial analysis and control of production costs.

**CONT 4995. ACCOUNTING INTERNSHIP.** One to six credit hours. Prerequisites: (CONT 3008 or CONT 4019) and (CONT 4035 or CONT 4078) and authorization of the Director of the Department.

Work experience in the area of accounting in an organization under the supervision of a faculty member, an Internship Coordinator, and the immediate supervisor at the workplace.

**CONT 5006. TAX LIABILITIES FOR BUSINESSES IN PUERTO RICO.** Three credit hours. Three hours of lecture per week.

A comprehensive study of business tax liabilities in Puerto Rico under local or federal laws. Includes topics such as property, municipal, labor-related and excise taxes as well as tax exemptions under the Industrial Incentives Act.

## **HUMAN RESOURCES MANAGEMENT**

**ESOR 4005. GOVERNMENTAL CONTROL OF BUSINESS.** (OD) Three credit hours. Three hours of lecture per week.

Presents a brief explanation of local and federal statutes geared to protect business against coercion and monopoly. Comprehends the powers of state to enforce the law, the civil and criminal remedies, and the protection of the affected parts, the governmental regulation of securities, as well as the regulation of distribution contracts. Also contains a brief explanation of the laws that regulates retails, installment sales, financing of conditioned sales, leases, loans, and consumer services.

**ESOR 4006. PRINCIPLES OF MANAGEMENT.** (I, II) Three credit hours. Three hours of lecture per week.

An introduction to the managerial functions of planning, organizing, directing, and controlling analyzed from the point of view of the integration of human resources to achieve the objectives and goals of the organization. The problems of leadership development, supervision, group motivation and dynamics, organization of human resources, and the establishment and control of working procedures are discussed and worked upon.

**ESOR 4007. ORGANIZATIONAL DESIGN.** (II) Three credit hours. Three hours of lecture per week. Prerequisites: (ESOR 4006 or GERH 4006) or (ESOR 4025 or GERH 4025).

Comparison of major approaches to the study of organizations: organizational structure, systems of power and influence, inter- and intra-organizational conflicts and cooperation and their implication for management.

**ESOR 4008. HUMAN RESOURCES MANAGEMENT.** (I, II) Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3009 or ESOR 4006 or GERH 4006 or ININ 4029.

Survey of the basic processes of personnel administration such as recruitment, selection, training, and the administration of wages and salaries. The labor relations perspective is incorporated within the context of the personnel approach of a unionized organization.

**ESOR 4009. HUMAN RESOURCES ADMINISTRATION.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: ESOR 4008 or GERH 4008.

Analysis of the basic processes in personnel administration: job design, recruitment, selection, training, compensation and maintenance. Study of contemporary problems in each of these areas and their possible solutions in the contemporary business and industrial world. Particular emphasis will be given to the local perspective.

**ESOR 4010. WOMEN AND WORK.** (OD) Three credit hours. Three hours of lecture per week.

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Prerequisite: ESOR 4008 or GERH 4008 or ININ 4035 or SOCI 3262 or PSIC 3006.

Study of the characteristics of the working woman. Nature of paid and unpaid "work" and its relationship with the notion of "woman"; changes in the female labor force participation; occupational segregation; wage differences by gender; women career development in traditional and non-traditional occupations. All topics will be analyzed in the context of government and business policies.

**ESOR or GERH 4015. WORKFORCE PLANNING AND EMPLOYMENT.** Three credit hours. Three hours of conference per week. Prerequisites: ESOR 4008 or GERH 4008.

Practical study and applications of all aspects of the staffing process, from recruitment to termination and outplacement. Study of human resources planning, human resources information systems, employee rights, and affirmative action plans. Discussion of the strategic nature of performance management and employee development.

**ESOR 4016. LABOR RELATIONS.** (II) Three credit hours. Three hours of lecture per week. Prerequisites: GERH 4008 or ESOR 4008.

An analysis of worker-management relationships; development and operation of trade and labor unions; public and private policies on labor relations; collective bargaining, job and union security, and labor and social legislation.

**ESOR or GERH 4017. COMPARATIVE LABOR LAW.** (II) Three credit hours. Three hours of lecture per week. Prerequisites: ESOR 4015 or GERH 4015.

Comparative study of existing and proposed labor laws in Puerto Rico, the United States, and other jurisdictions. Emphasis on the study of alternative work periods, compensation and benefits, and other working conditions.

**ESOR 4019. COMPENSATION MANAGEMENT.** (I) Three credit hours. Three hours of lecture per week. Prerequisites: (ESOR 4015 or GERH 4015 or ESOR 4008 or GERH 4008) and ESTA 3001.

Analysis and evaluation of the different factors and norms which are considered for the establishment of wages and salaries. Basic tools such as job analysis, job evaluation, salary classification, wage survey, wage incentives, fringe benefits, performance evaluation, and overtime work, are applied within the framework provided by wage and hour legislation, minimum salary

regulations, and the norms and procedures created by labor-management relations.

**ESOR 4025. ORGANIZATIONAL BEHAVIOR.** (I, II) Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3009 or ESOR 4006 or GERH 4006.

Human behavioral factors which shape the decision making and leadership process in the organization. Study of the effects of such factors on the relationships between the manager and his personnel responsibilities. Specific concepts of perception, motivation, communication, conflict, change and other variables at the individual group and organization level are to be discussed and applied through cases and simulations.

**ESOR 4026. ADMINISTRATIVE POLICY.** (I, II) Three credit hours. Three hours of lecture per week. Prerequisites: (GERE 4007 or GERE 4022 or GERE 4046) and ((MERC 4215) or (GERE 4008 and GERE 4009) or (ESOR 4009 and ESOR 4016) or (FINA 4036 and FINA 4037) or (CONT 4015 or CONT 4017)).

Case analysis of contemporary business problems.

**ESOR 4027. LEADERSHIP IN ORGANIZATIONS.** (I) Three credit hours. Three hours of lecture per week. Prerequisite: ESOR 4025 or GERH 4025.

Analysis of literature on leadership in organizations to identify effective management styles from a contingency perspective. Roles of leaders in organizations. Current trends in leadership.

**ESOR 4028. INTERPERSONAL COMMUNICATION APPLIED TO ENGINEERING, SCIENCE, AND BUSINESS CAREERS.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: 6 credits in social sciences or humanities courses.

Techniques for communicating effectively in organizations; skills for coping with intra- and inter-organizational conflicts; how to establish an organizational communication program; and other issues related to communication and interpersonal relationships.

**ESOR 4030. HUMAN RESOURCES DEVELOPMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: GERH 4008 or ESOR 4008.

Development of training programs. The study of general psychological principles such as: learning, motivation, communication, perception, and how these apply to human resources training.

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**ESOR or GERH 4035. INNOVATION AND ORGANIZATIONAL CHANGE.** Three credit hours. Three hours of lecture per week. Prerequisites: GERH 4007 or ESOR 4007.

Study of the different approaches for introducing process, structural, technological, and behavioral changes in organizations. Discussion of models for intervention and the role of managers as agents of change. A field project is required.

**ESOR or GERH 4036. INTERPERSONAL COMMUNICATION IN THE WORKPLACE.** Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3009 or (ADM 4016 and ESOR 4006).

Study of the conceptual and practical nature of interpersonal communication and how it is affected by issues such as ethical challenges, workforce diversity, and technology. Discussion of the skills and attitudes necessary to communicate effectively within the work environment.

**ESOR or GERH 4037. MANAGING DIVERSITY IN ORGANIZATIONS.** Three credit hours. Three hours of lecture per week. Prerequisites: GERH 4008 or ESOR 4008.

Study of demographic diversity in today's global environment. Techniques for the effective management of a diverse workforce. Study of the sources of diversity-related conflicts in organizations, constructive approaches for dealing with these conflicts, and how organizations can leverage diversity for competitive advantage. A group project is required.

**ESOR 4995. HUMAN RESOURCES MANAGEMENT INTERNSHIP.** One to six credit hours. The student must work four hours per week per credit during fifteen weeks or its equivalent during a summer session. Prerequisites: [(ESOR 4007 or GERH 4007) and (ESOR 4009 or GERH 4009)] or ESOR 4015 and authorization of the Director of the Department.

Supervised work experience in the area of human resources, in a government agency, private enterprise or foundation under the supervision of a faculty member; in coordination with a supervisor from the host organization.

**GERH 4007. ORGANIZATIONAL DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisites: (ESOR 4006 or GERH 4006) or (ESOR 4025 or GERH 4025).

Comparative study of major approaches for the effective design of organizational structures in

alignment with business strategy. Application of design principles to a simulated business situation will allow students to assess the impact of power and influence, organizational culture, and conflicts.

**GERH 4008. HUMAN RESOURCES DEVELOPMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3009 or ESOR 4006 or GERH 4006 or ININ 4029.

Study of the basic processes of human resources management. The strategic nature of staffing, training, compensation, and labor relations will be discussed within a global and ethical context.

**GERH 4010. WOMEN AND WORK.** Three credit hours. Three hours of lecture per week. Prerequisites: ESOR 4008 or GERH 4008 or ININ 4035 or SOCI 3262 or PSIC 3006.

Study of the characteristics of the working woman. Nature of paid and unpaid work and its relationship with the notion of woman, changes in the female labor force participation, occupational segregation, wage differences by gender, women career development in traditional and nontraditional occupations. All topics will be analyzed in the context of government and business policies.

**GERH 4016. LABOR RELATIONS.** Three credit hours. Three hours of lecture per week. Prerequisites: ESOR 4008 or GERH 4008.

Analysis of the legal framework of labor relations and operation of labor unions with emphasis in the United States and Puerto Rico. Collective bargaining in the private and public sectors, and the process of conflict negotiation and resolution will be discussed. A group project is required.

**GERH 4019. COMPENSATION MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: (ESOR 4015 o GERH 4015 o ESOR 4008 o GERH 4008) y ESTA 3001.

Analysis and evaluation of the different factors and norms considered to design a compensation system. Basic tools such as job analysis, job evaluation, and salary surveys are applied to a case study within the framework of compensation legislation, salary regulations, and labor relations.

**GERH 4025. ORGANIZATIONAL BEHAVIOR.** Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3009 o ESOR 4006 o GERH 4006.

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Study of the development of the behavioral forces that shape the decision-making and leadership of organizations. Perception, motivation, communication, conflict, process change, and other variables which impact human behavior at the individual, group and organizational levels will be discussed. Concepts are applied through cases and experiential learning.

**GERH 4027. LEADERSHIP IN ORGANIZATIONS.** Three credit hours. Three hours of lecture per week. Prerequisite: ESOR 4025 or GERH 4025.

Analysis of literature on leadership in organizations to identify effective management styles from a contingency perspective. Roles of leaders in organizations. Current trends in leadership.

**GERH 4030. HUMAN RESOURCES DEVELOPMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: ESOR 4008 or GERH 4008.

Study of general psychological principles such as the learning process, learning styles, motivation, communication, and perception, and how these apply to the training of technical and managerial employees. Application of the development of training programs including needs assessment and evaluation of training efforts. A group project is required.

**GERH 4995. HUMAN RESOURCES MANAGEMENT INTERNSHIP.** One to six credit hours. (GERH 4015 and (ESOR 4007 or GERH 4007) and authorization of the Director of the Department) or ((ESOR 4007 or GERH 4007) and (ESOR 4009 or GERH 4009) and authorization of the Director of the Department).

Work experience in the area of human resources in an organization under the supervision of a faculty member, an Internship Coordinator, and the immediate supervisor at the workplace.

## STATISTICS

**ESTA 3001. BUSINESS STATISTICS I.** (I, II) Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: MATE 3049 or MATE 3000 or MATE 3172 or MATE 3174.

Introduction to concepts of business statistics. Includes descriptive statistics, for summarizing and presenting the

essential information graphically and numerically, basic probability concepts, probability distributions and sampling distributions. Includes laboratory practice and application of statistics and data analysis in a project.

**ESTA 3002. BUSINESS STATISTICS II.** (II, S) Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: ESTA 3001.

Statistical inference as applied to business situations. Includes univariate and bivariate analysis, multiple regression analysis, basic concepts of experimental design, and non-parametric methods. Includes laboratory practice and application of statistics and data analysis in a project using computers.

## FINANCE

**FINA 3006. BUSINESS FINANCE.** (I, II) Three credit hours. Three hours of lecture per week. Prerequisites: CONT 3006 and ADMI 3007.

Financial analysis, including sources and uses of fund statement, cost and control of business funds, working capital management, long-term financing, capital budgeting, financial structure and the use of leverage.

**FINA 3016. BUSINESS ANALYSIS USING FINANCIAL REPORTS.** Four credit hours. Four hours of lecture per week. Prerequisites: (CONT 3012 or CONT 3006) and (ADMI 3009 or (ESOR 4006 and ADMI 4016)).

Analysis of an organizations financial performance based on its published financial reports. Use of financial data in making management decisions.

**FINA 3017. MONEY, BANKING, AND ECONOMIC CONDITIONS.** (I, II) Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3022.

Analysis of the U.S. financial system, its response to and impact on economic activity and policy. Role of the financial markets on intermediation. Emphasis on interest rates, monetary policy, securities and their markets, the Federal Reserve System, business cycles, and risk management by financial institutions.

**FINA 3018. WORKING CAPITAL MANAGEMENT.** Two credit hours. Two hours of lecture per week. Prerequisites: FINA 3016 or FINA 3006.

Study of the financing and management of the acquisition, maintenance and disposition of working capital. Emphasis on determining the optimum levels of current assets and current liabilities to minimize risk and maximize return.



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**FINA 3035. PERSONAL FINANCIAL MANAGEMENT.** Three credit hours. Three hours of lecture per week.

Study of concepts of personal financial planning. Topics include the financial planning process, money management and investments, insurance needs, income tax planning, retirement planning and estate planning.

**FINA 3037. FINANCIAL ANALYSIS AND FINANCING OF SMALL AND MEDIUM ENTERPRISES.** Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3100 o CONT 3006 o CONT 3012.

Identification of how entrepreneurs obtain and use financial resources and how they analyze their financial information to effectively manage their business. Analysis of the financing process and the available alternatives, and how financial contracts are structured to manage risk and obtain incentives.

**FINA 4028. INTERNATIONAL FINANCE. (II)** Three credit hours. Three hours of lecture per week. Prerequisites: FINA 3017 or FINA 3006.

Application of finance principles in the international environment, including the balance of payment mechanism, the factors affecting the foreign exchange market and defensive techniques to protect the business against foreign exchange risk.

**FINA 4029. FINANCIAL MARKETS. (I)/(II)** Three credit hours per semester. Three hours of lecture per week per semester. Prerequisites: ECON 3021 and ECON 3022.

A comprehensive survey of the macro financial system, including both domestic and international aspects. It introduces the student to modern capital and money markets theory. It analyzes the operations of commercial banks and other financial institutions as holders of savings and sources of money and credit. It also examines the supply, demand and flow of investible funds, the structure of interest rates and the impact of monetary and other governmental policies on interest rates and flow of funds.

**FINA 4035. FINANCIAL MARKETS. (I)/(II)** Three credit hours per semester. Three hours of lecture per week per semester. Prerequisites: FINA 4029.

A comprehensive survey of the macro financial system, including both domestic and international aspects. It introduces the student to modern capital and money markets theory. It analyzes the operations of commercial banks and other financial institutions as holders of savings and sources of money and credit. It also examines the supply, demand and flow of investible

funds, the structure of interest rates and the impact of monetary and other governmental policies on interest rates and flow of funds.

**FINA 4036. ADMINISTRATION OF FINANCIAL INSTITUTIONS. (II)** Three credit hours. Three hours of lecture per week. Prerequisites: FINA 3017 or FINA 4035.

Study of the role of the major financial institutions and the principal financial management problems the institutions face. Emphasis is given to management problems of commercial banks, savings and loan associations, life insurance companies, credit cooperatives and how pension plans function.

**FINA 4037. FINANCIAL INVESTMENT MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: FINA 3016 or FINA 3006.

Study of the principles of the investment process and investment alternatives, including security analysis, information on securities markets, risk-return analysis, and security pricing models.

**FINA 4039. PUBLIC SECTOR FINANCES. (II)** Three credit hours. Three hours of lecture per week. Prerequisites: ECON 3021 and ECON 3022.

The study of the allocation, distribution, and stabilization functions of the modern state and their effects on the business firm; analysis of public sector budget policies from the point of view of income and expenditure, theories of taxation; public expenditure, budget incidence and effects, public debt; and their effect on the business decision-making process.

**FINA 4040. CURRENT FINANCIAL TRENDS. (I, II)** Three credit hours. Three lectures per week. Prerequisites: FINA 4035, FINA 4037 and FINA 4046.

Current developments in the field of money, banking, foreign exchange, corporation finance, investment, and allied fields. Special attention is given to the developments in Puerto Rico, and to those developments abroad which affect Puerto Rico.

**FINA 4046. CORPORATE FINANCE.** Three credit hours. Three hours of lecture per week. Prerequisites: FINA 3016 or FINA 3006.

Analysis of the implications of modern financial theory for the major decisions corporate managers face. Emphasis will be given to decision making in the areas of capital budgeting, capital structure, long and short term financing decisions, and working capital management.

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**FINA 4047. INVESTMENT ANALYSIS AND PORTFOLIO SELECTION.** Three credit hours. Three hours of lecture per week. Prerequisite: FINA 4037.

In-depth study of the field investment including portfolio theory and management. The course includes investment policies, risk handling, timing of investment decisions and portfolio performance. A portfolio construction and management project is required.

**FINA 4048. CREDIT AND COLLECTION MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: FINA 3016 or FINA 3006.

Study of advanced theory and practices of credit collection management. Evaluation of commercial and personal loan applications based on available credit options, laws and regulations.

**FINA 4055. FINANCIAL DERIVATIVES.** Three credit hours. Three hours of lecture per week. Prerequisite: FINA 4037.

Study of financial derivatives, such as options, forwards, futures, and swaps. Trading, pricing, and their arbitrage relationships will be discussed.

**FINA 4069. INTEGRATIVE FINANCE.** Two credit hours. Two hours of lecture per week. Prerequisites: FINA 4037 and FINA 4046 and ADMI 4039.

Capstone course that integrates financial decision-making in functional areas of business; utilizes various concepts to promulgate strategies, policies, and procedures in managing finance to achieve the company's goals. Case analysis and a research project are required.

**FINA 4995. FINANCE INTERNSHIP.** (I, II) One to six credit hours. Prerequisites: FINA 4046 and authorization of the Director of the Department.

Work experience in the area of finance in an organization under the supervision of a faculty member, an Internship Coordinator, and the immediate supervisor at the workplace.

**FINA 5015. PRINCIPLES OF FINANCIAL ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisites: (ESTA 3002 and MATE 3049) or authorization of the Director of the Department.

Introduction to the development of financial strategies and financial instruments according to the efficient market hypothesis.

## **OPERATIONS MANAGEMENT**

**GERE 4008. QUANTITATIVE METHODS IN OPERATIONS MANAGEMENT.** (I) Three credit hours. Three hours of lecture per week. Prerequisites: GERE 4007 or GERE 4022 or GERE 4046.

Application of mathematical models and techniques in operations research to the analysis, formulation and solution of operations problems such as allocation of resources, inventory control and scheduling. Probabilistic as well as deterministic models are considered emphasizing linear programming. Attention is centered on the formulation of problems and the evaluation of methodology.

**GERE 4009. PRODUCTION PLANNING AND CONTROL.** (I) Three credit hours. Three hours of lecture per week. Prerequisites: GERE 4046 or GERE 4007 or GERE 4022.

Study of the production planning and control system with emphasis on Master Production Scheduling, Material Requirements Planning, Capacity Planning and Utilization and Production Activity Control.

**GERE 4021. PRODUCTION MANAGEMENT I.** (I) Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3049 and ESOR 4006 and ESTA 3002 and ADMI 3007.

Concepts, techniques and decision-making procedures encountered in the management of production operations. Basic processes within an industrial organization with emphasis on inventory procurement and control, and problems typical of manufacturing operations.

**GERE 4022. PRODUCTION MANAGEMENT II.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: GERE 4021.

Development and operation of production control systems with special emphasis on problems of production planning, scheduling, and inventory control under conditions of uncertainty. Also includes simulation techniques.

**GERE 4028. MATERIALS MANAGEMENT.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: GERE 4007 or GERE 4022.

Economic, legal and environmental problems encountered in the acquisition and management of inventories; application of modern business methods to their solution.

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**GERE 4030. CONTEMPORARY ASPECTS OF INDUSTRIAL MANAGEMENT.** (OD) Three credit hours. Three hours of lecture per week. Prerequisite: GERE 4022.

Integration of practical and theoretical aspects of areas related to Industrial Management: Just in Time, Material Requirement Planning I and II, Quality Assurance, and others.

**GERE 4036. ASSURANCE SCIENCES.** Three credit hours. Three hours of lecture per week. Prerequisites: ESTA 3002 and (GERE 4046 or GERE 4022).

Study of techniques for monitoring and improving the quality, maintainability, reliability, and safety of products and processes. Discussion of issues of health, ethics, and social responsibility. A team research project in an organization is required.

**GERE 4045. SUPPLY CHAIN MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: GERE 4046 or GERE 4007 or GERE 4022.

Study of the movement of products, services, and information among all links in the value chain. Emphasis on supplier selection and relationships, material management including purchasing, inventories, distribution, and transportation.

**GERE 4046. OPERATIONS MANAGEMENT.** (I, II, S) Four credit hours. Four hours of lecture per week. Prerequisites: ESTA 3001 and (ADMI 3009 or (ADMI 4016 and ESOR 4006)).

Study of qualitative and quantitative techniques, decision-making procedures, processes, and tools used in the operations of manufacturing and service organizations.

**GERE 4055. SERVICE OPERATIONS MANAGEMENT.** (II) Three credit hours. Three hours of lecture per week. Prerequisites: GERE 4007 or GERE 4046 or GERE 4022.

Study of mainstream and emerging service industries with emphasis on their operational strategies for obtaining competitive advantage. Includes topics such as: revenue management, service quality management, and the impact of information technology on the productivity of services.

**GERE 4085. PROJECT MANAGEMENT APPLICATIONS IN BUSINESS.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: ADMI 4085.

Applications of project management tools to the management of project related businesses.

**GERE 4995. OPERATIONS MANAGEMENT INTERNSHIP.** (I, II) One to six credit hours. Prerequisites: (GERE 4008 or GERE 4022) and authorization of the Director of the Department.

Work experience in the area of operations management in an organization under the supervision of a faculty member, an Internship Coordinator, and the immediate supervisor at the workplace.

## MARKETING

**MERC 3115. PRINCIPLES OF MARKETING.** (I, II) Three credit hours. Three hours of lecture per week.

Introduction to the concepts, principles, activities, techniques and strategies of the function of marketing in a national and international context. Applications to different types of organizations will be discussed.

**MERC 3117. SELLING AND SALES MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: MERC 3115.

Study of traditional and emerging selling techniques making effective sales presentations. Current theories about selling of goods and services including building trust in customers, sales ethics, behavior of customers in purchasing, and effective communication in selling will be covered. The organization and management of the sales force will be discussed.

**MERC 4009. PROMOTION AND ADVERTISEMENT.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: MERC 4217.

Introduction to the basic concepts of promotion management. Stimulation of demand through personal selling and advertising. Managerial issues and problems of the promotional manager.

**MERC 4065. GLOBAL MARKETING STRATEGIES.** (II) Three credit hours. Three hours of lecture per week. Prerequisites: MERC 3115 y ECON 3022.

Analysis of international marketing strategies considering market trends, costs, forecasting, pricing, sourcing, and distribution factors. Development of an international export/import marketing plan including strategy analysis and formulations and evaluation of portfolios of product offerings at domestic or global levels.

**MERC 4075. MARKETING RESEARCH.** (OD) Three credit hours. Three hours of lecture per week. Prerequisites: MERC 3115 and ESTA 3002.

Systematic gathering, recording and analysis of data about problems relating to the marketing of goods and services.

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**MERC 4215. RETAIL MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: MERC 3115.

Study of the philosophy, concepts, strategies and techniques in the retail selling business. Emphasis will be placed in topics of strategic planning, inventory management, location analysis, merchandising, human resources, pricing and promotion.

**MERC 4217. CONSUMER BEHAVIOR.** (I) Three credit hours. Three hours of lecture per week. Prerequisite: MERC 3115.

The study of individuals, groups, and organizations in their role as consumers of goods and services, including selection processes consumers use and their impact on organizations of the public and private sector, as well as not-for-profit organizations. Discussion includes how marketing strategies are developed to influence the way consumers behave.

**MERC 4218. MANAGEMENT OF PHYSICAL DISTRIBUTION.** (I) Three credit hours. Three hours of lecture per week. Prerequisites: MERC 3115 and (GERE 4007 or GERE 4022 or GERE 4046).

Analysis of the activities pertinent to the distribution channel as well as their integration to the overall marketing activities of the business. Special emphasis will be given to the management of physical distribution activities including packaging, management of transportation, electronic channels and customer services.

**MERC 4230. INTEGRATED MARKETING COMMUNICATIONS.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: MERC 4217.

Study of the basic concepts of integrated marketing communications management. Discussion of traditional and emerging marketing communications functions and their use in developing effective communication strategies and programs from a global and ethical perspective.

**MERC 4236. SERVICES MARKETING.** Three credit hours. Three hours of lecture per week. Prerequisite: MERC 3115.

Study of the nature of service organizations. Development of strategies, elements, and marketing mix in the service market with emphasis on the differences between the marketing of traditional goods and services.

**MERC 4995. MARKETING INTERNSHIP.** (I, II, S) One to six credit hours. Prerequisites: MERC 4217 and authorization of the Director of the Department.

Work experience in the area of marketing in an organization under the supervision of a faculty member,

an Internship Coordinator, and the immediate supervisor at the workplace.

## **COMPUTERIZED INFORMATION SYSTEMS**

**SICI 3018. FUNDAMENTALS OF INFORMATION SYSTEMS.** (II) Two credit hours. Two hours of lecture per week. Prerequisites: ADMI 3007 or ADMI 3010.

Discussion of concepts related to information technology, information systems development and application software. Study of the use and impact of information technology in businesses and how it improves information quality, timeliness and competitive advantage.

**SICI 3029. PROGRAMMING FUNDAMENTALS FOR BUSINESS.** (I) Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: ADMI 3007 or ADMI 3010.

Study of the fundamentals of object-oriented programming for the development and implementation of programs that support the managerial decision-making process. Practical laboratory experience in object-oriented programming.

**SICI 3051. PROGRAM DEVELOPMENT I.** (I) Three credit hours. Three hours of lecture per week. Prerequisite: ADMI 3007.

Elemental computer programming and solution of managerial problems using a modern programming language. Fundamentals of structured program design: development, testing, implementation and documentation; language syntax, file structure, and operational system facilities for the implementation of programs that generate managerial reports.

**SICI 3052. PROGRAM DEVELOPMENT II.** (II) Three credit hours. Three hours of lecture per week. Prerequisite: SICI 3051.

Advanced computer programming and managerial problem solving using a modern programming language.

**SICI 3056. STRUCTURED LANGUAGES.** (OD) Three credit hours. Three hours of lecture per week. Prerequisite: SICI 3051.

Algorithm design using the logical structures of sequence, selection, and iteration. Modularized top-down design using functions, procedures, and static and dynamic data structures. Structured languages such as Pascal or Ada will be used.

**SICI 3057. DATA STRUCTURES.** Three credit hours. Three hours of lecture per week. Prerequisites: SICI 3029 or ((SICI 3052 and (SICI 3056 or SICI 3058)).

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Study of the fundamental nature of digital information and storage structures and their manipulation.

**SICI 3058. PROGRAMMING IN C LANGUAGE.** Three credit hours. Three hours of lecture per week. Prerequisites: SICI 3052 or SICI 3029.

The study of the unique characteristics of the c language. Programs for different business applications will be developed using its flexibility to work at a lower level of computer hardware. Introduction to object oriented programming using C++. Control the physical components of computers. Object oriented programming concepts will be used.

**SICI 3059. INFORMATION SYSTEMS THEORY AND PRACTICE. (II)** Three credit hours. Three hours of lecture per week. Prerequisite: ADMI 3007.

Description and use of information systems as a support tool in the managerial decision process; utilization of information as a resource to provide competitive advantage. Planning, implementation, and efficient project management using information systems.

**SICI 4046. INFORMATION SYSTEMS ANALYSIS AND DESIGN. (II)** Three credit hours. Three hours of lecture per week. Prerequisites: SICI 3029 and ADMI 4085.

Study of analysis and design strategies appropriate for the development of business information systems. Identification of problems, gathering of information to determine system requirements, evaluation of possible solutions and their feasibility, and generation of a logical design. Application of course concepts in projects.

**SICI 4085. INFORMATION SYSTEMS ANALYSIS METHODS. (I)** Three credit hours. Three hours of lecture per week. Prerequisite: SICI 3051.

System development life cycle. Process flow, data structure and flow: file and input/output design; program specifications. Collection and reporting activities.

**SICI 4087. STRUCTURED INFORMATION SYSTEM ANALYSIS AND DESIGN. (II)** Three credit hours. Three hours of lecture per week. Prerequisites: SICI 3052 and SICI 4085.

Structured analysis and design strategies for dealing with complex information systems.

**SICI 4088. DATA COMMUNICATIONS AND NETWORKING. (II)** Three credit hours. Three hours of lecture per week. Prerequisite: SICI 4085 or SICI 4145.

The study of networking and data communications fundamentals. Data communication and telecommunication concepts, models, standards, and protocols will be studied. Installation, configuration, systems integration and management of networking and

telecommunications technologies will be practiced in the laboratory.

**SICI 4089. DATA COMMUNICATIONS AND NETWORKING.** Three credit hours. Three hours of lecture per week. Prerequisite: SICI 4146.

Study of networking and data communications fundamentals. Analysis of data communication and telecommunication concepts, models, standards, and protocols. Laboratory practice in installation, configuration, systems integration and management of networking and telecommunications technologies.

**SICI 4095. DATABASE DEVELOPMENT.** Three credit hours. Two hours of lecture and one hour of laboratory per week. Prerequisites: SICI 4046 or SICI 4085.

Fundamentals of database systems, emphasizing data modeling and design, basic notation, query processing, and database services including concurrency, security and integrity. The laboratory will provide hands-on experience with database applications.

**SICI 4096. MANAGEMENT OF CONTEMPORARY ISSUES IN MANAGEMENT INFORMATION SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: SICI 4046 or SICI 4085.

Study of contemporary issues in the area of information technology. Emphasis will be given to technological alternatives for management of current situations, the legal aspects, and the social implications of information technology.

**SICI 4097. SYSTEMS DEVELOPMENT.** Two credit hours. One hour of lecture and two hours of supervised workshop per week. Prerequisites: SICI 4088 or (SICI 4087 and SICI 4095).

Capstone course where the student will analyze, design, implement, and test a computer information system using appropriate development methodologies. A group project is required where students will develop an information system applying project management principles.

**SICI 4140. OFFICE AUTOMATION. (OD)** Three credit hours. Three hours of lecture per week. Prerequisite: SICI 4087.

Information and decision support systems used as critical elements of the managerial decision process. Data managerial report; electronic filing and retrieving systems; word processing and telecommunications.

**SICI 4144. BUSINESS PROGRAMMING LANGUAGES.** Three credit hours. Two hours of lecture and one hour of laboratory per week. Prerequisites: SICI 3029 or SICI 3052.

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Comparative analysis of modern business programming languages. Advanced concepts and capabilities of programming languages used in the business field.

**SICI 4145. SOFTWARE AND HARDWARE CONCEPTS.** (I) Three credit hours. Three hours of lecture per week. Prerequisite: SICI 3052.

Technical topics related to computer systems emphasizing the relationship between hardware and software design in the development of business application programs.

**SICI 4146. HARDWARE AND SOFTWARE TECHNOLOGY IN INFORMATION SYSTEMS.** (II) Two credit hours. Two hours of lecture per week. Prerequisite: SICI 3018.

Discussion of technical aspects of information technology including concepts of computer hardware, software, and networking. Analysis of trade-offs in computer hardware and system software for effective use in organizations.

**SICI 4155. DECISION-MAKING SYSTEMS.** (II) Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3007 and ESTA 3002.

Specialized information systems used by business managers to support decision-making.

**SICI 4157. ADVANCED DATABASE CONCEPTS.** (OD) Three credit hours. Three hours of lecture per week. Prerequisite: SICI 4095.

Application of advanced database concepts in the development of management information systems. Discussion of emerging technologies related to database systems. A project is required in which the student will develop a database system.

**SICI 4168. ELECTRONIC DATA PROCESSING AUDITING.** (OD) Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3007, and SICI 4087 or CONT 4017.

Electronic data processing auditing; techniques, controls and auditing types.

**SICI 4175. INTRODUCTION TO JAVA PROGRAMMING.** Three credit hours. Three hours of lecture per week. Prerequisites: SICI 3029 or SICI 3051 or COMP 3010 or INGE 3016.

Introduction to object oriented programming using Java. Discussion of classes, objects, inheritance, polymorphism, encapsulation, and other fundamental object oriented programming concepts.

**SICI 4185. INTRODUCTION TO PROGRAMMING FOR MOBILE DEVICES.** Three credit hours. Three hours of lecture per week. Prerequisites: SICI 3029.

Introduction to the basic foundations in building mobile device applications. Analysis of the key concepts and basic technical skills for creating fully-functional mobile applications, presuming previous basic programming experience in an object-oriented language (such as Java or C#).

**SICI 4186. COMPUTER AND MOBILE FORENSICS INVESTIGATIONS.** Three credit hours. Three hours of lecture per week. Prerequisites: ADMI 3007 or ADMI 3010 or authorization of the Director of the Department.

Exploration and analysis of electronic discoveries and issues related to cyber evidence. Use of evidence to identify and analyze the nature of security incidents, the source of potential threats and the methods used in incident management and mitigation. Evaluation of technical and business issues which affect the actions of the enterprise in responding to a security incident.

**SICI/COMP 4308. NETWORKING AND ROUTING FUNDAMENTALS.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3063 or SICI 4088 or SICI 4089 or COMP 3075.

Study of the terminology of computer networks and their protocols, internet protocol (IP) addressing, introduction to network design, and networking standards. Presentation, study, and configuration of several routing protocols.

**SICI 4995. COMPUTERIZED INFORMATION SYSTEMS INTERNSHIP.** One to six credit hours. Prerequisites: (SICI 4046 or SICI 4087) and authorization of the Director of the Department.

Work experience in the area of information systems in an organization under the supervision of a faculty member, an Internship Coordinator, and the immediate supervisor at the workplace.

**INEL/ICOM/SICI/COMP 5318. INTERMEDIATE ROUTING, SWITCHING AND WIDE AREA NETWORKS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL/ICOM/SICI/COMP 4308 or authorization of the Director of the Department.

Study and configuration of link state protocols. Study of intermediate level concepts such as switching, wide area network or WAN standards, virtual local area networks or VLAN, network design, and redundancy. Presentation and study of strategies for managing and saving address space such as variable length subnet masks and network address translation.

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## **COLLEGE OF ENGINEERING**

### **Aims and Objectives**

The aims and objectives of the University of Puerto Rico as pertaining to its Mayagüez Campus, of which the College of Engineering constitutes a major educational division, are expressed in Section 12 of the amended University Law, as follows:

"The principal function of the College of Agriculture & Mechanic Arts at Mayagüez shall be, without excluding other scientific and classic studies and including military science, to teach those branches of knowledge related to Agriculture and Mechanic Arts with the purpose of encouraging the liberal and practical education of the industrial classes. This is in accordance with the provisions of the congressional law known as the Second Morrill Act as amended by Congress in 1907."

Following this educational directive, engineering curricula have been designed to provide a firm educational foundation upon which engineering graduates can build social and professional competence after leaving college and become men and women of high value to modern society.

### **Mission**

The College of Engineering mission is to provide citizens to our society able to think critically, professionally prepared in engineering and related areas, and capable of exercising leadership positions to contribute to the cultural, social, economic, scientific and technological development of our immediate environment, Puerto Rico and the rest world. At the same time, it is the mission of the College of Engineering, the creation and dissemination of scientific knowledge, innovation and adaptation of technology for the benefit of society in general with emphasis on Puerto Rican society.

### **Vision**

Our commitment is to prepare the best professionals in engineering and related areas, and to be a major center for research, publications and service for the technological development of Puerto Rico, the U.S., the Caribbean, Central and South America.

### **General Education**

The General Education component in every Engineering program is designed to provide students with a preparation in subjects that surpass the boundaries of their technical disciplines. It is our belief that a well-rounded engineering education must instill in its students the ability to think critically, to communicate effectively, and to develop a fairly comprehensive understanding of human desires and aspirations, human convictions, and human behavior under varying circumstances.

### **General Education Learning Outcomes**

The General Education Component in our Engineering programs is designed to provide students with ability to:

1. Become an intentional learner
2. Demonstrate creative and critical thinking
3. Communicate effectively
4. Identify, study, and propose solutions to problems; transform knowledge into action
5. Apply mathematical, scientific, and technological skills
6. Apply interpretative and integrative skills
7. Relate global contexts and issues of importance to Puerto Rico
8. Show moral autonomy; develop a sense of wellbeing; understand ethical conduct
9. Practice civic virtues
10. Value diversity

### **General Education Course Categories**

To fulfill our general education learning outcomes, every engineering study program includes a series of integrated courses include:

- Spanish
- English
- Mathematics
- Sciences
- Kinesiology,
- Humanities, and
- Social Sciences.

These are recognized as indispensable to the proper education of engineers not only because of their practical application in industrial, business, and civic life, but also because they provide a breadth of knowledge that enriches a person's private life.

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## Student Chapters of Honorary and Professional Societies

The College of Engineering is home of a rich and diverse body of student chapters of honorary and professional societies and other student groups that offer plenty of opportunities for developing and exercising leadership and social skills in all areas of engineering. These include:

- Alpha Pi MU (Industrial Engineering Honor Society)
- American Concrete Institute
- American Institute of Aeronautics and Astronautics
- American Institute of Chemical Engineers
- American Society Civil Engineers
- American Society for Quality
- American Society Mechanical Engineers
- Associated General Contractors of America
- Association for Computing Machinery
- Association of Females in Mechanical Engineering
- Biomedical Engineering Society
- Chemical Engineering Graduate Student Association
- Civil Engineering and Surveying Student Association
- College Robotics Organization for Mechanical Engineers
- Construction Engineering Management Association
- Earthquake Engineering and Research Institute
- Electrical & Computer Engineering Graduate Student Association
- Engineers without Borders
- Golden Key International Honor Society
- Human Factors and Ergonomics Society
- Industrial Engineering Graduate Association
- Institute of Civil Engineering
- Institute of Electrical and Electronics Engineers
- Institute of Industrial Engineers
- Institute of Puerto Rican Chemical Engineers
- Institute of Transportation Engineering

- International Society for Pharmaceutical Engineering
- Materials Advantage
- National Society of Professional Engineers
- Pi Tau Sigma (Mech. Eng. Honor Society)
- Puerto Rico Water and Environment Association
- Society Aerospace Engineering
- Society of Hispanic Professional Engineers
- Society of Puerto Rican Electrical Engineers
- Society of Women Engineers
- Solar Engineering Racing Team
- Student Council of the College of Engineering
- Students Branch of Institute of Surveying
- Tau Beta Pi
- US Green Building Council

## Academic Offerings

The College of Engineering includes the Departments of Engineering Sciences and Materials, Chemical, Civil and Surveying, Electrical and Computer Engineering, Industrial, Mechanical Engineering and Computer Science and Engineering. It also includes a Research and Development Center, spanning multiple centers and institutes as denoted in our Research and Development Manifest.

The Department of Engineering Sciences and Materials provides and is responsible for the administration of basic engineering courses taken by students from all departments. In addition, the department administers the master's program in Engineering Sciences and Materials.

The Departments of Chemical, Civil and Surveying, Electrical and Computer, Industrial, Mechanical and Computer Science and Engineering provide and are responsible for uniformity of instruction, academic orientation, enrollment, and administration of the courses offered by each department, leading to the degrees of Bachelor of Science in Chemical, Civil, Electrical, Computer, Industrial, and Mechanical Engineering, Computer Science and Engineering, Software Engineering and in Surveying and Topography.

The College of Engineering offers graduate education leading to the degrees of Master of Science and Master of Engineering in Chemical, Mechanical, Industrial,



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Civil, Electrical, and Computer, Bioengineering, Engineering Sciences and Materials. In addition, it offers a Master's Degree of Engineering in Management Systems. The College of Engineering also offers Doctor of Philosophy degrees in Bioengineering, Civil, Electrical, Mechanical, Chemical Engineering and Computing and Information Sciences and Engineering. Information concerning these programs may be obtained by consulting the Bulletin of Information of the Graduate School.

The Research and Development Center offers an opportunity for undergraduate and graduate students and professors to join their efforts in the common goals of research and development in scientific and technological areas. It is also the objective of the Center to study the particular problems in these areas as they apply to Puerto Rico, and to offer technical and scientific training for the best utilization of the island's own resources.

### **Advanced Placement**

First year students who pass the advanced-level exams with a high score in mathematics, English, and/or Spanish upon request, may be given credit and will not be required to take the basic courses in these subjects.

### **Cooperative Education Program**

At the Bachelor's degree level, the Cooperative Education Program offers students the opportunity to blend classroom learning with practical work experience. The Cooperative Education Program complements college studies with on-the-job experience alternating study and work periods. Student participation in the program is voluntary; however, interested students are screened by the Cooperative Education Office of the College of Engineering. Work-study periods are scheduled for each student to provide a multitude of learning opportunities available in business, industry, and public agencies, which become an integral part of a more comprehensive career-oriented college education.

Participating students can receive up to nine (9) academic credits in the free or technical electives. A Cooperative Education Working Agreement is signed by the participating employer, the Cooperative Education Office, and the University to guarantee maximum program effectiveness.

To enter the program students enrolled in an engineering program must be at least in their second year and have a general GPA of 2.50/4.00 or higher.

Cooperative education benefits the student, the participating employer, and the university.

#### **Benefits to students:**

1. A COOP practice helps students obtain insight and evaluate his/her chosen major.
2. Classroom theory and principles become more meaningful through practical application in work assignments.
3. Students earn up to nine academic credits and maintain a regular student standing.
4. Students have the advantage of gaining professional experience before graduating.
5. Students receive monetary compensation for their work, helping them offset the costs of their education.
6. COOP students have priority in the registration process.

#### **Benefits to employers:**

1. Employers and students have a better opportunity of knowing each other for several months in a work environment, rather than during a short job interview.
2. Upon returning to campus, students become company ambassadors among their peers.
3. Employers reduce their training costs.
4. Employers have the opportunity of extending job offers to COOP students before their graduation.

#### **Benefits to the University:**

1. The program promotes better relationships between industry and university.
2. The program creates ties with governmental, business, and industrial communities.
3. The program provides faculty members with opportunities to gain additional knowledge about their subject matter.
4. The program provides faculty members with research and internship opportunities with the companies.
5. The program helps update curricula to keep courses aligned with on-the-job requirements.

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## DEPARTMENT OF CHEMICAL ENGINEERING

Chemical Engineering creatively combines the three basic physical sciences – chemistry, physics, and biology – along with mathematics to address the world's needs by creating new technology and solving problems in existing technology (Solen & Harb, 2011). Chemical engineers apply science, mathematics, and engineering principles to them to the design, analysis, and control of chemical, physical, or biological processes, including the hazards associated with these processes. Chemical engineers convert raw materials or chemicals to more valuable or useful forms.

Nearly all physical phenomena can be described through the combination of the basic sciences and mathematics making chemical engineering extremely versatile. Because of this versatility, chemical engineers make valuable contributions in most fields, from food processing, pharmaceuticals production to medical device fabrication, and from energy production to artificial-organ development.

There are several fundamental physical phenomena that are important to engineers as they develop and implement a chemical process. These form the common educational basis of all chemical engineers, and include: conservation of mass, energy, and momentum, fluid mechanics, heat transfer, mass transfer, reaction engineering, process control, materials, and economics.

### Mission

To develop a strong Chemical Engineering program focused on research, services and on educating students coming from all socioeconomic levels to convert them in professionals competitive at a worldwide level and knowledgeable of their social responsibility.

### Vision

To become a Department that harmonizes high quality education and a strong research program to provide world competitive graduates.

## Program Educational Objectives

Graduates of the Chemical Engineering program are expected within a few years to:

1. Pursue careers as practicing chemical engineers in fields such as chemical, materials, energy and environment, pharmaceuticals, biotechnology, food processing, and consumer products.
2. Pursue advanced studies in chemical engineering or a related technical discipline, medicine, law, or business, if desired.
3. Succeed in their chosen career path, demonstrating high standards of professional and social responsibility.

## Student Learning Outcomes

To achieve the Program Educational Objectives students of the Chemical Engineering program will develop the following skills throughout their curriculum:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Attainment of these outcomes prepares graduates to enter the professional practice of chemical engineering. The curriculum described below is continuously assessed and improved to prepare students to develop the skills needed to succeed as a chemical engineering professional. For more information on the relationship between Student Outcomes-Program Educational Objectives and

courses-Student Outcomes please visit our webpage at [www.inqu.uprm.edu/accreditation](http://www.inqu.uprm.edu/accreditation).

The Bachelor of Science Program in Chemical Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

## PROGRAM OF STUDY

### CHEMICAL ENGINEERING CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits | Course                       |
|------------|---------|------------------------------|
| *MATE 3005 | 5       | Pre-Calculus                 |
| QUIM 3041  | 4       | General Chemistry I          |
| ELECTIVE   | 3       | **Sociohumanistic Elective   |
| *INGL 3--- | 3       | First year course in English |
| *ESPA 3101 | 3       | Basic course in Spanish I    |
|            | 18      |                              |

##### Second Semester

| Number     | Credits | Course                       |
|------------|---------|------------------------------|
| MATE 3031  | 4       | Calculus I                   |
| QUIM 3042  | 4       | General Chemistry II         |
| *INGL 3--- | 3       | First year course in English |
| *ESPA 3102 | 3       | Basic course in Spanish II   |
| INGE 3011  | 2       | Engineering Graphics I       |
| EDFI---    | 2       | Physical Education Elective  |
|            | 18      |                              |

#### SECOND YEAR

##### First Semester

| Number     | Credits | Course                            |
|------------|---------|-----------------------------------|
| MATE 3032  | 4       | Calculus II                       |
| FISI 3171  | 4       | Physics I                         |
| FISI 3173  | 1       | Physics Laboratory I              |
| QUIM 3450  | 5       | Fundamentals of Organic Chemistry |
| ^INGL 3--- | 3       | Second year course in English     |
| ELECTIVE   | 1       | Free Elective                     |
|            | 18      |                                   |

##### Second Semester

| Number    | Credits | Course                |
|-----------|---------|-----------------------|
| MATE 3063 | 3       | Calculus III          |
| FISI 3172 | 4       | Physics II            |
| FISI 3174 | 1       | Physics Laboratory II |

|            |    |                                     |
|------------|----|-------------------------------------|
| ^INGL 3--- | 3  | Second year course in English       |
| QUIM 3055  | 4  | Analytical Chemistry                |
| INGE 3016  | 3  | Algorithms and Computer Programming |
|            | 18 |                                     |

#### THIRD YEAR

##### First Semester

| Number    | Credits | Course                          |
|-----------|---------|---------------------------------|
| INGE 3031 | 3       | Engineering Mechanics-Static    |
| ININ 4015 | 3       | Engineering Economic Analysis   |
| MATE 4009 | 3       | Ordinary Differential Equations |
| QUIM 4041 | 3       | Physical Chemistry I            |
| INQU 4005 | 4       | Materials and Energy Balances   |
| ELECTIVE  | 2       | Free Elective                   |
|           | 18      |                                 |

##### Second Semester

| Number    | Credits | Course  |
|-----------|---------|---|
| QUIM 4042 | 3       | Physical Chemistry II                           |
| QUIM 4101 | 1       | Physical Chemistry Laboratory I                 |
| INQU 4008 | 3       | Mathematical Analysis of Chemical Eng. Problems |
| INQU 4010 | 4       | Momentum Transfer Operations                    |
| INQU 4011 | 3       | Chemical Engineering Thermodynamics I           |
| ELECTIVE  | 3       | Free Elective                                   |
|           | 17      |   |

#### FOURTH YEAR

##### First Semester

| Number    | Credits | Course                                 |
|-----------|---------|--|
| QUIM 4102 | 1       | Physical Chemistry Laboratory II       |
| QUIM ---- | 3       | Elective in Chemistry                  |
| INQU 4001 | 4       | Heat Transfer Operations               |
| INQU 4012 | 3       | Chemical Engineering Thermodynamics II |
| ELECTIVE  | 3       | **Sociohumanistic Elective             |
| INEL 4075 | 3       | Fundamentals of Electrical Engineering |
|           | 17      |  |

##### Second Semester

| Number    | Credits | Course                               |
|-----------|---------|--------------------------------------|
| INQU 4002 | 4       | Mass Transfer Operations             |
| INQU 4017 | 4       | Chemical Eng. Kinetics and Catalysis |
| INQU 4034 | 2       | Chemical Engineering Laboratory I    |
| INQU ---- | 3       | Elective in Chemical Engineering     |
| INGE 4001 | 3       | Materials Engineering                |
|           | 16      |                                      |

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## FIFTH YEAR

### First Semester

| Number    | Credits | Course                                |
|-----------|---------|---------------------------------------|
| INQU 5030 | 2       | Chemical Engineering Laboratory II    |
| INQU 5020 | 3       | Chemical Process Safety and Economics |
| INQU 5021 | 3       | Chemical Engineering Process Design I |
| INQU 5025 | 3       | Analysis and Control of Processes     |
| ELECTIVES | 6       | **Sociohumanistic Electives           |
|           | 17      |                                       |

### Second Semester

| Number    | Credits | Course                                 |
|-----------|---------|--|
| INQU 5022 | 3       | Chemical Engineering Process Design II |
| INQU ---- | 3       | Elective in Chemical Engineering       |
| ELECTIVE  | 3       | **Sociohumanistic Elective             |
| ELECTIVES | 6       | Free Electives                         |
|           | 15      |  |

**Total credits required for program: 172**

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*The fifteen (15) credit hours of Sociohumanistic electives will be selected by the student, with the advisor's approval, from a list of recommended courses.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## DEPARTMENTAL FACULTY

**ALDO ACEVEDO-RULLÁN**, *Professor*, Ph.D., 2006, University of Delaware.

**CLARIBEL ACEVEDO VELEZ**, *Assistant Professor*, Ph.D., 2011, University of Wisconsin, Madison.

**MOSES BOGERE**, *Professor*, Ph.D., 1993, University of Akron.

**NELSON CARDONA-MARTÍNEZ**, *Professor*, Ph.D., 1989, University of Wisconsin-Madison.

**UBALDO M. CÓRDOVA-FIGUEROA**, *Professor*, Ph.D., 2008, California Institute of Technology.

**MARÍA C. CURET ARANA**, *Professor*, Ph.D., 2006, Northwestern University.

**MARIBELLA DOMENECH-GARCÍA**, *Associate Professor*, Ph.D., 2010, University of Wisconsin, Madison.

**L. ANTONIO ESTÉVEZ-DE VIDTS**, *Professor*, Ph.D., 1983, University of California-Davis.

**ARTURO J. HERNÁNDEZ-MALDONADO**, *Professor*, Ph.D., 2004, University of Michigan.

**MAGDA LATORRE-ESTEVEZ**, *Associate Researcher*, Ph.D., 2006, Harvard Medical School.

**MARÍA M. MARTÍNEZ-IÑESTA**, *Professor*, Ph.D., 2006, University of Delaware.

**RAFAEL MÉNDEZ-ROMÁN**, *Professor*, Ph.D., 2005, University of Puerto Rico, Mayagüez.

**PATRICIA ORTIZ-BERMUDEZ**, *Professor*, Ph.D., 2005, University of Wisconsin, Madison.

**YOMAIRA J. PAGAN-TORRES**, *Assistant Professor*, Ph.D., 2011, University of Wisconsin, Madison.

**CARLOS A. RAMÍREZ-QUÍÑONES**, *Professor*, Sc.D. Ch.E., 1979, Massachusetts Institute of Technology.

**LAKSHMI N. SRIDHAR**, *Professor*, Ph.D., 1991, Clarkson University.

**LORENZO SALICETI-PIAZZA**, *Professor*, Ph.D., 1996, Purdue University.

**DAVID SULEIMAN-ROSADO**, *Professor*, Ph.D., 1994, Georgia Institute of Technology.

**MADELINE TORRES-LUGO**, *Professor*, Ph.D., 2001, Purdue University.

**CARLOS VELÁZQUEZ-FIGUEROA**, *Professor*, Ph.D., 1993, University of Connecticut, Storrs, CT.

**GILBERTO VILLAFANE-RUIZ**, *Professor*, Ph.D., 1974, Tulane University.

## COURSES OF INSTRUCTION

### CHEMICAL ENGINEERING

**INQU 3047. CHEMICAL PROCESS MANUFACTURING.** Three credit hours. Three hours of lectures per week. Prerequisite: QUIM 3042 or QUIM 3002.

Introduction to the chemical plants manufacturing processes and raw materials processing at large scale of: chemicals, petroleum products, food, drugs, and wastes. Discussion of the chemical-process stem transformation of raw materials into desired end products, processing equipment, process flow diagram and schematic representation of the physical and chemical process interactions to carry out the overall transformation.

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Evaluation of the economic performance of different manufacturing options to reach the optimal or best solution. Evaluation of environmental, health and safety criteria as other considerations in the manufacturing steps. Discussion of ethical considerations in the manufacturing engineers profession.

**INQU 4001. HEAT TRANSFER OPERATIONS.** Four credit hours. Four hours of lecture per week. Prerequisites: INQU 4010 and INQU 4011.

Heat transfer principles, including multidimensional flow and unsteady state conditions, radiation heat transfer, design of exchangers, empirical relations.

**INQU 4002. MASS TRANSFER OPERATIONS.** Four credit hours. Four hours of lecture per week. Prerequisites: INQU 4001 and INQU 4012.

Phase equilibria and equilibrium stage operations, with particular emphasis on distillation, gas absorption, humidification, and liquid-liquid extraction.

**INQU 4003. UNIT OPERATIONS III.** Four credit hours. Four hours of lecture per week. Prerequisite: INQU 4005.

Theory, applications, and design of unit operations which are mostly employed in the pharmaceutical industry; air, water, and media sterilizations, recovery of fermentation products, aeration, agitation, crystallization, and scale-up.

**INQU 4004. UNIT OPERATIONS LABORATORY III.** One credit hour. One three-hour laboratory per week. Corequisite: INQU 4003.

Experimental studies on crystallization, drying of solids, fermentation, sterilization, validation, extraction, and filtration using pilot plant equipment.

**INQU 4005. MATERIALS AND ENERGY BALANCES.** Four credit hours. Three hours of lecture and two hours of discussion per week. Corequisites: QUIM 4041 or QUIM 4057 or authorization of the Director of the Department.

An introduction to chemical engineering calculations involving the laws of conservation of mass and energy.

**INQU 4008. MATHEMATICAL ANALYSIS OF CHEMICAL ENGINEERING PROBLEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: INQU 4005 and MATE 4009.

Mathematical analysis of problems of interest in chemical engineering. Methods of interpretation and analysis of experimental data, formulation and solution of mass and energy balance equations in open and closed

systems: use of Laplace transforms, error and Bessel functions, matrices, solution of problems by means of digital computers.

**INQU 4010. MOMENTUM TRANSFER OPERATIONS.** Four credit hours. Four hours of lecture per week. Prerequisite: INQU 4005. Corequisite: MATE 4009.

Introduction to mass, momentum and energy transport, and the calculation of transport coefficients. Shell momentum balances; analytical solution of problems in viscous flow; dimensional analysis. Introduction to turbulent flow. Friction factor in ducts and particulate systems. Macroscopic balances, application to the design of chemical engineering systems.

**INQU 4011. CHEMICAL ENGINEERING THERMODYNAMICS I.** Three credit hours. Three hours of lecture per week. Prerequisites: INQU 4005 and QUIM 4041 and (MATE 4009 or MATE 3048).

Thermodynamic principles; applications of the first and second laws of thermodynamics to the solution of chemical engineering problems; thermodynamic properties of fluids.

**INQU 4012. CHEMICAL ENGINEERING THERMODYNAMICS II.** Three credit hours. Three hours of lecture per week. Prerequisites: INQU 4011 and QUIM 4042 and INGE 3016.

Emphasis on thermodynamic functions, properties of solutions, phase equilibria, and chemical reaction equilibria.

**INQU 4017. CHEMICAL ENGINEERING KINETICS AND CATALYSIS.** Four credit hours. Four hours of lecture per week. Prerequisites: INQU 4001 and INQU 4012.

The principles of chemical kinetics and catalysis, and their application to reactor design and industrial processes.

**INQU 4027. CHEMICAL ENGINEERING SEMINAR.** One credit hour. One and one-half hour of seminar per week. Prerequisite: INQU 4010.

Discussion and reports on special topics in chemical engineering. Involves literature searches and evaluation for the preparation of written and oral reports. Students are required to attend all seminars sponsored by the Department of Chemical Engineering.

**INQU 4029. PHARMACEUTICAL OPERATIONS.** Four credit hours. Three hours of lecture and two hours of laboratory per week. Prerequisites: INME 4001 or INME 4045 or QUIM 4041.

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Theory, principles and practices related with the manufacture of pharmaceutical preparations and pharmaceutical related plant and equipment design. Studies on key unit operations like powder weighing granulation, milling, blending and compressing. Plant and equipment validation and good manufacturing practices (GMP).

**INQU 4034. CHEMICAL ENGINEERING**

LABORATORY I. Two credit hours. Two three-hour laboratories per week. Prerequisite: INQU 4001.

Experimental studies on fluid flow and heat transfer using pilot plant equipment.

**INQU 4036. CHEMICAL ENGINEERING PRACTICE.** Three credit hours. Thirty five hours per week for seven or more weeks during the summer or its equivalent during the semester. Prerequisites: authorization of the Director of the Department.

A course organized in cooperation with private industry or government to provide the student with practical experience in chemical engineering. The work performed by the student will be jointly supervised by the academic department and an appropriate official from the cooperating organization. An oral and written report will be required from the student upon completion of the project.

**INQU 4038. PROJECT MANAGEMENT FOR CHEMICAL ENGINEERS.** Three credit hours. Three hours of lecture per week. Prerequisite: INQU 4005.

Skills for successful management projects that require development, design, construction and operation of chemical plants and related industries.

**INQU 4077. UNIT OPERATIONS IN FOOD PROCESSING.** Three credit hours. Three hours of lecture per week. Prerequisites: INQU 4001 and INQU 4012. Corequisite: INQU 4002.

Drying: tray, belt, drum, spray, freeze drying, instantizing, and agglomeration. Freezing and freeze concentration. Membrane processes: osmosis, reverse osmosis, ultrafiltration, electrodialysis, Extrusion, Expression, Microwave heating.

**INQU 4206. QUANTITATIVE FRAMEWORKS IN BIOLOGICAL SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisite: INGE 3016.

Study of fundamental concepts, technology, and utilization of living things in the context of engineering disciplines. Discussion of the interactions between a biological unit in its physical, chemical, and biological

environments. Applications of engineering principles to the quantification of biological responses.

**INQU 4207. BIOSEPARATION ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: INQU 4005.

Study of the theory, applications, and design of the biochemical unit operations related to pretreatment of raw materials and product processing, such as filtration, sedimentation, extraction, chromatography, crystallization, mixing, and drying, amongst others.

**INQU 4995. ENGINEERING PRACTICE FOR COOP STUDENTS.** Zero to nine credit hours. Prerequisites: INQU 4005 and authorization of the Director of the Department.

Practical experience in chemical engineering in cooperation with private industry or government to be jointly supervised by the academic department, the coop program coordinator, and an official from the cooperating organization. A written report will be required upon completion of each period of work.

**INQU 4998. UNDERGRADUATE RESEARCH.** One to six credit hours. Three to twenty-four hours of laboratory per week. Pre-requisite: fourth or fifth year student and authorization of the Director of the Department.

Participation, under the supervision of a faculty member acting as an investigator, in a research project.

### **Advanced Undergraduate and Graduate Courses**

**INQU 5006. STATISTICAL METHODS FOR CHEMICAL ENGINEERS.** Three credit hours. Three hours of lecture per week. Prerequisites: (INQU 4005 and (MATE 4009 or MATE 3048)) or authorization of the Director of the Department.

Statistical analysis of experimental data, curve fitting, and sampling theory; nomography; problem solving with digital computers. Emphasis is given to chemical engineering applications.

**INQU 5015. FUNDAMENTALS OF AIR POLLUTION.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4008 or authorization of the Director of the Department. Corequisite: INQU 4002.

Classification and extent of air pollution problems; meteorology and air pollution; dispersion from effluents; the effect of air pollution on plants and animals; visibility problems; socioeconomic impact of pollution problems; analytical and experimental sampling methods; equipment and process for abating air pollution; governmental regulations for air pollution control.

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**INQU 5018. AIR POLLUTION CONTROL.** Three credit hours. Three hours of lecture per week. Prerequisite: INQU 4010 or INCI 4008 or authorization of the Director of the Department.

A discussion of the theory, principles, and practices related to engineering control of particulate and gaseous emissions from natural, industrial, agricultural, commercial, and municipal sources of atmospheric pollution.

**INQU 5019. INDUSTRIAL WASTE CONTROL.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4008 or authorization of the Director of the Department. Corequisite: INQU 4002.

The minimization of industrial wastes through the proper design and operation of manufacturing plants; treatment of disposal of industrial wastes, with emphasis on the chemical industries in Puerto Rico.

**INQU 5020. CHEMICAL PROCESS SAFETY AND ECONOMICS.** Three credit hours. Three hours of lecture per week. Prerequisite: INQU 4001 or authorization of the Director of the Department.

Process safety and economic engineering analysis of chemical engineering unit operations and processes. Estimation of capital and manufacturing costs for engineering economic analysis and profitability analysis of chemical processes. Evaluation of the impact of chemical processing on the health and safety of people, and damage to the environment. Understanding of potential hazards and risk assessment associated with chemical processes and equipment. Analysis of process design and optimization.

**INQU 5021. CHEMICAL ENGINEERING PROCESS DESIGN I.** Three credit hours. Three hours of lecture per week. Corequisites: INQU 4002 and INQU 4017.

Analysis and design of chemical and biochemical process units, in particular, chemical reactors, mixers, separation units, heat exchangers, and transport of fluids.

**INQU 5022. CHEMICAL ENGINEERING PROCESS DESIGN II.** Three credit hours. Three hours of lecture per week. Prerequisites: (INQU 4017 and INQU 4002 and INQU 5021) or authorization of the Director of the Department.

Integration of chemical engineering concepts, economics, safety, ethics, and environmental considerations to plant and/or chemical process design.

**INQU 5025. ANALYSIS AND CONTROL OF PROCESSES.** Three credit hours. Three hours of lecture

per week. Prerequisites: (INQU 4017 and INQU 4002) or authorization of the Director of the Department.

Mathematical simulation of chemical and physical processes. Analysis of first and second order systems; control modes; control hardware; roots locus and frequency response analysis; optimum control settings; applications to the design of control systems.

**INQU 5026. MICROCLIMATE AND DISPERSION OF AIR POLLUTANTS.** Three credit hours. Three hours of lecture per week. Prerequisite: INQU 4002 or INCI 4008 or authorization of the Director of the Department.

Discussion of the elements of microclimate in urban, rural, and valley environments. Dispersion of air pollutants in these environments.

**INQU 5029. BIOPROCESS ENGINEERING LABORATORY.** Two credit hours. One hour of lecture and three hours of laboratory per week. Prerequisites: INQU 4207 or INQU 4003 or authorization of the Director of the Department.

Hands-on experiences in upstream and downstream bioprocess unit operations. Experiments in the areas of bioreactor cultures, cell and protein separation, as well as application of bioanalytical methods.

**INQU 5030. CHEMICAL ENGINEERING LABORATORY II.** Two credit hours. Two threehour laboratory periods per week. Prerequisite: (INQU 4002 and INQU 4017) or authorization of the Director of the Department. Corequisite: INQU 5025.

Experimental studies on mass transfer, process control, fermentation, kinetics and catalysis using pilot plant equipment at the Unit Operations Laboratory.

**INQU 5035. BIOREACTOR ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: INQU 4005 or authorization of the Director of the Department.

Fundamentals of biochemistry. Kinetics of enzyme reactors; growth kinetics of suspended cell cultures; consideration of transport phenomena in bioreactors; operation and control strategies of bioreactors; culture of genetically engineered cells to produce recombinant proteins of therapeutic value.

**INQU 5036. PARTICULATE SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisite: INQU 4002 or authorization of the Director of the Department.

Creation, characterization, separation and agglomeration of particles. Sizing fractionation of powders, surface area

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and pore size determinations. Pulverization, crystallization, agglomeration, tableting and granulation.

**INQU 5050. HAZARDOUS WASTE TREATMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: INQU 4012 or INCI 4008 or authorization of the Director of the Department.

Introduction to the application of traditional and innovative technologies for the treatment of hazardous wastes in water and soil. Discussion of aspects such as: environmental regulations, design and operating parameters, and cost analysis. Use of computer software for the simulation and design of the different technologies.

**INQU 5075. POLYMER ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisites: ((QUIM 3042 or QUIM 3132) and (INQU 4010 or INGE4010 or INGE4015)) or authorization of the Director of the Department.

Application of the principles of fluid mechanics, and heat and mass transfer to describe the production and processing of polymeric materials. Application of engineering principles to the analysis of polymer processes such as extrusion, molding and other industrially relevant unit operations. Emphasis on the effects of processing on structure and physical properties of polymers, and vice versa.

**INQU 5076. POLYMER SCIENCE.** Three credit hours. Three hours of lecture per week. Prerequisites: QUIM 3042 or QUIM 3132 or authorization of the Director of the Department.

Analysis of the fundamental physical and chemical properties of polymers and their relevance in the synthesis, production and characterization of polymer-based materials. Discussion of polymerization and reaction kinetics of polymers and copolymers, structure and morphology in solution, melt, and solid phases, thermodynamics of polymers, solutions and blends, and molecular weight characterization.

**INQU 5995. SPECIAL PROBLEMS.** One to three credit hours. One to three laboratory, library or independent work periods per week. Prerequisite: authorization of the Director of the Department.

Undergraduate research problems in chemical engineering or related field. Topics vary with interest of student and instructor. Open only to outstanding Chemical Engineering students.



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## DEPARTMENT OF CIVIL ENGINEERING AND SURVEYING

The College of Engineering offers a five-year program leading to a Bachelor of Science degree in Civil Engineering and a four-year Bachelor of Science in Surveying and Topography which are administered by the Civil Engineering and Surveying Department.

### Vision

We provide society with people-serving problem - solvers in civil engineering and surveying.

### Mission

Provide our society with high quality professionals having a strong education in civil engineering and/or land surveying; with rich cultural, ethical, environmental, and social sensitivities; capacity for critical thinking; and the entrepreneurial skills to solve civil infrastructure problems. Search for and disseminate new knowledge. Provide services to solve engineering problems as members of interdisciplinary teams.

### SLOGAN:

**CES=(PS)<sup>2</sup>** (Civil Engineers and Surveyors =  
People-serving, problem solvers)

## CIVIL ENGINEERING

The Bachelor of Science Program in Civil Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

It offers a BS in Civil Engineering, and MS, ME, in structures, environmental, transportation, geotechnical engineering, and construction management, and a PhD with options in structures, environmental, and transportation. It also offers a BS in Surveying and Topography. The Department serves approximately **900** undergraduate students and about **100** graduate students.

### Highlights:

- Ranks among the top ten programs in the US, in terms of graduating Civil Engineers, with an 88% success rate in credit approval.
- Largest program in the US in terms of graduating female Civil Engineers (33% of the student population).

- Only program offering doctoral degrees (structures, environmental, and transportation) in Civil Engineering in the Caribbean.
- Hosts a faculty with thirty top rank professors with extraordinary local and international academic and research experiences and reputation.
- Supports basic and applied research in man-made and natural hazards (earthquakes, hurricanes, floods, others), transportation, environmental, land surveying, and civil engineering materials.
- Our Faculty in Civil Engineering and Surveying submitted research proposals for external funding for more than \$2 million during the previous academic year thus ranking among the top departments submitting proposals for external funding in Campus.
- Participated actively (with extreme success; multiple Championships) in the ASCE Southeast Regional Conferences, American Concrete Institute (ACI), Earthquake Engineering Research Institute (EERI) and National Society of Professional Engineers (NSPE) Student Competitions during the past two decades.

Civil Engineering, the oldest of the traditional divisions of engineering, encompasses a broad range of public and private infrastructure projects for improving the world's large-scale environment with the most innovative and up-to-date technology. Highways, bridges, railroads, dams, docks and wharves, airports, launching facilities, multistory buildings, industrial structures, water, air, and land conservation and protection, and water distribution systems, industrial and residential waste treatment systems, tunnels, and transit systems supported by computer aided design and geographical information systems (the country's infrastructure) are some examples of the work performed by civil engineers. Each work has an impact upon the daily living of most people. Civil engineers, therefore, are called upon to consider, in an integrated manner, the social and physical factors which affect the planning, design, construction, operation, and maintenance of our total infrastructure systems.

The Bachelor's degree program precedes a well-coordinated graduate study program, which offers Master's and Ph.D. degrees in Civil Engineering.

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## **PROGRAM EDUCATIONAL OBJECTIVES:**

After their graduation from UPRM, our Civil Engineering Program's...

1. Graduates will meet the expectations of employers of Civil Engineers.
2. Qualified Graduates will pursue advanced studies if they so desire.
3. Graduates will assume/undertake leadership roles in their communities, as well as in their profession.

## **STUDENT (1-6) OUTCOMES:**

We expect that by the time of their graduation, our students will have developed:

1. An ability to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics and science and/or technical topics to areas relevant to the discipline.
2. An ability to formulate or design a system, process, procedure or program to meet desired needs.
3. An ability to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
4. An ability to communicate effectively with a range of audiences.
5. An ability to understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in global, economic, environmental, and societal contexts.
6. An ability to function effectively or teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

## **GRADUATE PROGRAMS**

### **Master of Science and Master of Engineering**

The Master's degree programs offers three options; a Master of Science which requires a written thesis, a Master of Engineering which requires a comprehensive engineering project, and a Master of Engineering which requires only course work in addition to a final written exam.

### **PhD**

The Doctor in Philosophy degree requires a minimum of 42 credit-hours in courses after the BS and a doctorate dissertation (18 credit-hours). Up to 30 credit-hours of course work can be accredited for students who already have a master's degree before entering the PhD program.

## **LABORATORIES AND COMPUTATIONAL FACILITIES**

Nine civil engineering laboratories provide sophomore and senior students with hands-on learning experience. Three equipped computer centers and laboratories provide about 100 computer accesses and terminals to students. A state-of-the-art computer network infrastructure provides rapid and efficient internal and external communication to Internet and other well-known networks.

## **MINOR AND CERTIFICATE**

The Department offers a minor in Integrated Practice in Construction Engineering and Architecture. This minor is offered in coordination and collaboration with the School of Architecture at UPR-Rio Piedras. It requires 15 credits.

A certificate in Environmental Engineering is offered to all students who complete 15 credits in environmental engineering courses.

A certificate in Project Management is offer to all students who take 12 credits-hours in project management courses.

The Civil Engineering faculty is actively involved in research and public services to external institutions. Various centers provide administrative support to these initiatives: the Civil Infrastructure Research Center (CIRC), the Natural Hazards Mitigation

Institute (NHMI), Puerto Rico Strong Motion Program (PRSM), the Transportation Technology Transfer Center (T<sup>2</sup>), and the Computer Aided Instruction and Research Laboratory (CAIREL). Undergraduate students participate in research experiences, both on-campus and off-campus. Students also participate in summer internship programs in prestigious universities and research centers in the United States of America.

### DEFINITION OF GENERAL EDUCATION FOR CIVIL ENGINEERING:

The General Education requirements for the Department are contained within those for UPRM as follows:

| Subject                        | Requirements | Courses   |
|--------------------------------|--------------|---|
|                                | INCI         |   |
| Spanish                        | 6            | ESPA 3101<br>ESPA 3102  |
| English                        | 12           | INGL 3101<br>INGL 3102<br>INGL 3201<br>INGL 3202              |
| Humanities and Social Sciences | 15           | Over 100 courses to select                                    |
| Sciences                       |              |   |
| • Physics                      | 10           | FISI 3171<br>FISI 3173<br>FISI 3172<br>FISI 3174              |
| • Chemistry                    | 8            | QUIM 3131<br>QUIM 3133<br>QUIM 3132<br>QUIM 3134              |
| • Geology                      | 3            | GEOL 4015   |
| Physical Education             | 2            | Over 25 courses to select                                     |
| Math                           | 19           | MATE 3005<br>MATE 3031<br>MATE 3032<br>MATE 3063<br>MATE 4009 |
| Total                          | 75           |   |

The courses that fulfill the general education requirements are shown in the previous table.

### GENERAL EDUCATION STUDENT OUTCOMES:

The Civil Engineering Department General Student Outcomes are included/embedded within the programs' **Student Outcomes** listed previously.

### PROGRAM OF STUDY

#### CIVIL ENGINEERING CURRICULUM

##### FIRST YEAR

###### First Semester

| Number     | Credits | Course                         |
|------------|---------|--------------------------------|
| *MATE 3005 | 5       | Pre-Calculus                   |
| QUIM 3131  | 3       | General Chemistry I            |
| QUIM 3133  | 1       | General Chemistry Laboratory I |
| *INGL 3--- | 3       | First year course in English   |
| *ESPA 3101 | 3       | Basic course in Spanish I      |
| INGE 3011  | 2       | Engineering Graphics I         |
| EDFI ----  | 1       | Elective in Physical Education |
|            | 18      |                                |

###### Second Semester

| Number     | Credits | Course                          |
|------------|---------|---------------------------------|
| MATE 3031  | 4       | Calculus I                      |
| QUIM 3132  | 3       | General Chemistry II            |
| QUIM 3134  | 1       | General Chemistry Laboratory II |
| *INGL 3--- | 3       | First year course in English    |
| *ESPA 3102 | 3       | Basic course in Spanish II      |
| INGE 3012  | 2       | Engineering Graphics II         |
| EDFI ----  | 1       | Elective in Physical Education  |
|            | 17      |                                 |

##### SECOND YEAR

###### First Semester

| Number    | Credits | Course                              |
|-----------|---------|-------------------------------------|
| MATE 3032 | 4       | Calculus II                         |
| FISI 3171 | 4       | Physics I                           |
| FISI 3173 | 1       | Physics Laboratory I                |
| INGL 3--- | 3       | Second year course in English       |
| INGE 3031 | 3       | Engineering Mechanics-Statics       |
| INGE 3016 | 3       | Algorithms and Computer Programming |
|           | 18      |                                     |

###### Second Semester

| Number    | Credits | Course                |
|-----------|---------|-----------------------|
| MATE 3063 | 3       | Calculus III          |
| FISI 3172 | 4       | Physics II            |
| FISI 3174 | 1       | Physics Laboratory II |

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|            |          |                                |
|------------|----------|--------------------------------|
| ^INGL 3--- | 3        | Second year course in English  |
| INGE 3032  | 3        | Engineering Mechanics-Dynamics |
| INGE 4011  | <u>3</u> | Mechanics of Materials I       |
|            | 17       |                                |

### THIRD YEAR

#### First Semester

| Number    | Credits  | Course                                    |
|-----------|----------|---|
| MATE 4009 | 3        | Ordinary Differential Equations           |
| INCI 4001 | 3        | Geomatics I                               |
| INCI 4095 | 2        | Mathematical Methods in Civil Engineering |
| INGE 4012 | 3        | Mechanics of Materials II                 |
| INGE 4001 | 3        | Engineering Materials                     |
| INEL 4075 | <u>3</u> | Fundamentals of Electrical Engineering    |
|           | 17       |   |

#### Second Semester

| Number    | Credits  | Course                            |
|-----------|----------|-----------------------------------|
| INCI 4021 | 3        | Structural Analysis I             |
| INCI 4035 | 3        | Civil Engineering Materials       |
| INCI 4002 | 3        | Geomatics II                      |
| INCI 4136 | 2        | Applied Statistics for Civil Eng. |
| INGE 4015 | 3        | Fluid Mechanics                   |
| INGE 4016 | 1        | Fluid Mechanics Laboratory        |
| GEOL 4015 | <u>3</u> | Geology for Engineers             |
|           | 18       |                                   |

### FOURTH YEAR

#### First Semester

| Number    | Credits  | Course                                    |
|-----------|----------|---|
| INCI 4007 | 3        | Highway Location and Curve Design         |
| INCI 4008 | 3        | Introduction to Environmental Engineering |
| INCI 4011 | 3        | Structural Steel Design                   |
| INCI 4022 | 3        | Structural Analysis II                    |
| INCI 4055 | 3        | Construction Engineering and Management I |
| ECON 3021 | <u>3</u> | Principles of Economics: Microeconomics   |
|           | 18       |   |

#### Second Semester

| Number    | Credits  | Course                                     |
|-----------|----------|--|
| INCI 4139 | 4        | Intro. to Geotechnical Engineering         |
| INCI 4012 | 3        | Reinforced Concrete Design                 |
| INCI 4138 | 3        | Water Resources Engineering                |
| INCI 4137 | 3        | Intro. to Transportation Engineering       |
| INCI 4056 | 3        | Construction Engineering and Management II |
| ELECTIVE  | <u>3</u> | **Socio-humanistic Electives               |
|           | 19       |  |

### FIFTH YEAR

#### First Semester

| Number    | Credits  | Course  |
|-----------|----------|---|
| INCI 4049 | 3        | Foundations Engineering                             |
| INCI 4026 | 3        | Highway Engineering                                 |
| INCI 4145 | 3        | Waterworks and Sewerage Design                      |
| INCI 4146 | 1        | Information Technology Applications in Construction |
| ELECTIVE  | 3        | **Socio-humanistic Elective                         |
| ELECTIVES | <u>6</u> | ***Free Electives                                   |
|           | 19       |   |

#### Second Semester

| Number    | Credits  | Course  |
|-----------|----------|---|
| INCI 4950 | 3        | Integrated Civil Engineering (CAPSTONE) Project |
| INCI 4019 | 1        | Civil Engineering Seminar                       |
| ELECTIVE  | 3        | **Socio-humanistic Electives                    |
| ELECTIVE  | 3        | **Socio-humanistic Electives                    |
| ELECTIVE  | 3        | **Socio-humanistic Electives                    |
| ELECTIVES | <u>6</u> | ***Free Electives                               |
|           | 19       |   |

### Total credits required for this program: 180

\*Refer to the Academic Regulations section for information on Advanced Placement.

\*\*The fifteen (15) credit-hours of Socio-humanistic electives will be selected by the student, with the advisor's approval, from a list of recommended courses.

\*\*\*The twelve (12) credit-hours of free electives will be selected by the student with the advisor's approval, from available courses with equal or higher, and different contents than those required in the curriculum.

^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

### SURVEYING AND TOPOGRAPHY

The very high cost of real estate on the Island and the highly sophisticated modern instrumentation used today make this program mandatory in order to produce better-qualified professionals in the field of surveying.

Surveying students will be enrolled in a program that covers a wide spectrum of activities from the very basic plane surveying, to cartography, photogrammetry, geodesy, and astronomy. The student will have the opportunity to apply theory into practice, through laboratory sessions and a summer camp. The program has been designed to meet the

needs and the qualification criteria of the Board of Examiners of Engineers, Architects, and Surveyors of Puerto Rico, the Society of Engineers and Surveyors of Puerto Rico, and the surveying profession itself.

### PROGRAM EDUCATIONAL OBJECTIVES:

After their graduation from UPRM, our Surveying and Topography Program's...

1. Graduates will meet the expectations of employers of Surveyors.
2. Qualified Graduates will pursue advanced studies if they so desire.
3. Graduates will assume/undertake leadership roles in their communities, as well as in their profession.

### STUDENT (a-k) OUTCOMES:

We expect that by the time of their graduation, our students will have developed:

- a. An ability to apply knowledge of mathematics, science, and applied sciences
- b. An ability to design and conduct experiments, as well as to analyze and interpret data
- c. An ability to formulate or design a system, process, or program to meet desired needs
- d. An ability to function on multidisciplinary teams
- e. An ability to identify and solve applied science problems
- f. An understanding of professional and ethical responsibility
- g. An ability to communicate effectively
- h. The broad education necessary to understand the impact of solutions in a global and societal context
- i. A recognition of the need for and an ability to engage in life-long learning
- j. A knowledge of contemporary issues
- k. An ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice

### DEFINITION OF GENERAL EDUCATION FOR SURVEYING & TOPOGRAPHY:

The General Education requirements for the Department are contained within those for UPRM as follows:

| Subject                        | Requirements | Courses   |
|--------------------------------|--------------|---|
|                                | INCI         |   |
| Spanish                        | 6            | ESPA 3101<br>ESPA 3102  |
| English                        | 12           | INGL 3101<br>INGL 3102<br>INGL 3201<br>INGL 3202              |
| Humanities and Social Sciences | 6            | Over 100 courses to select                                    |
| Sciences                       |              |   |
| • Physics                      | 10           | FISI 3171<br>FISI 3173<br>FISI 3172<br>FISI 3174              |
| • Chemistry                    | 8            | QUIM 3131<br>QUIM 3133<br>QUIM 3132<br>QUIM 3134              |
| • Geology                      | 3            | GEOL 4015   |
| Physical Education             | 2            | Over 25 courses to select                                     |
| Math                           | 19           | MATE 3005<br>MATE 3031<br>MATE 3032<br>MATE 3063<br>MATE 4009 |
| Total                          | 66           |   |

The courses that fulfill the general education requirements are shown in the previous table.

### PROGRAM OF STUDY

#### SURVEYING AND TOPOGRAPHY CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits | Course                         |
|------------|---------|--------------------------------|
| *MATE 3005 | 5       | Pre-Calculus                   |
| QUIM 3131  | 3       | General Chemistry I            |
| QUIM 3133  | 1       | General Chemistry Laboratory I |

|            |          |                                |
|------------|----------|--------------------------------|
| *INGL 3--- | 3        | First year course in English   |
| *ESPA 3101 | 3        | Basic course in Spanish I      |
| INGE 3011  | 2        | Engineering Graphics I         |
| EDFI ----  | <u>1</u> | Elective in Physical Education |
|            | 18       |                                |

### Second Semester

| Number     | Credits  | Course                          |
|------------|----------|---------------------------------|
| MATE 3031  | 4        | Calculus I                      |
| QUIM 3132  | 3        | General Chemistry II            |
| QUIM 3134  | 1        | General Chemistry Laboratory II |
| *INGL 3--- | 3        | First year course in English    |
| *ESPA 3102 | 3        | Basic course in Spanish II      |
| INGE 3012  | 2        | Engineering Graphics II         |
| EDFI ----  | <u>1</u> | Elective in Physical Education  |
|            | 17       |                                 |

## SECOND YEAR

### First Semester

| Number    | Credits  | Course                                     |
|-----------|----------|--|
| MATE 3032 | 4        | Calculus II                                |
| INGL 3--- | 3        | Second year course in English              |
| FISI 3171 | 4        | Physics I                                  |
| FISI 3173 | 1        | Physics Laboratory I                       |
| ECON 3021 | 3        | Principles of Economics:<br>Microeconomics |
| INGE 3031 | <u>3</u> | Engineering Mechanics-Statics              |
|           | 18       |  |

### Second Semester

| Number     | Credits  | Course                         |
|------------|----------|--------------------------------|
| MATE 3063  | 3        | Calculus III                   |
| ^INGL 3--- | 3        | Second year course in English  |
| FISI 3172  | 4        | Physics II                     |
| FISI 3174  | 1        | Physics Laboratory II          |
| INGE 3032  | 3        | Engineering Mechanics-Dynamics |
| INGE 3016  | 3        | Introduction to Computers      |
| INCI 4001  | <u>3</u> | Geomatics I                    |
|            | 20       |                                |

## THIRD YEAR

### First Semester

| Number    | Credits  | Course   |
|-----------|----------|--|
| MATE 4009 | 3        | Ordinary Differential Equations                                |
| ASTR 4005 | 3        | Astronomy I  |
| INCI 4135 | 3        | Elements of Optics and Remote<br>Sensing in Geospatial Science |
| INCI 4002 | 3        | Geomatics II   |
| ININ 4007 | 3        | Industrial Organization and<br>Management                      |
| ELECTIVE  | <u>3</u> | **Socio-humanistic Elective                                    |
|           | 18       |  |

### Second Semester

| Number    | Credits  | Course                            |
|-----------|----------|-----------------------------------|
| INCI 4078 | 2        | Topographic Drawing               |
| INCI 4081 | 3        | Photogrammetry I                  |
| INCI 4051 | 3        | Geodesy I                         |
| INCI 4007 | 3        | Highway Location and Curve Design |
| ELECTIVE  | 3        | **Socio-humanistic Elective       |
| GEOL 4015 | <u>3</u> | Geology for Engineers             |
|           | 17       |                                   |

### SUMMER

| Number    | Credits | Course               |
|-----------|---------|----------------------|
| INCI 4018 | 4       | Topographic Practice |

## FOURTH YEAR

### First Semester

| Number    | Credits  | Course                    |
|-----------|----------|---------------------------|
| INCI 4071 | 3        | Adjustment Computation I  |
| INCI 4085 | 3        | Theory of Map Projections |
| INCI 4061 | 3        | Legal Aspects I           |
| INCI 4087 | 3        | Special Surveys           |
| ELECTIVE  | 3        | INCI Elective             |
| ELECTIVE  | <u>3</u> | ***Free Elective          |
|           | 18       |                           |

### Second Semester

| Number    | Credits  | Course                              |
|-----------|----------|-------------------------------------|
| INCI 4086 | 3        | Introduction to<br>Physical Geodesy |
| INCI 4059 | 3        | Geodetic Astronomy                  |
| ELECTIVES | 9        | ***Free Electives                   |
| ELECTIVE  | <u>3</u> | INCI Elective                       |
|           | 18       |                                     |

### Total credits required for this program: 148

\* Refer to the Academic Regulations section for information on Advanced Placement.

\*\* The six (6) credit-hours of Social-humanistic electives will be selected by the student, with the advisor's approval, from a list of recommended courses.

\*\*\* The twelve (12) credit-hours of free electives will be selected by the student with the advisor's approval, from available courses with equal or higher, and different contents than those required in the curriculum.

^Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

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## DEPARTMENTAL FACULTY

**FELIPE J. ACOSTA-COSTA**, *Professor*, Ph.D., 1999, Georgia Institute of Technology.

**LUIS D. APONTE-BERMÚDEZ**, *Professor*, Ph.D. 2006, University of Florida.

**JUAN B. BERNAL-VERA**, *Professor*, Ph.D., 1984, University of Texas at Austin.

**ARSENIO CÁCERES-FERNÁNDEZ**, *Associate Professor*, Ph.D., 1998, West Virginia University.

**BEATRIZ I. CAMACHO-PADRÓN**, *Associate Professor*, Ph.D., 2006, University of Texas at Austin.

**BENJAMÍN COLUCCI-RÍOS**, *Professor*, Ph.D., 1984, Purdue University.

**IVETTE CRUZADO-VÉLEZ**, *Associate Professor*, Ph.D., 2009, Penn State University.

**EVI DE LA ROSA-RICCIARDI**, *Professor*, Ph.D., 2009, University of Florida.

**ALBERTO M. FIGUEROA-MEDINA**, *Professor*, Ph.D., 2005, Purdue University.

**JOSÉ L. FLORES-MALAVÉ**, *Professor*, M.S.C.E., 1994, Purdue University.

**HIRAM GONZÁLEZ-HERNÁNDEZ**, *Professor*, M.S.C.E., 1984, University of Puerto Rico.

**SERGIO GONZALEZ-QUEVEDO**, *Adjunct Professor*, Ph.D., 1985, Massachusetts Institute of Technology.

**JOSÉ O. GUEVARA**, *Professor*, Ph.D., 1990, University of Florida.

**CARLOS I. HUERTA-LÓPEZ**, *Associate Professor*, Ph.D., 2001, University of Texas at Austin.

**SANGCHUL HWANG**, *Professor*, Ph.D., 2002, University of Akron.

**CARLA LOPEZ DEL PUERTO**, *Associate Professor*, Ph.D., 2009, University of Saint Louis.

**RICARDO R. LÓPEZ-RODRÍGUEZ**, *Professor*, Ph.D., 1988, University of Illinois at Urbana-Champaign.

**FRANCISCO MALDONADO-FORTUNET**, *Professor*, Ph.D., 2002, Georgia Institute of Technology.

**JOSÉ A. MARTÍNEZ-CRUZADO**, *Professor*, Ph.D., 1993, University of California at Berkeley.

**OMAR I. MOLINA-BAS**, *Professor*, Ph.D., 2008, Universidad Politécnica de Madrid.

**ALESANDRA C. MORALES-VÉLEZ**, *Associate Professor*, Ph. D., 2014, University of Rhode Island.

**JONATHAN MUÑOZ-BARRETO**, *Associate Professor*, Ph. D., 2014, City College of New York.

**INGRID Y. PADILLA-CESTERO**, *Professor*, Ph.D., 1998, University of Arizona.

**ISMAEL PAGÁN-TRINIDAD**, *Professor*, M.S.C.E., 1977, University of Puerto Rico.

**MIGUEL A. PANDO-LÓPEZ**, *Adjunct Professor*, Ph.D., 2003, Virginia Polytechnic Institute and State University.

**JOSÉ L. PERDOMO-RIVERA**, *Professor*, Ph.D., 2004, Virginia Polytechnic Institute and State University.

**RICARDO RAMOS-CABEZA**, *Professor*, Ph.D., 1999, Rensselaer Polytechnic Institute.

**JORGE RIVERA-SANTOS**, *Professor*, Ph.D., 1988, University of Colorado at Boulder.

**GUILLERMO RIVEROS**, *Adjunct Professor*, Ph.D., 2005, University of Missouri, Columbia.

**DANIEL RODRÍGUEZ-ROMÁN**, *Associate Professor*, Ph.D., 2015, University of California, Irvine.

**ALI SAFFAR**, *Professor*, Ph.D., 1986, Worcester Polytechnic Institute.

**RAFAEL SEGARRA-GARCÍA**, *Professor*, Ph.D., 1988, Virginia Polytechnic Institute and State University.

**WALTER F. SILVA-ARAYA**, *Professor*, Ph.D., 1993, Washington State University.

**LUIS E. SUÁREZ-COLCHE**, *Professor*, Ph.D., 1986, Virginia Polytechnic Institute and State University.

**PEDRO J. TARAFA-VELEZ**, *Associate Professor*, Ph.D., 2010, University of South Carolina, Columbia.

**DIDIER M. VALDÉS-DÍAZ**, *Professor*, Ph.D., 1999, University of Texas at Austin.

**LINDA L. VÉLEZ-RODRÍGUEZ**, *Professor*, MS, 1981, Ohio State University.

**DANIEL A. WENDICHANSKY**, *Professor*, Ph.D., 1996, State University of New York at Buffalo.

**RAÚL E. ZAPATA-LÓPEZ**, *Professor*, Ph.D., 1987, University of Florida.

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## COURSES OF INSTRUCTION

### CIVIL ENGINEERING

**INCI 4000. INTRODUCTION TO ARCHITECTURE.** Three credit hours. Three hours of lecture per week.

The significance of architecture in relation to culture, the development of construction technology, and to the sociopolitical structure of the times. Relationship between the architect and the civil engineer in modern society. Elements of architectural design. Architectural analysis of different types of buildings. Anatomy of the building.

**INCI 4001. GEOMATICS I.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: (INGE 3012 or INGE 3809 or INME 3809) and (MATE 3031).

Study of measurement of distances, angles and elevations; use of traverse and leveling equipment; measurement of traverses. Traverse, area, coordinates, elevation and subdivision computations. Systematic and random errors analysis.

**INCI 4002. GEOMATICS II.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisite: INCI 4001. Corequisite: INGE 3016.

Study and application of topographic surveys; earthworks; control surveys (horizontal and vertical); coordinate systems; construction surveys; special topics in geomatics; software applications.

**INCI 4005. AGRICULTURAL SURVEYING.** Three credit hours. Two hours of lecture and one-three hour laboratory per week. Prerequisites: INGE 3011 and (MATE 3172 or MATE 3174 or MATE 3005 or MATE 3143).

Use and care of surveying instruments; measurement of distances, angles, areas, and volumes; subdivision of land; differential and profile leveling, topographic surveying and mapping, interpretation of aerial photographs; elements of legal land surveying.

**INCI 4007. HIGHWAY LOCATION AND CURVE DESIGN.** Three credit hours. Two hours of lecture and three hours of computation per week. Prerequisite: INCI 4002.

Highway location surveys; study and design of simple and compound circular, parabolic, and transition curves; earthwork; special project.

**INCI 4008. INTRODUCTION TO ENVIRONMENTAL ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisites:

(INGE 4015 or INQU 4010 or INGE 4010) and (QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134)).

Water and wastewater treatment, water quality measurement, and wastewater pollution effects on receiving waters; solid waste management and air pollution control.

**INCI 4011. STRUCTURAL STEEL DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4021.

Basic methods of stress analysis and design of structural steel elements subjected to elastic and non-elastic stresses due to axial, bending and shearing loads.

**INCI 4012. REINFORCED CONCRETE DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4021 and INCI 4035.

Basic methods of stress analysis and design of reinforced concrete elements subjected to bending, shear, combined bending and axial loads.

**INCI 4018. TOPOGRAPHIC PRACTICE.** Four credit hours. Six weeks during the Summer. Prerequisite: INCI 4078.

Field work, computations and drawing related to land surveying and subdivision, topography, meridian determination, triangulation, leveling, lay out of highway curves, and construction work.

**INCI 4019. CIVIL ENGINEERING SEMINAR.** One credit hour. One hour of lecture per week. Prerequisites: 40 credits approved in INCI or authorization of the Director of the Department.

Presentation and discussion of topics on Civil Engineering by students, faculty members or guest speakers.

**INCI 4021. STRUCTURAL ANALYSIS I.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 4012 and INCI 4095.

Basic principles and theorems of structural analysis; strain energy concepts; simple structures; trusses; graphic statics; influence lines.

**INCI 4022. STRUCTURAL ANALYSIS II.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4021.

Analysis of statically indeterminate structures using prismatic and non-prismatic elements by the methods of slope-deflection and moment distribution. Approximate analysis of multistory structures.

**INCI 4026. HIGHWAY ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisites: INCI 4137 and INCI 4007.



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Classification, planning and administration of highway systems. Geometric design; traffic engineering; subgrade structure; flexible and rigid pavement design.

**INCI 4028. GEOMETRIC DESIGN OF HIGHWAYS.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4007.

Traffic characteristics and highway capacity; elements, criteria, controls and guide values for geometric design; cross section elements; highway types and access controls; intersection design elements and procedures; grade separation and traffic interchanges.

**INCI 4032. SOIL MECHANICS II.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4139.

The theory of consolidation; settlements and contact pressure; stress analysis; stability of slopes; soil compaction and stabilization.

**INCI 4035. CIVIL ENGINEERING MATERIALS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INGE 4001.

Engineering application of the physico-chemical properties of materials; aggregate fundamentals; selection of materials, and their structural behavior; test principles and methods applied to concrete, steel, wood, aluminum, asphaltic and other construction materials, failure analysis; specifications.

**INCI 4048. PLANNING AND SCHEDULING OF CONSTRUCTION PROJECTS.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4055.

Planning and scheduling of construction projects using CPM and PERT methods, sequence networks, bidding strategy, use of computers for project scheduling.

**INCI 4049. FOUNDATIONS ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4139.

Evaluation of subsoil conditions as they affect the choice of type of foundation. Analysis and dimensioning of shallow and deep foundations in sands and clays. Study of lateral earth pressures. Analysis and dimensioning of retaining walls.

**INCI 4051. GEODESY I.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4002.

Triangulations, spherical coordinates computation. Legendre's theorem, traverses, leveling, and orthometric and dynamic elevations.

**INCI 4052. GEODESY II.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4051.

The shape of the earth, the spheroid and ellipsoid; dimensions of the ellipsoid; radius of curvature in the prime vertical plane and in the normal section at any azimuth; computation of angles and distances on the ellipsoid; the geodesic line.

**INCI 4055. CONSTRUCTION ENGINEERING AND MANAGEMENT I.** Three credit hours. Three hours of lecture per week. Prerequisite: INGE 3016.

Study of the construction project lifecycle process from the initial conceptual design phase of a project through to the completion of the pre-construction phase with emphasis on the project management aspects of the lifecycle.

**INCI 4056. CONSTRUCTION ENGINEERING AND MANAGEMENT II.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4055.

Study of the construction project lifecycle process from the initial steps of the construction phase of a project through to the project closeout with emphasis on the construction engineering and project management aspects of the lifecycle.

**INCI 4057. CIVIL ENGINEERING PRACTICE.** Three credit hours. Thirty five hours per week for seven (7) or more weeks during the Summer or its equivalent during the semester. Prerequisite: authorization of the Director of the Department.

A course organized in cooperation with private industry or government to provide the student with practical experience in Civil Engineering. The work performed by the student will be jointly supervised by the Academic Department and an appropriate official from the cooperating organization. An oral and written report will be required from the student upon completion of the project.

**INCI 4059. GEODETIC ASTRONOMY.** Three credit hours. Two hours of conference and one two-hour laboratory per week. Prerequisite: INCI 4051 and ASTR 4005.

Geodetic methods for determining latitude, longitude, and azimuth of second and third order.

**INCI 4061. LEGAL ASPECTS I.** Three credit hours. Three hours of lecture per week. Pre-requisite: third year students.

Laws of the Board of Examiners of Engineers, Architects, Surveyors and Landscape Architects of Puerto Rico, the College of Engineers and Surveyors of P.R. (CIAPR), Code of Ethics of the CIAPR, etc.

**INCI 4062. LEGAL ASPECTS II.** Three credit hours. Three hours of lecture per week. Corequisite: INCI 4002.

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A study of those laws of Puerto Rico which rule land ownership, land transfer, and land use.

**INCI 4071. ADJUSTMENT COMPUTATION I.** Three credit hours. Three hours of lecture per week. Prerequisites: INCI 4051 and (MATE 3063 or MATE 3185).

Theory and analysis of random errors, normal distribution, adjustment of simple triangulation and leveling networks by condition and observation equations, least squares.

**INCI 4072. ADJUSTMENT COMPUTATION II.** Three credit hours. One lecture and two two-hour periods of computation per week. Prerequisite: INCI 4071.

Solution of normal equations; Cholesky's method; adjustment of leveling and triangulation networks; method of variation of coordinates; Lagrangian multipliers; trisection and intersection adjustment.

**INCI 4078. TOPOGRAPHIC DRAWING.** Two credit hours. One hour of lecture and three-hour laboratory or computation per week. Prerequisite: INCI 4002.

The plane table, drawing, interpretation and utilization of topographic maps; volume computation.

**INCI 4079. PHOTO INTERPRETATION.** Three credit hours. One lecture and two two-hour periods of computation or laboratory per week. Prerequisite: GEOL 4015.

Analysis and interpretation of patterns in aerial photography: color tones and vegetation, geologic formation, erosion, soil and rock types, drainage, and other engineering works.

**INCI 4081. PHOTOGRAMMETRY I.** Three credit hours. Three hours of lecture per week. Prerequisites: INCI 4002 and INCI 4135.

Geometry of aerial photographs, determination of distances and coordinates, elevations by radial displacement, stereoscopy, and parallax.

**INCI 4082. PHOTOGRAMMETRY II.** Three credit hours. One hour of lecture and two two-hour periods of computation or laboratory per week. Prerequisite: INCI 4081.

Flight planning and photographic control; theory of stereo plotters of the second and third order; introduction to analytical photogrammetry.

**INCI 4085. THEORY OF MAP PROJECTIONS.** Three credit hours. Three hours of lecture per week. Prerequisites: INCI 4051 and (MATE 3063 or MATE 3185).

Mathematical analysis of map projections, the Lambert conformal conic projection of Puerto Rico.

**INCI 4086. INTRODUCTION TO PHYSICAL GEODESY.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4071.

The shape of the earth, the geoid, gravimetry, Stokes' theorem applied to the determination of the shape of the earth, isostatic equilibrium.

**INCI 4087. SPECIAL SURVEYS.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4002.

Techniques and equipment used in topographic surveys, hydrography, mine surveys, optical tooling, electronic distance measurements.

**INCI 4088. CARTOGRAPHY.** Three credit hours. Three hours of lecture per week.

History of maps; scales and projections, symbols; map reproduction, map types and their uses.

**INCI 4095. MATHEMATICAL METHODS IN CIVIL ENGINEERING.** Two credit hours. Two hours of lecture per week. Prerequisite: INGE 3016 and (MATE 3063 or MATE 3185).

Numerical and statistical methods applied in the solution of Civil Engineering problems using computers.

**INCI 4125. INTRODUCTION TO LAND INFORMATION SYSTEMS.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisite: MATE 3171 or MATE 3005 or MATE 3143.

Methods for the acquisition and conversion data to be used in a Land Information System (LIS) for later analysis. Different types of data structures, including databases in a LIS. Emphasis in vector-based systems. Observe the benefits of a land information system in Puerto Rico.

**INCI 4135. ELEMENTS OF OPTICS AND REMOTE SENSING IN GEOSPATIAL SCIENCE.** Three credit hours. Three hours of lecture per week. Prerequisite: FISI 3172 or FISI 3162.

Principles of geometrical optics and remote sensing applied to Geospatial Science. Acquisition, handling, and interpretation of geospatial data acquired at different portions of the electromagnetic spectrum.

**INCI 4136. APPLIED STATISTICS FOR CIVIL ENGINEERING.** Two credit hours. Two hours of lecture per week. Prerequisite: MATE 3063 or MATE 3185.

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Application of probability and statistical theory in civil engineering. Probability fundamentals; continuous and discrete distributions; point and interval estimation; test of hypothesis; multiple regression.

**INCI 4137. INTRODUCTION TO TRANSPORTATION ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4136.

Basic concepts in transportation: demand, service and equilibrium; transportation planning process and economics; components, operation and design of transportation systems.

**INCI 4138. WATER RESOURCES ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 4015 or INQU 4010 or INGE 4010.

Hydrologic measurements; hydrographs; probability theory applied to hydrologic computations; well hydraulics; capacity of reservoirs and stability of dams; hydraulics of open channels and of pressure conduits; flood control; legal and economic aspects of water resources.

**INCI 4139. INTRODUCTION TO GEOTECHNICAL ENGINEERING.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisites: INGE 4011 and (INGE 4015 or INQU 4010 or INGE 4010). Corequisite: GEOL 4015.

Sampling, identification and description of soils; index and hydraulic properties; interaction between mineral particles and water; permeability and seepage; stress-strain and consolidation characteristics of soils; shear strength determinations. Stress distribution and soil improvement.

**INCI 4145. WATERWORKS AND SEWERAGE DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4138.

Design of water transmission, distribution, and collection systems. Analysis of flow in pipe networks, head losses, pressure distribution; system configuration; sewer hydraulics; quantities of water, sewage, and storm flows used in design; design of water supply systems, sanitary and storm sewers, and pumping stations.

**INCI 4146. INFORMATION TECHNOLOGY APPLICATIONS IN CONSTRUCTION.** One credit hour. Three hours of laboratory per week. Prerequisite: INCI 4055.

Introduction to the main applications of information technology used in construction. Laboratory practice of information technology applications in the construction process. Applications related to project and facilities management, construction cost estimating, construction planning and scheduling, productivity, information

storage and retrieval are presented. In addition, contracts, specifications, visualization and modeling are included.

**INCI 4950. INTEGRATED CIVIL ENGINEERING PROJECT.** Three credit hours. One hour of lecture and four hours of practice per week. Pre-requisite: authorization of the Director of the Department.

Design of a Civil Engineering project, integrating subdisciplines of the profession. Development of a project from its inception, and a conceptual and preliminary design, to its final design. Development of design alternatives, including computational methodology, plans, cost estimates, and specifications.

**INCI 4995. ENGINEERING PRACTICE FOR CO-OP STUDENTS.** Three to nine credit hours. Prerequisites: authorization of the Director of the Department. Be registered in the Civil Engineering or Surveying program.

Practical experience in Civil Engineering in cooperation with a Company or agency to be jointly supervised by the academic department, the coop program coordinator, and an official from the cooperating organization. A written report will be required upon completion of each period of work and its corresponding final grade will be given at the end of each period.

**INCI 4998. UNDERGRADUATE RESEARCH.** One to six credit hours. Three to twenty-four hours of laboratory per week. Pre-requisite: fourth or fifth year student and authorization of the Director of the Department.

Participation, under the supervision of a faculty member acting as an investigator, in a research project.

### **Advanced Undergraduate and Graduate Courses**

**INCI 5006. APPLIED HYDRAULICS.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4138 or authorization of the Director of the Department.

Dimensional analysis and modeling; hydraulic machinery and structures; steady conduit and open channel flow; pipe network system.

**INCI 5007. SOLID WASTE MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4008 or authorization of the Director of the Department.

The solid waste problem: volume reduction and storage of solid wastes, design and optimization of collection systems, recycling, integrated treatment and disposal systems.

**INCI 5008. INTRODUCTION TO HYDROLOGY.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4138 or authorization of the Director of the Department.

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The elements of the hydrologic cycle; probability theory and commonly used probability distributions in hydrology; hydrologic and hydraulic flood routing analysis; use of hydrologic concepts in design.

**INCI 5009. FUNDAMENTALS OF AIR POLLUTION.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4008 or authorization of the Director of the Department.

Classification and extent of air pollution problems, its effects on plants, animals, visibility, and its socio-economic impact; dispersion of effluents; analytical and experimental sampling methods.

**INCI 5010. SUSTAINABLE AND RESILIENT DESIGN AND CONSTRUCTION.** Three credit hours. Three hours of lecture per week. Prerequisites: Fifth year student or authorization of the Director of the Department.

Discussion of sustainable development. Application of sustainability and resiliency to engineering design and construction. Discussion of the engineering and ethical principles needed to support green and resilient design and construction. Discussion of the process to deliver and assess green and resilient construction, the construction system for resource optimization, the reduction of environmental impact, and the use of the integrated building design to achieve sustainability and resiliency.

**INCI 5012. APPLIED SANITARY ENGINEERING CHEMISTRY.** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisite: INCI 4008 or authorization of the Director of the Department.

The application of chemical principles to the sanitary engineering field. Physical, chemical, and biochemical analysis of water and wastewater. Interpretation of analytical data. Integration of experimental data into the design process. The preparation of laboratory reports in the form of engineering reports is emphasized.

**INCI 5015. WATER TREATMENT AND POLLUTION CONTROL.** Three credit hours. Two lectures and one three-hour laboratory per week. Prerequisite: INCI 4008 or authorization of the Director of the Department.

Study of water and wastewater treatment processes in terms of the underlying physical, chemical, and biological principles; the application of the principles to the study of unit treatment processes and to the design, operation, and analysis of performance of integrated treatment plants; the influence of the self-purification of natural bodies of water and of the planned use of the resources on the type and degree of treatment of waste and its disposal; wastewater reclamation.

**INCI 5017. PRESTRESSED CONCRETE STRUCTURES.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4012 or authorization of the Director of the Department. Corequisite: INCI 4022.

Prestressing systems and materials; stress losses, design of beams for flexure, bond, shear and bearing; current specifications and economics of design.

**INCI 5018. MATRIX ANALYSIS OF STRUCTURES I.** Three credit hours. Three hours of lecture per week. Prerequisites: INCI 4022 and authorization of the Director of the Department.

Use of matrix methods in the analysis of structures; flexibility and stiffness methods.

**INCI 5019. DESIGN OF REINFORCED MASONRY STRUCTURES.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4012 or authorization of the Director of the Department.

Analysis and design of reinforced and unreinforced masonry structures using advanced analytical techniques and design philosophies. Includes topics such as: material properties, stability, and buckling of unreinforced masonry; flexural strength, stiffness, and ductility of reinforced masonry elements; and seismic and wind load design provisions.

**INCI 5021. INTRODUCTION TO DYNAMICS OF STRUCTURES.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4022 or authorization of the Director of the Department.

Study of the modeling of structures as systems of single and multiple degrees of freedom. Explanation of the calculation of natural frequencies and vibration modes. Use of computer programs for the dynamic analysis of structures. Introduction of the concept of response and design spectra along with their use for the calculation of the response to earthquake loads.

**INCI 5026 BRIDGE DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisites: (INCI 4012 and INCI 4022) or authorization of the Director of the Department.

Bridge analysis and design; bridge types, characteristics; design problems.

**INCI 5027. MODEL ANALYSIS OF STRUCTURE.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INCI 4022 or authorization of the Director of the Department.

Model analysis in structural engineering; similarity of structures; theory of models of trussed and framed structures and shells; direct and indirect model analysis of structures.

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**INCI 5029. PRINCIPLES OF CITY PLANNING.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

The scope of and legislative bases for planning, organization of planning agencies, basic studies for studies for planning, public utilities and related service facilities, transit and transportation systems, recreation and related service facilities, transit and transportation systems, recreation and public spaces, land use planning, zoning, land subdivision regulations, economic and social aspects of planning, local, regional and national levels of planning.

**INCI 5036. DESIGN-BUILD PROJECT DELIVERY.** Three credit hours. Three hours of lecture per week.

Discussion of the design-build project delivery process. Analysis of the dynamics of the Design-Build process for the development of resilient and sustainable infrastructure. Use of management techniques to capitalize on Design-Build's potential. Application of procurement methods that require interdisciplinary, resilient, and sustainable approaches.

**INCI 5047. INTRODUCTION TO ROCK MECHANICS.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4139 or INCI 4031 or authorization of the Director of the Department.

Fundamentals of rock mechanics: properties of rocks; strength and deformation characteristics of intact and in-situ rocks, computation of internal stresses in a rock mass; methods of rock exploration; application of rock mechanics.

**INCI 5049. GEOSYNTHETICS IN CIVIL ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4139 or authorization of the Director of the Department.

Manufacture, properties and test methods of the different products which comprise the geosynthetics. Applications in: drainage and filtration, design of pavements, earth retaining structures, systems of pollution control, sanitary landfills and other environmental projects.

**INCI 5055. DESIGN OF TIMBER STRUCTURES.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4021 or authorization of the Director of the Department.

Physical and mechanical properties of solid and laminated wood; design and behavior of flexural, tension, and compression members; design of timber connections and mechanical fasteners; special problems in the design of wood trusses, shear walls, diaphragms and plywood composite beams.

**INCI 5056. STRUCTURAL ANALYSIS III.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4022 or authorization of the Director of the Department.

Application of methods for analysis of statically indeterminate structures. Moment distribution. Slope deflection and energy theorems.

**INCI 5057. DESIGN OF REINFORCED CONCRETE STRUCTURES.** Three credit hours. Two hours of conference and one hour of computation per week. Prerequisites: (INCI 4012 and INCI 4022) or authorization of the Director of the Department.

Design of concrete buildings, review of the design of slabs, beams and columns applied to buildings using the new seismic design codes, design of two-way slab systems, shear walls, typical foundations, retaining walls and design for torsion. Discussion of examples related to a complete structural design of a multistory building including the preparation of construction drawings.

**INCI 5065. PRODUCTION OF BITUMINOUS MATERIALS.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INGE 4001 or authorization of the Director of the Department. Corequisite: INCI 4035 or authorization of the Director of the Department.

Study of the production of bituminous materials, the distillation process, and products applicable to the construction and rehabilitation of flexible pavements. Laboratory tests and trials for the characterization of such materials according to current standards. Design of bituminous mixtures for different types of pavement construction.

**INCI 5146. INTRODUCTION TO TRAFFIC ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4137 or authorization of the Director of the Department.

Operation and geometric analysis and design of intersections. Interrupted traffic flow theory, queuing theory, capacity and level of service, traffic studies, service models for signalized intersections and traffic simulation models.

**INCI 5995. SPECIAL TOPICS.** One to six credit hours. The contact will vary according to the topic to be presented. Prerequisite: authorization of the Director of the Department.

The topics will be presented by visiting professors and members of the department who are specialists in the field to be covered. The selection and scope of the topics shall be in accordance with the interests and needs of the students.

**INCI 5996. SPECIAL PROBLEMS.** One to six credit hours. The contact will vary according to the topic to be presented. Prerequisite: authorization of the Director of the Department.

Research and special problems in Civil Engineering and related fields. Open to outstanding students in the field of Civil Engineering.

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## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

The Department of Computer Science and Engineering (CSE) was established in 2016, as stated in the Certification 12-2015/2016 of the Governing Board of the University of Puerto Rico. The CSE department offers undergraduate programs leading to the degrees of *Bachelor of Science in Computer Science and Engineering (BS CSE)* and *Bachelor of Science in Software Engineering (BS SWE)*. It also offers a Ph.D. degree in Computing and Information Sciences and Engineering (CISE) jointly with the Mathematical Sciences Department of the College of Arts and Sciences of the University of Puerto Rico at Mayaguez (UPRM).

### Mission

To create, share, and apply knowledge in Computer Science and Software Engineering for the benefit of society. To provide students with the high-quality education that enables them to contribute to the economic and well-being of humanity, observing the highest standards of ethics and effectiveness in the exercise of the computing profession.

### Vision

To be one of the nation's leaders in Computer Science and Engineering education and research.

### Objectives

The CSE Department is committed to excellence in undergraduate and graduate teaching, research, and service aiming to contribute to the socioeconomic development of Puerto Rico through:

- The education of a diverse, well-rounded, entrepreneurial engineering workforce with a keen sense of social responsibility and a vocation for global engagement.
- The production of new knowledge and the transfer of technology.
- The cultivation of strong ties with community, governmental, and non-governmental organizations.

## Personnel and Facilities

The CSE department is supported by an outstanding staff that includes academic counselors, administrative officers, assistants and secretaries that are committed to offer our students and faculty the administrative support that they need.

All CSE faculty members hold doctoral degrees in Computer Science and Engineering or closely related fields and are active in science and education research.

Although most CSE students use their personal laptops for projects and assignments, the CSE Department provides them with well-equipped computing labs with access to the UPRM high bandwidth Internet infrastructure. The departmental computing backend is endowed with high capacity virtualized servers for serving efficiently the recurrent or occasional computing and data storage needs of our students.

## Undergraduate Experience

The CSE Department offers a rich and sound educational experience that combines a challenging curriculum, and a wide range of experience education activities such as internships, coops, undergraduate research and student groups. Internships and coops programs allow students to spend summers, or eventually, entire semesters working in an academic research project or in the industrial or corporate world, or government agency. Coop or similar educational experiences provide CSE students with an early embedment with the Computer Science and Engineering, and with the Software Engineering professions. In turn, undergraduate research projects offer CSE students a way to engage in research or development projects, expanding their knowledge and reinforcing their creativity.

Various student groups such as the Society of Hispanic Professional Engineers (SHPE), the IEEE Computer Society and the ACM, count with a significant membership of CSE students. Students of the department participate in competitive team projects such as the NASA Swarmathon and the ACM Intercollegiate Programming Contest, as well.

## Contact Information

Please visit <http://www.cse.uprm.edu> for more information on the Department of Computer Science and Engineering.

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## Undergraduate Programs

The Bachelor of Science in Computer Science and Engineering, and the Bachelor of Science Program in Software Engineering were designed in accordance to the guidelines provided by the *Computing Curricula 2013* by the *Association for Computing Machinery* (ACM) and the *Institute of Electrical and Electronic Engineers Computer Society* (IEEE-CS). Their curricula include advanced elective courses for tailoring the study programs to the student's particular professional interests.

### Program Educational Objectives

Upon graduation students in the Bachelor of Science in Computer Science and Engineering and in the Bachelor of Science in Software Engineering, are expected to:

1. Contribute to the advancement of society through the ethical application of their knowledge and skills.
2. Demonstrate professional competence, leadership, and entrepreneurial spirit to excel in the practice of the profession.
3. Effectively participate and contribute in global markets.
4. Pursue advanced studies, continued education, and be involved in professional societies to succeed in a constantly evolving field.

### Student Outcomes

Graduates from the baccalaureate in Computer Science and Engineering, and graduates from the baccalaureate in Software Engineering, must be able to:

1. Identify, formulate, analyze and solve complex computing problems by applying principles of computing, engineering, science, mathematics, and other relevant disciplines.
2. Apply engineering and computing principles to design, implement, and evaluate a computing-based solution to meet a given set of computing requirements with consideration of public health, safety, and

welfare, as well as global, cultural, social, environmental, and economic factors.

3. Communicate effectively in a variety of professional contexts and with a range of audiences.
4. Recognize ethical and professional responsibilities and make informed judgments in computing and engineering practice, which must consider the impact of the proposed solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Apply computer science theory and software development fundamentals to produce computing-based solutions
7. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
8. Acquire and apply new knowledge as needed, using appropriate learning strategies.

### General Education Component

Both baccalaureates provide a well-rounded education that includes courses in languages and communication, social sciences, arts and humanities. Students also acquire and enhance their team work and collaboration skills throughout the team projects that are required in several of its courses and especially, in the capstone design experience.

The general education component takes 44 of the total of 155 credits of the programs. Following is a list of courses in the general education component:

#### Language, Oral and Written Communication

- INGL xxxx Basic Course in English I and II (6 credits)
- ESPA 3101-02 Basic course in Spanish I & II (6 credits)
- INGL xxxx Second year courses in English (6 credits)

#### Humanities and Social Sciences

- Electives in Social Sciences and Humanities (12 credits)

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#### Other Electives

- EDFI xxxx Electives in Physical Education (2 credits)
- ELECTIVES – Free Electives (12 credits)

## Bachelor of Science in Computer Science and Engineering

The BS in Computer Science and Engineering provides a wide formation in aspects of analysis, design, and implementation of computing systems including computer networking, artificial intelligence, databases, computer graphics, web applications, mobile devices, design and implementation of programming languages, computer architecture, and computer security.

### PROGRAM OF STUDY

#### COMPUTER SCIENCES AND ENGINEERING CURRICULUM

##### FIRST YEAR

###### First Semester

| Number      | Credits | Course                                 |
|-------------|---------|--|
| *MATE 3031  | 4       | Calculus                               |
| QUIM 3131   | 3       | General Chemistry I                    |
| QUIM 3133   | 1       | General Chemistry Lab I                |
| **INGL 3--- | 3       | Basic course in English                |
| ESPA 3101   | 3       | Basic course in Spanish I              |
| CIIC 3011   |         | Introduction to Computer Programming I |
|             |         | or                                     |
| COMP 3010   | 3       | Introduction to Computer Programming I |
|             | 17      |  |

###### Second Semester

| Number      | Credits | Course                     |
|-------------|---------|----------------------------|
| MATE 3032   | 4       | Calculus II                |
| QUIM 3132   | 3       | General Chemistry II       |
| QUIM 3134   | 1       | General Chemistry Lab II   |
| **INGL 3--- | 3       | Basic course in English    |
| ESPA 3102   | 3       | Basic course in Spanish II |
| CIIC 3075   | 3       | Fundamentals of Computing  |
|             | 17      |                            |

##### SECOND YEAR

###### First Semester

| Number      | Credits | Course                  |
|-------------|---------|-------------------------|
| MATE 3063   | 3       | Calculus III            |
| FISI 3171   | 4       | Physics I               |
| FISI 3173   | 1       | Physics Laboratory I    |
| INGE 3011   | 2       | Engineering Graphics I  |
| CIIC 4010   | 4       | Advanced Programming    |
| **INGL 3--- | 3       | Basic course in English |
|             | 17      |                         |

###### Second Semester

| Number      | Credits | Course                        |
|-------------|---------|-------------------------------|
| CIIC 4020   | 4       | Data Structures               |
| FISI 3172   | 4       | Physics II                    |
| FISI 3174   | 1       | Physics Laboratory II         |
| **INGL 3--- | 3       | Basic course in English       |
| INEL 3105   | 3       | Electrical Systems Analysis I |
| INEL 4115   | 1       | Electrical Measurements       |
|             | 16      |                               |

##### THIRD YEAR

###### First Semester

| Number    | Credits | Course                                    |
|-----------|---------|---|
| CIIC 4025 | 3       | Analysis and Design of Algorithms         |
| CIIC 3081 | 3       | Computer Architecture I                   |
| MATE 4145 | 4       | Linear Algebra and Differential Equations |
| INGE 3035 | 3       | Engineering Mechanics                     |
| ELECTIVE  | 3       | Sociohumanistic Elective                  |
|           | 16      |   |

###### Second Semester

| Number    | Credits | Course                                   |
|-----------|---------|--|
| CIIC 4030 | 3       | Programming Languages                    |
| CIIC 4082 | 3       | Computer Architecture II                 |
| ININ 4010 | 3       | Probability and Statistics for Engineers |
| INME 4045 | 3       | General Thermodynamics for Engineers     |
| ELECTIVE  | 3       | Sociohumanistic Elective                 |
|           | 15      |  |



## FOURTH YEAR

### First Semester

| Number    | Credits  | Course                               |
|-----------|----------|--------------------------------------|
| CIIC 4050 | 4        | Operating Systems                    |
| INSO 4101 | 3        | Introduction to Software Engineering |
| CIIC 5045 | 3        | Automata and Formal Languages        |
| COMP 5045 | 3        | Automata and Formal Languages        |
| ININ 4015 | 3        | Engineering Economic Analysis        |
| ELECTIVE  | <u>3</u> | Sociohumanistic Elective             |
|           | 16       |                                      |

### Second Semester

| Number       | Credits  | Course                                     |
|--------------|----------|--|
| CIIC 4060    | 3        | Database Systems                           |
| CIIC 4070    | 3        | Computer Networks                          |
| INGE 3045    | 3        | Materials Science for Electrical Engineers |
| ***CIIC ---- | 3        | Technical Elective                         |
| ELECTIVE     | <u>3</u> | Sociohumanistic Elective                   |
|              | 15       |  |

## FIFTH YEAR

### First Semester

| Number       | Credits  | Course                       |
|--------------|----------|------------------------------|
| ***CIIC ---- | 3        | Technical Elective           |
| ***CIIC ---- | 3        | Technical Elective           |
| ELECTIVE     | 3        | Free Elective                |
| ELECTIVE     | 3        | Free Elective                |
| EDFI ----    | <u>1</u> | Course in Physical Education |
|              | 13       |                              |

### Second Semester

| Number       | Credits  | Course                       |
|--------------|----------|------------------------------|
| ***CIIC ---- | 3        | Technical Elective           |
| ***CIIC ---- | 3        | Technical Elective           |
| ELECTIVE     | 3        | Free Elective                |
| ELECTIVE     | 3        | Free Elective                |
| EDFI ----    | <u>1</u> | Course in Physical Education |
|              | 13       |                              |

### Total credits required for this program: 155

- \* Pre-calculus must be previously approved by the student.
- \*\* Refer to the Academic regulations section for information regarding Advanced Placement
- \*\*\* Technical elective selected by the student

## Bachelor of Science in Software Engineering

The first three academic years The first three academic years of both baccalaureates are common. Consequently, graduates of the BS in Software Engineering share with graduates of the BS in Computer Science and Engineering, a wide formation in aspects of analysis, design, and implementation of computing systems. In addition, the Bachelor of Science in Software Engineering offers courses on well-structured, systematical and quantitative methodologies for the development, operation, and maintenance of complex, mission-critical computational systems. This latter curricular segment is the core of the Software Engineering specialty.

## PROGRAM OF STUDY

### SOFTWARE ENGINEERING CURRICULUM

#### FIRST YEAR

##### First Semester

| Number      | Credits  | Course                                 |
|-------------|----------|--|
| *MATE 3031  | 4        | Calculus                               |
| QUIM 3131   | 3        | General Chemistry I                    |
| QUIM 3133   | 1        | General Chemistry Lab I                |
| **INGL 3--- | 3        | Basic course in English                |
| ESPA 3101   | 3        | Basic course in Spanish I              |
| CIIC 3011   |          | Introduction to Computer Programming I |
|             |          | or                                     |
| COMP 3010   |          | Introduction to Computer Programming I |
|             | <u>3</u> |  |
|             | 17       |  |

##### Second Semester

| Number      | Credits  | Course                     |
|-------------|----------|----------------------------|
| MATE 3032   | 4        | Calculus II                |
| QUIM 3132   | 3        | General Chemistry II       |
| QUIM 3134   | 1        | General Chemistry Lab II   |
| **INGL 3--- | 3        | Basic course in English    |
| ESPA 3102   | 3        | Basic course in Spanish II |
| CIIC 3075   | <u>3</u> | Fundamentals of Computing  |
|             | 17       |                            |

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## SECOND YEAR

### First Semester

| Number      | Credits | Course                  |
|-------------|---------|-------------------------|
| MATE 3063   | 3       | Calculus III            |
| FISI 3171   | 4       | Physics I               |
| FISI 3173   | 1       | Physics Laboratory I    |
| INGE 3011   | 2       | Engineering Graphics I  |
| CIIC 4010   | 4       | Advanced Programming    |
| **INGL 3--- | 3       | Basic course in English |
|             | 17      |                         |

### Second Semester

| Number      | Credits | Course                        |
|-------------|---------|-------------------------------|
| CIIC 4020   | 4       | Data Structures               |
| FISI 3172   | 4       | Physics II                    |
| FISI 3174   | 1       | Physics Laboratory II         |
| **INGL 3--- | 3       | Basic course in English       |
| INEL 3105   | 3       | Electrical Systems Analysis I |
| INEL 4115   | 1       | Electrical Measurements       |
|             | 16      |                               |

## THIRD YEAR

### First Semester

| Number    | Credits | Course                                    |
|-----------|---------|---|
| INSO 4101 | 3       | Introduction to Software Engineering      |
| CIIC 3081 | 3       | Computer Architecture I                   |
| MATE 4145 | 4       | Linear Algebra and Differential Equations |
| CIIC 4030 | 3       | Programming Languages                     |
| ELECTIVE  | 3       | Sociohumanistic Elective                  |
|           | 16      |   |

### Second Semester

| Number    | Credits | Course                                   |
|-----------|---------|--|
| CIIC 4025 | 3       | Analysis and Design of Algorithms        |
| INSO 4115 | 3       | Software Engineering Requirements        |
| CIIC 4082 | 3       | Computer Architecture II                 |
| ININ 4010 | 3       | Probability and Statistics for Engineers |
| ELECTIVE  | 3       | Sociohumanistic Elective                 |
|           | 15      |  |

## FOURTH YEAR

### First Semester

| Number    | Credits | Course                        |
|-----------|---------|-------------------------------|
| CIIC 4050 | 4       | Operating Systems             |
| INGE 3035 | 3       | Engineering Mechanics         |
| INSO 4116 | 3       | Software Design               |
| ININ 4015 | 3       | Engineering Economic Analysis |

|          |    |                          |
|----------|----|--------------------------|
| ELECTIVE | 3  | Sociohumanistic Elective |
|          | 16 |                          |

### Second Semester

| Number    | Credits | Course                               |
|-----------|---------|--------------------------------------|
| CIIC 4060 | 3       | Database Systems                     |
| CIIC 4070 | 3       | Computer Networks                    |
| INSO 4117 | 3       | Software Reliability Testing         |
| INME 4045 | 3       | General Thermodynamics for Engineers |
| ELECTIVE  | 3       | Sociohumanistic Elective             |
|           | 15      |                                      |

## FIFTH YEAR

### First Semester

| Number    | Credits | Course                                     |
|-----------|---------|--|
| INSO 4151 | 3       | Software Engineering Project I             |
| INGE 3045 | 3       | Materials Science for Electrical Engineers |
| ELECTIVE  | 3       | Free Elective                              |
| ELECTIVE  | 3       | Free Elective                              |
| EDFI ---- | 1       | Course in Physical Education               |
|           | 13      |  |

### Second Semester

| Number       | Credits | Course                       |
|--------------|---------|------------------------------|
| ***INSO ---- | 3       | Technical Elective           |
| ***INSO ---- | 3       | Technical Elective           |
| ELECTIVE     | 3       | Free Elective                |
| ELECTIVE     | 3       | Free Elective                |
| EDFI ----    | 1       | Course in Physical Education |
|              | 13      |                              |

### Total credits required for this program: 155

- \* Pre-calculus must be previously approved by the student.
- \*\* Refer to the Academic regulations section for information regarding Advanced Placement
- \*\*\* Technical elective selected by the student

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## DEPARTMENTAL FACULTY

**EMMANUEL ARZUAGA**, *Assistant Professor*, Ph.D. 2012, Northeastern University.

**HENRICK M. IERKIC-VIDMAR**, *Professor*, Ph.D. 1980, Cornell University.

**LUIS O. JIMÉNEZ-RODRÍGUEZ**, *Professor*, Ph.D. 1996, Purdue University.

**KEJIE LU**, *Professor*, Ph.D. 2004, University of Texas at Dallas.

**WILSON RIVERA-GALLEGO**, *Professor*, Ph.D. 2000, Mississippi State University.

**PEDRO I. RIVERA-VEGA**, *Professor*, Ph.D. 1990, University of Florida.

**MANUEL RODRÍGUEZ-MARTÍNEZ**, *Professor*, Ph.D. 2001, University of Maryland.

**JAIME SEGUEL**, *Professor*, Ph.D. 1987, City University of New York.

**HEIDY SIERRA**, *Assistant Professor*, Ph.D. 2010, Northeastern University.

**BIENVENIDO VÉLEZ**, *Associate Professor*, Ph.D. 1999, Massachusetts Institute of Technology.

## COURSES OF INSTRUCTION

### COMPUTER SCIENCES AND ENGINEERING

**CIIC 3011. INTRODUCTION TO COMPUTER PROGRAMMING I.** Three credit hours. Three hours of lecture per week.

Analysis of algorithmic problems, development of solutions and their implementation in a high level programming language using object-oriented programming techniques. Topics: numerical systems, internal representation, constants, variables, and data types, selection and iteration control structures, functions, and data passing mechanisms, basic data structures, pointers, and dynamic memory management, data input/output, files and software development environments.

**CIIC 3075. FUNDAMENTALS OF COMPUTING.** Three credit hours. Three hours of lecture per week. Prerequisites: CIIC 3011 or INGE 3016. Corequisite: MATE 3031.

Discrete structures in computer sciences and engineering with emphasis on problem-solving skills and algorithms. Topics include: set theory, logic and proof techniques, graph theory, computability, and discrete probability applied to computing problems.

**CIIC 3081. COMPUTER ARCHITECTURE I.** Three credit hours. Three hours of lecture per week. Prerequisites: INEL 3105 and (CIIC 4010 or ICOM 4015).

Study of fundamental concepts of logic circuit analysis and design with the aim of understanding and designing the main components of a modern processor. Topics include: boolean algebra, logic gates, combinational and sequential circuits, arithmetic logic units (alu), memory and programmable logic devices, data paths, and control units. Practice with logic circuit design problems.

**CIIC 4010. ADVANCED PROGRAMMING.** Four credit hours. Three hours of lecture and two hours of laboratory per week. Prerequisites: CIIC 3011 or INGE 3016.

Advanced programming techniques applied to the solution of engineering problems, extensive use of subprograms, logical and specifications statements. Principles of multiprogramming, multiprocessing, and real-time systems.

**CIIC 4020. DATA STRUCTURES.** Four credit hours. Three hours of lecture and two hours of laboratory per week. Prerequisites: (CIIC 4010 or ICOM 4015) and MATE 3031 and (ICOM 4075 or CIIC 3075).

Data structures in programming languages; representation of information as data lists in linear, orthogonal, string, and array form; tree structures; techniques for storage allocation, distribution collection, and sorting of data.

**CIIC 4025. ANALYSIS AND DESIGN OF ALGORITHMS.** Three credit hours. Three hours of lecture per week. Prerequisites: ICOM 4035 or CIIC 4020.

Study of methods and techniques for the complexity analysis of computer algorithms. Design of new algorithms capable of minimizing execution time while optimizing the use of computer resources. Topics include: asymptotic analysis, greedy strategies, divide and conquer, dynamic programming, backtracking, and graph, search, and sorting algorithms.

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**CIIC 4030. PROGRAMMING LANGUAGES.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 4035 or CIIC 4020.

Comparative study of programming paradigms including imperative, object-oriented, functional, logic, and concurrent programming; data encapsulation and inheritance; formal specification of the syntactic structure of a language; context-free grammars and parse trees.

**CIIC 4050. OPERATING SYSTEMS.** Four credit hours. Three hours of lecture and three hours of laboratory per week. Prerequisites: (ICOM 4035 or CIIC 4020) and (CIIC 4082 or INEL 4206).

Study of operating systems, multiprogramming, multiprocessing, batch, partitioned, and real time processing, organization and processing of file systems, queuing theory and information flow control.

**CIIC 4060. DATABASE SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: ICOM 4035 or CIIC 4020. Corequisites: ICOM 5007 or CIIC 4050.

Study of database system architectures, design and implementation of database applications, conceptual and representational models, SQL and the relational model, functional dependencies and normalization, transaction processing.

**CIIC 4070. COMPUTER NETWORKS.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 5007 or CIIC 4050.

Study and development of skills required for the design of network protocols and network-centric applications, with emphasis on internet protocols. Topics include: the iso layered model, TCP/IP, routing, client-server model, World Wide Web, and web services. Practice with analysis and programming problems.

**CIIC 4082. COMPUTER ARCHITECTURE II.** Three credit hours. Three hours of lecture per week. Prerequisite: CIIC 3081.

Study of fundamental computer architecture concepts with the objective of designing efficient processors and computing systems to support operating systems and high-level programming languages. Topics include: subroutines, exceptions, input/output, pipelining, and hierarchical memories. Practice with analysis, design, and programming problems.

**CIIC 4151. SENIOR DESIGN PROJECT (CAPSTONE).** Three credit hours. Three hours of lecture per week. Prerequisites: (CIIC 4025 and CIIC 4060 and INSO 4101) or authorization of the Director of the Department.

Team project to design, implement, test, and document a system based on Computer Systems and Computer Architecture techniques, incorporating computer science standards, engineering standards and problem constraints.

**CIIC 4995. ENGINEERING PRACTICE FOR COOP STUDENTS.** Zero to six credit hours. Prerequisite: authorization of the Director of the Department.

Practical experience in Computer Science and Engineering in cooperation with private industry or government to be jointly supervised by the academic department, the Co-op Program Coordinator, and an official from the cooperating organization.

**CIIC 4998. UNDERGRADUATE RESEARCH.** One to six credit hours. Prerequisite: ICOM 4035 or CIIC 4020 and authorization of the Director of the Department.

Development of a research project in computer science and computer engineering under the supervision of a faculty member.

**CIIC 5015. ARTIFICIAL INTELLIGENCE.** Three credit hours. Three hours of lecture per week. Prerequisites: ICOM 4035 or CIIC 4020.

An introduction to the field of artificial intelligence: Lisp language, search techniques, games, vision, representation of knowledge, inference and process of proving theorems, natural language understanding.

**CIIC 5017. OPERATING SYSTEM AND NETWORK ADMINISTRATION AND SECURITY.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: CIIC 4070 or ICOM 5026.

Practical experience in the administration and security of operating systems and networks. Design and development of measures for the detection and response to attacks on such systems.

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**CIIC 5018. CRYPTOGRAPHY AND NETWORK SECURITY.** Three credit hours. Three hours of lecture per week. Prerequisites: CIIC 4050 or ICOM 5007.

Theoretical and practical aspects of computing system and network security, threat models, system vulnerability to attacks such as: hackers, malicious code, Trojan horses, viruses, and worms, cryptographic techniques used to defend systems from such attacks.

**CIIC 5019. HIGH PERFORMANCE COMPUTING.** Three credit hours. Three hours of lecture per week. Prerequisites: ICOM 4035 or CIIC 4020 or authorization of the Director of the Department.

Study of the fundamentals concepts associated with the performance of a computing systems. Discussion of techniques for the reduction of operations with the aim of minimizing the response time of a system to problems whose solution poses a high demand of computational resources. Study of parallelization, and concurrency strategies, and practical experiences with the use of systems and tools implementing them.

**CIIC 5029. COMPILERS DEVELOPMENT.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisites: CIIC 4082 or INEL 4206. Corequisites: CIIC 4030 or ICOM 4036.

Study and application of techniques associated with the analysis of source languages and the generation of efficient object codes with emphasis on the components of a compiler.

**CIIC 5045. AUTOMATA AND FORMAL LANGUAGES.** Three credit hours. Three hours of lecture per week. Prerequisites: CIIC 4020 or ICOM 4035 or authorization of the Director of the Department.

Study of theoretical computational models, languages, and machines. Introduction to the theory of intractable and un-decidable problems. Topics include: finite automata, regular languages, context-free languages, pushdown automata, turing machine, halting problem, undecidability, and intractable problems.

**CIIC 5110. BIOINFORMATICS ALGORITHMS.** Three credit hours. Three hours of lecture per week. Prerequisites: ININ 4010- Probability and Statistics for Engineers and (ICOM 4038- Algorithm Design and Analysis or CIIC 4025- Analysis and Design of Algorithms or authorization of the Director of the Department).

Discussion of algorithms for processing genomic and proteomic data. Discussion of heuristic randomized and non-heuristic algorithmic solutions for sequence comparison, gene finding and gene expression state determination problems, among others. Discussion of algorithmic design principles and their impacts on time and space complexity and the quality of results.

**CIIC 5120. VIRTUAL MACHINES.** Three credit hours. Three hours of lecture per week. Prerequisites: ICOM 5007- Operating Systems Programming or CIIC 4050- Operating Systems or authorization of the Director of the Department.

Discussion of concepts related to the design and implementation of virtual computer monitors, including traditional computer virtualization techniques such as “trap-and-emulate”, translation of binary files, “shadow page tables” and principles of emulation of devices. Discussion of classic publications in the area of virtualization and recent advances in the subject.

**CIIC 5130. CLOUD COMPUTING INFRASTRUCTURES.** Three credit hours. Three hours of lecture per week. Prerequisites: ((CIIC 4060 or ICOM 5016- Database Systems) and (CIIC 4070 or ICOM 5026- Computer Networks)) or authorization of the Director of the Department.

Description of the principles of cloud computing. Discussion of the virtualization, load balancing in the system, scalability and elasticity, replication and deployment. Design and programming of applications in the cloud. Discussion of advanced aspects of cloud computing including security and software performance evaluation. Discussion of the use of cloud infrastructure for areas such as health, transportation, energy and education.

**CIIC 5140. BIG DATA ANALYTICS.** Three credit hours. Three hours of lecture per week. Prerequisites: ININ 4010- Probability and Statistics for Engineers and ((CIIC 4060 or ICOM 5016- Database Systems) or authorization of the Director of the Department).

Description of the principles of big data systems and analysis techniques for the design of cloud computing processes. Discussion of the implementation of parallel algorithms to process data on cloud-resident storage and memory-based file systems.

**CIIC 5995. SELECTED TOPICS.** One to three credit hours. Prerequisite: authorization of the Director of the Department.

Selected topics in computer science and engineering.

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## SOFTWARE ENGINEERING

**INSO 4101. INTRODUCTION TO SOFTWARE ENGINEERING.** Three credit hour. Three hours of lecture per week. Prerequisite: ICOM 4035 or CIIC 4020.

Introduction to the activities of the software development cycle. Software development process models and related metrics. Ethical issues in software engineering.

**INSO 4115. SOFTWARE ENGINEERING REQUIREMENTS.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 4009 or INSO 4101.

Techniques used to determine the requirements of a complex software system: specification standards, the UML language, validation, specification management tools, and quality metrics. Elicitation and development of software system requirements. Discussion of ethical issues arising during requirements elicitation.

**INSO 4116. SOFTWARE DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisites: INSO 4101 or ICOM 4009.

Fundamental principles and development of skills required for the effective design of complex software systems. Topics include: formal design methods, design specification standards, design patterns, design validation, and design metrics. Use of computer-aided software engineering (CASE) tools.

**INSO 4117. SOFTWARE RELIABILITY TESTING.** Three credit hours. Three hours of lecture per week. Prerequisites: INSO 4101 or ICOM 4009.

Software testing and validation techniques with the aim of developing the skills required to design reliable and fault-tolerant software systems. Topics include: unit, integrated, performance, stress, usability, and fault tolerance testing. Practice with computerized testing and debugging tools.

**INSO 4151. SOFTWARE ENGINEERING PROJECT I.** Three credit hours. Three hours of lecture per week. Prerequisites: (INSO 4115 and INSO 4116 and INSO 4117 and CIIC 4025 and CIIC 4060) or authorization of the Director of the Department.

Team project to implement a previously designed system of software engineering development to solve an academic, governmental, commercial, or industrial problem. Final presentation and evaluation of the project.

**INSO 4152. SOFTWARE ENGINEERING PROJECT II.** Three credit hours. Three hours of discussion per week. Prerequisite: INSO 4151.

Team project to implement a previously designed system of software engineering development to solve an academic, governmental, commercial, or industrial problem. Final presentation and evaluation of the project.

**INSO 4995. ENGINEERING PRACTICE FOR COOP STUDENTS.** Zero to six credit hours. Prerequisite: authorization of the Director of the Department.

Practical experience in Software Engineering in cooperation with private industry or government to be jointly supervised by the academic department, the Co-op Program Coordinator, and an official from the cooperating organization.

**INSO 4998. UNDERGRADUATE RESEARCH IN SOFTWARE ENGINEERING.** One to three credit hours. One to three hours of research per week. Prerequisites: authorization of the Director of the Department.

Development of a research project related to Software Engineering, under the supervision of a faculty member.

### Advanced Undergraduate and Graduate Courses

**INSO 5111. INTRODUCTION TO HUMAN-COMPUTER INTERACTION.** Three credit hours. Three hours of lecture per week. Prerequisites: ICOM 4035 or CIIC 4020 or authorization of the Director of the Department.

Introduction to the principles of human-computer interaction with the objective of developing the skills necessary to design and implement graphical user interfaces (GUI). Topics include: cognitive psychology, human factors, and interaction styles. Practice in designing and evaluating the usability of various graphical user interfaces.

**INSO 5118. SOFTWARE ENGINEERING PROJECT MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: INSO 4101 or ICOM 4009 or authorization of the Director of the Department.

Discussion of techniques and tools for estimation, planning, monitoring, documentation, evaluation, refinement, and quality control of software. Development of skills for the effective administration of complex software engineering projects. Practice in project administration.

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## DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

The Department of Electrical and Computer Engineering (ECE) offers programs leading to the degrees of *Bachelor of Science in Electrical Engineering* and, *Bachelor of Science in Computer Engineering*. It also offers graduate programs for Master's degrees in Electrical Engineering and Computer Engineering, and a Ph.D. in Electrical Engineering.

Each of our academic programs is based on globally recognized curriculum standards for its particular disciplines. The two programs are designed to produce well-prepared professional engineers, who will be capable of serving well our society through the practice of their profession under the challenging demands of the new millennium, while performing it with excellence and maximum ethical consciousness. *The ECE department is proud that, throughout its more than 80 years since its creation, it has been a fundamental step for thousands of our alumni that have achieved remarkable success through their professional life in our modern society.*

The ECE department is guided by its Mission and Vision, which are as follows:

### Mission

The ECE Department is committed to the pursuit of excellence in undergraduate and graduate teaching, research, and service activities that contribute to the socioeconomic development of Puerto Rico through:

- The education of a diverse, well-rounded, entrepreneurial engineering workforce with a keen sense of social responsibility and a vocation for global engagement.
- The production of new knowledge and the transfer of technology.
- The cultivation of strong ties with community, governmental, and non-governmental organizations.

### Vision

To be widely recognized as leaders and innovators in the development of ECE curricula, teaching methods and research that drives knowledge creation and socioeconomic development in Puerto Rico and the World.

## Personnel and Facilities

The ECE department counts with a strong team of well-qualified professionals, including faculty, as well as administrative, counseling, and other support staff, to effectively fulfill its mission through teaching, research, and service activities. To support this, the department manages a variety of well-equipped laboratories that make possible practical hands-on experience activities by which the students have the opportunity to visualize and experiment with core topics of the two academic disciplines. These facilities are used in courses, as well as in research and development projects. Additionally, the department administers a modern computational infrastructure based on the latest technologies available, consisting of specialized computer equipment, software, and communications. This infrastructure provides the required computational services to satisfy the needs demanded by our academic activities and by the large number of users among our constituents. Such services can be accessed from different computational facilities within the department that are open to our students at all times. Moreover, our computational infrastructure is connected through a modern communications network (ECENET), including several wireless access points, hence allowing secured access to most of its resources from anywhere in Campus and wherever Internet is available. Similarly, other resources through campus and over the Internet are as well accessible from our facilities through ECENET.

## Undergraduate Research

Our programs recognize the importance of students to be involved in research and development as early as possible. These types of activities support our goal to prepare professionals that are capable of applying well known practices in the disciplines to bring correct and cost-effective solutions to societal problems. Aligned with that, the ECE department started the Industrial Affiliates Program (IAP) in 1989 to provide undergraduate students the opportunity to engage in research and development projects under the sponsorship of industry and government agencies. Several of our students have benefited from this program by having the opportunity to work in real and challenging problems. Every year, participating students have the opportunity to present their results to all the community in Campus, as well as to visitors from sponsoring organizations.

Students in our programs have access to a wide spectrum of other opportunities during the regular semesters or during summers. In particular, they

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usually have the opportunity to work in campus, internships in other universities, in national research labs or in different industries, in Puerto Rico and throughout the States, and occasionally in other countries as well. All these opportunities have an extraordinary impact in their education and formation in many aspects. They represent an excellent experience that is valuable not only for their studies but also for their future practice as a computer or electrical engineer. They are also excellent in providing an attractive source of income, which the student can use to support his/her financial needs while in school.

Most of these experiences can be counted as part of the credits that the student needs to complete the degree by registering in undergraduate research courses (INEL 4998 and ICOM 4998), the Practice in Engineering course (INEL/ICOM 4048) or the Cooperative Education Program (INEL/ICOM 4995).

### Contact Information

For more information about the ECE Department and on our programs, please visit:  
<http://www.ece.uprm.edu>.

## Bachelor of Science in Electrical Engineering

The Bachelor of Science Program in Electrical Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

### Program's Educational Objectives

Graduates from the Electrical Engineering program will:

1. Contribute to the educational, cultural, social, technological and economic development of their societies by applying, ethically, their knowledge and skills.
2. Demonstrate professional competence, leadership, and entrepreneurial spirit to excel in their chosen profession or to create their own businesses.
3. Take advantage of the multicultural background and bilingual education to effectively participate and contribute in global markets.

4. Pursue advanced studies, be involved in professional societies, and succeed in a constantly changing field.

### Student Outcomes

Graduates from our programs should demonstrate the following outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Electrical Engineering integrates mathematical and scientific principles of electricity and magnetism to analyze electrical phenomena and to design electrical systems. Electrical and electronic systems are present in almost any aspect of our daily lives, ranging from the generation of electrical power vital to the social and economic well-being of society, to appliances, instruments, and devices at home and at work. Therefore, our Electrical Engineering program is designed to prepare students for a wide-range of professional activities involving design and implementation of electrical systems.

The profession of Electrical Engineering has evolved to encompass many fields of specialization. In recognition of that fact, the undergraduate program is



structured into a common core sequence of courses which provides a broad coverage of the areas which Electrical Engineers are expected to master, and a cluster of technical electives which study closely at least one area of emphasis within the discipline. Current options include:

- RF Systems and Microwave Remote Sensing
- Communications and Signal Processing
- Control systems
- Electronics
- Power Engineering Systems

Electronic devices and systems are the core of all modern communication, information processing, control, and automation systems present in industrial and consumer use. The electronic collection, transmission, and processing of information are vital to support the needs of society. Signals need to be transmitted efficiently for a wide variety of applications, from entertainment to space exploration. The success of an industrial society depends on the production of high quality goods and services, which in turn require effective robotic and automation systems.

Since computer systems are present in all aspects of the engineering practice, the program incorporates the use of computerized analysis, design techniques, and tools where appropriate. The curriculum incorporates laboratory courses in Chemistry, Physics, Electronics, and Electrical Machinery to allow students practical experiences with physical and engineering principles. Technical electives provide structured design experiences where students learn to design practical systems with real world constraints.

## General Education Component

The general education component in the Electrical Engineering program is designed to support the development of a professional that is aware not only of the technical professional needs, but also the general needs of society. In addition to achieve expertise in the discipline, the electrical engineering professional needs to communicate adequately, understand the importance of cultural, ethical, and social issues, and value the need to constantly upgrade knowledge.

The institutional student learning outcomes for the general education component in both programs are:

1. Become an intentional learner.
2. Demonstrate creative and critical thinking.
3. Communicate effectively.

4. Identify and solve problems; transform knowledge into action.
5. Apply mathematical, scientific and technology skills.
6. Apply interpretative and integrative skills.
7. Relate global contexts and issues of importance to Puerto Rico.
8. Show moral autonomy and develop a sense of well-being.
9. Practice civic virtue.
10. Value diversity.

The following courses are aimed to support these student outcomes. These correspond to a total of 47 credits.

### Language Oral and Written Communication

- INGL xxxx Basic Course in English I and II (6 credits)
- ESPA 3101-02 Basic course in Spanish I & II (6 credits)
- INGL xxxx Second year courses in English (6 credits)

### Humanities and Social Sciences

- Electives in Social Sciences and Humanities (15 credits)

### Electives

- EDFI xxxx Electives in Physical Education (2 credits)
- ELECTIVES – Free Electives (12 credits)

## PROGRAM OF STUDY

### ELECTRICAL ENGINEERING CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits | Course                       |
|------------|---------|------------------------------|
| *MATE 3005 | 5       | Pre-Calculus                 |
| QUIM 3131  | 3       | General Chemistry I          |
| QUIM 3133  | 1       | General Chemistry Lab I      |
| INGE 3011  | 2       | Engineering Graphics I       |
| *ESPA 3101 | 3       | Basic course in Spanish I    |
| *INGL 3--- | 3       | First year course in English |
| EDFI ----  | 1       | Course in Physical Education |
|            |         | 18                           |

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**Second Semester**

| Number     | Credits  | Course                       |
|------------|----------|------------------------------|
| MATE 3031  | 4        | Calculus I                   |
| QUIM 3132  | 3        | General Chemistry II         |
| QUIM 3134  | 1        | General Chemistry Lab II     |
| *ESPA 3102 | 3        | Basic course in Spanish II   |
| *INGL 3--- | 3        | First year course in English |
| EDFI ----  | <u>1</u> | Course in Physical Education |
|            | 15       |                              |

**SECOND YEAR****First Semester**

| Number    | Credits  | Course                              |
|-----------|----------|-------------------------------------|
| MATE 3032 | 4        | Calculus II                         |
| FISI 3171 | 4        | Physics I                           |
| FISI 3173 | 1        | Physics Laboratory I                |
| INGE 3016 | 3        | Algorithms and Computer Programming |
| INGL 3--- | 3        | Second year course in English       |
| INGE 3035 | <u>3</u> | Engineering Mechanics               |
|           | 18       |                                     |

**Second Semester**

| Number     | Credits  | Course                                |
|------------|----------|---------------------------------------|
| MATE 3063  | 3        | Calculus III                          |
| FISI 3172  | 4        | Physics II                            |
| FISI 3174  | 1        | Physics Laboratory II                 |
| INGE 3045  | 3        | Materials Science for Electrical Eng. |
| INEL 3105  | 3        | Electrical Systems Analysis I         |
| ^INGL 3--- | <u>3</u> | Second year course in English         |
|            | 17       |                                       |

**THIRD YEAR****First Semester**

| Number    | Credits  | Course                             |
|-----------|----------|------------------------------------|
| MATE 4009 | 3        | Ordinary Differential Equations    |
| INEL 4102 | 3        | Electrical Systems Analysis II     |
| INEL 4201 | 3        | Electronics I                      |
| INEL 4205 | 3        | Logic Circuits                     |
| INEL 4115 | 1        | Electrical Measurements Laboratory |
| INEL 4151 | <u>3</u> | Electromagnetics I                 |
|           | 16       |                                    |

**Second Semester**

| Number    | Credits | Course                                   |
|-----------|---------|--|
| ININ 4010 | 3       | Probability and Statistics for Engineers |
| INEL 4103 | 3       | Electrical Systems Analysis III          |

|           |          |   |
|-----------|----------|---|
| INEL 4095 | 3        | Signals and Systems                       |
| INEL 4211 | 1        | Electronics Laboratory I                  |
| INEL 4--- | 3        | **Electrical Engineering Breadth Elective |
| INEL 4206 | <u>3</u> | Microprocessors and Embedded Systems      |
|           | 16       |   |

**FOURTH YEAR****First Semester**

| Number    | Credits  | Course                                    |
|-----------|----------|---|
| ININ 4015 | 3        | Engineering Economic Analysis             |
| INEL 4--- | 3        | **Electrical Engineering Breadth Elective |
| INEL 4--- | 3        | **Electrical Engineering Breadth Elective |
| INEL 4505 | 3        | Introduction to Control Systems           |
| INEL 4--- | 1        | **Electrical Engineering Breadth Elective |
| ELECTIVE  | <u>3</u> | Free Elective                             |
|           | 16       |   |

**Second Semester**

| Number            | Credits  | Course                                   |
|-------------------|----------|--|
| INME 4045         | 3        | General Thermodynamics for Engineers     |
| MATE or INGE 4XXX | 3***     | Elective in Mathematics                  |
| INEL 4406         | 1        | Electric Machines Laboratory             |
| INEL ----         | 6        | **Electrical Engineering Depth Electives |
| ELECTIVE          | <u>3</u> | ***Sociohumanistic Elective              |
|                   | 16       |  |

**FIFTH YEAR****First Semester**

| Number    | Credits  | Course                                   |
|-----------|----------|--|
| INEL ---- | 6        | **Electrical Engineering Depth Electives |
| ELECTIVES | 6***     | Sociohumanistic Electives                |
| ELECTIVES | <u>3</u> | Free Elective                            |
|           | 15       |  |

**Second Semester**

| Number    | Credits  | Course                                   |
|-----------|----------|--|
| INEL ---- | 3        | **Electrical Engineering Depth Electives |
| INEL 5195 | 3        | Design Project in Electrical Engineering |
| ELECTIVES | 6***     | Sociohumanistic Electives                |
| ELECTIVES | <u>6</u> | Free Electives                           |
|           | 18       |  |

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### Total credits required for this program: 165

- \* Refer to the Academic Regulations section for information on Advanced Placement.
- \*\* Requirements for the BSEE degree include twenty-five (25) credit hours of TECHNICAL ELECTIVES. Course selection will be made by the student with the advisor's approval and will include 10 credits in Breadth Electives and 15 credits in Depth Electives. Students are responsible for visiting their academic advisors in order to define and select the Breadth and Depth electives. In terms of the Depth Electives, each student is required to accomplish the requisites for at least, one (1) of the areas of emphasis: There are five (5) possible areas of emphasis for the BSEE degree: Applied Electromagnetics, Control Systems, Communications and Signal Processing, Electronics, and Power Engineering Systems.
- \*\*\* Fifteen (15) credit hours of Sociohumanistic electives to be selected from the official list approved by the Engineering Faculty.
- \*\*\*\* Elective in Mathematics to be chosen from:  
Numerical Analysis (MATE 4061) or (INGE 4035)  
Numerical Methods Applied to the engineering, Linear Algebra (MATE 4031) or Complex Variables (MATE 4010).
- ^ Only for students who are in the Basic Sequence (INGL 3101 + INGL 3102); choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## Bachelor of Science in Computer Engineering

The Bachelor of Science Program in Computer Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

### Program Educational Objectives

Graduates from the Computer Engineering program will:

1. Contribute to the educational, cultural, social, technological and economic development of their societies by applying, ethically, their knowledge and skills.
2. Demonstrate professional competence, leadership, and entrepreneurial spirit to excel in their chosen profession or to create their own businesses.
3. Take advantage of the multicultural background and bilingual education to effectively participate and contribute in global markets.

4. Pursue advanced studies, be involved in professional societies, and succeed in a constantly changing field.

### Student Outcomes

Graduates from our programs should demonstrate the following outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Computer Engineering integrates computer sciences and electronics principles to analyze and design computer systems. The Computer Engineering program encompasses all aspects of design, theory and practice related to systems of digital and analog computation and information processing; components and circuits for computing systems; relevant portions of supporting disciplines; applications, use, and programming of computing devices and information processing systems; and the use of computers in electrical and electronic engineering."

The curriculum for the computer engineering program provides a general education in mathematics, science, and humanities; computer sciences; electronics, including practical and theoretical aspects of hardware; and specialized study in the selected areas

of computer engineering, including information systems, human-computer interaction, object technologies, computer networking, embedded systems, advanced electronics, and very-large-scale integration.

## General Education Component

The general education component in the Computer Engineering program is designed to support the development of a professional that is aware not only of the technical professional needs, but also the general needs of society. In addition to achieve expertise in the discipline, the computer engineering professional needs to communicate adequately, understand the importance of cultural, ethical, and social issues, and value the need to constantly upgrade knowledge.

The institutional student learning outcomes for the general education component in both programs are:

1. Become an intentional learner.
2. Demonstrate creative and critical thinking.
3. Communicate effectively.
4. Identify and solve problems; transform knowledge into action.
5. Apply mathematical, scientific and technology skills.
6. Apply interpretative and integrative skills.
7. Relate global contexts and issues of importance to Puerto Rico.
8. Show moral autonomy and develop a sense of well-being.
9. Practice civic virtue.
10. Value diversity.

The following courses are aimed to support these student outcomes. These correspond to a total of 47 credits.

### Language Oral and Written Communication

- INGL xxxx Basic Course in English I and II (6 credits)
- ESPA 3101-02 Basic course in Spanish I & II (6 credits)
- INGL xxxx Second year courses in English (6 credits)

### Humanities and Social Sciences

- Electives in Social Sciences and Humanities (15 credits)

### Electives

- EDFI xxxx Electives in Physical Education (2 credits)
- ELECTIVES – Free Electives (12 credits)

## PROGRAM OF STUDY

### COMPUTER ENGINEERING CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits  | Course                       |
|------------|----------|------------------------------|
| *MATE 3005 | 5        | Pre-Calculus                 |
| QUIM 3131  | 3        | General Chemistry I          |
| QUIM 3133  | 1        | General Chemistry Lab I      |
| INGE 3011  | 2        | Engineering Graphics I       |
| *ESPA 3101 | 3        | Basic course in Spanish I    |
| *INGL 3--- | 3        | First year course in English |
| EDFI ----  | <u>1</u> | Course in Physical Education |
|            | 18       |                              |

##### Second Semester

| Number     | Credits  | Course                       |
|------------|----------|------------------------------|
| MATE 3031  | 4        | Calculus I                   |
| QUIM 3132  | 3        | General Chemistry II         |
| QUIM 3134  | 1        | General Chemistry Lab II     |
| *INGL 3--- | 3        | First year course in English |
| *ESPA 3102 | 3        | Basic course in Spanish II   |
| ELECTIVE   | 3        | **Sociohumanistic Elective   |
| EDFI ----  | <u>1</u> | Physical Education Elective  |
|            | 18       |                              |

#### SECOND YEAR

##### First Semester

| Number    | Credits  | Course                              |
|-----------|----------|-------------------------------------|
| MATE 3032 | 4        | Calculus II                         |
| FISI 3171 | 4        | Physics I                           |
| FISI 3173 | 1        | Physics Laboratory I                |
| INGE 3016 | 3        | Algorithms and Computer Programming |
| ICOM 4075 | 3        | Foundations of Computing            |
| INGL 3--- | <u>3</u> | Second year course in English       |
|           | 18       |                                     |

##### Second Semester

| Number    | Credits | Course       |
|-----------|---------|--------------|
| MATE 3063 | 3       | Calculus III |
| FISI 3172 | 4       | Physics II   |

|            |          |  |
|------------|----------|--|
| FISI 3174  | 1        | Physics Laboratory II                        |
| INGE 3045  | 3        | Materials Science for Electrical Engineering |
| ^INGL 3--- | 3        | Second year course in English                |
| INEL 3105  | <u>3</u> | Electrical System Analysis I                 |
|            | 17       |  |

### THIRD YEAR

#### First Semester

| Number    | Credits  | Course                             |
|-----------|----------|------------------------------------|
| ICOM 4015 | 3        | Advanced Programming               |
| INEL 4102 | 3        | Electrical Systems Analysis II     |
| INEL 4115 | 1        | Electrical Measurements Laboratory |
| INEL 4201 | 3        | Electronics I                      |
| INEL 4205 | 3        | Logic Circuits                     |
| MATE 4009 | <u>3</u> | Ordinary Differential Equations    |
|           | 16       |                                    |

#### Second Semester

| Number    | Credits  | Course                                   |
|-----------|----------|--|
| ICOM 4035 | 4        | Data Structures                          |
| INEL 4206 | 3        | Microprocessors and Embedded Systems     |
| INEL 4207 | 3        | Digital Electronics                      |
| INEL 4211 | 1        | Electronics Laboratory I                 |
| ININ 4010 | 3        | Probability and Statistics for Engineers |
| INGE 3035 | <u>3</u> | Engineering Mechanics                    |
|           | 17       |  |

### FOURTH YEAR

#### First Semester

| Number    | Credits  | Course  |
|-----------|----------|---|
| ICOM 4215 | 3        | Computer Architecture and Organization              |
| INEL 4225 | 1        | Digital Electronics Laboratory                      |
| INEL 4301 | 3        | Communications Theory I                             |
| ICOM/INEL | 3****    | Computer or Electrical Engineering Breadth Elective |
| INME 4045 | 3        | General Thermodynamics for Engineers                |
| ELECTIVE  | <u>3</u> | **Sociohumanistic Elective                          |
|           | 16       |   |

#### Second Semester

| Number    | Credits  | Course  |
|-----------|----------|---|
| ININ 4015 | 3        | Engineering Economic Analysis                       |
| ICOM 5007 | 4        | Operating Systems Programming                       |
| ICOM/INEL | 6****    | Computer or Electrical Engineering Breadth Elective |
| ELECTIVE  | <u>3</u> | **Sociohumanistic Elective                          |
|           | 16       |   |

### FIFTH YEAR

#### First Semester

| Number    | Credits  | Course  |
|-----------|----------|---|
| ICOM 5047 | 3        | Computer Engineering Design                         |
| ICOM/INEL | 6****    | Computer or Electrical Engineering Breadth Elective |
| ELECTIVE  | 3        | **Sociohumanistic Electives                         |
| ELECTIVE  | <u>3</u> | Elective  |
|           | 15       |   |

#### Second Semester

| Number    | Credits  | Course                     |
|-----------|----------|----------------------------|
| MATE/INGE | 3        | ***Elective in Mathematics |
| 4XXX      |          |                            |
| ELECTIVE  | 3        | **Sociohumanistic Elective |
| ELECTIVES | <u>9</u> | Electives                  |
|           | 15       |                            |

### Total number of credits in the program: 166

- \* Refer to the Academic Regulations section for information on Advanced Placement.
- \*\* Fifteen (15) credit hours of Sociohumanistic electives to be selected from the official list approved by the Engineering Faculty.
- \*\*\* Elective in Mathematics to be selected between the following courses: MATE 4061, INGE 4035, MATE 4031 or MATE 4010.
- \*\*\*\* Requirements for the BScPE degree include fifteen (15) credit hours of TECHNICAL ELECTIVES. Each student is required to accomplish the requisites for at least, one (1) of the three (3) areas of emphasis within the TECHNICAL ELECTIVES. There are three (3) possible areas of emphasis for the BScPE degree which are: Communications and Signal Processing, Computing Systems, and Hardware and Embedded Systems.
- ^ Only for students who are in the Basic Sequence (INGL 3101 + INGL 3102); choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

### DEPARTMENTAL FACULTY

**FABIO ANDRADE**, *Assistant Professor*, Ph.D., 2013, “Universidad Politécnica de Cataluña”

**ERICK E. APONTE-BEZARES**, *Associate Professor*, Ph.D., 2005, Rensselaer Polytechnic Institute.

**JAIME ARBONA-FAZZI**, *Professor*, Ph.D., 1972, University of Arkansas.

**EMMANUEL ARZUAGA**, *Assistant Professor*, Ph.D., 2012, Northeastern University.

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**GERSON BEAUCHAMP**, *Professor*, Ph.D., 1990, Georgia Institute of Technology.

**MARCEL CASTRO-SITIRICHE**, *Assistant Professor*, Ph.D., 2007, Howard University.

**JOSÉ R. CEDEÑO-MALDONADO**, *Professor*, Ph.D., 2002, The Ohio State University.

**JOSÉ COLOM-USTARIZ**, *Professor*, Ph.D., 1998, Pennsylvania State University.

**ISIDORO COUVERTIER-REYES**, *Professor*, Ph.D. 1996, Louisiana State University.

**SANDRA CRUZ-POL**, *Professor*, Ph.D., 1998, Pennsylvania State University.

**GLADYS O. DUCOUDRAY**, *Professor*, Ph.D., 2003, New Mexico State University.

**SHAWN HUNT**, *Professor*, Ph.D., 1992, Michigan State University.

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**AGUSTÍN A. IRIZARRY-RIVERA**, *Professor*, Ph.D., 1996, Iowa State University.

**LEYDA V. LEÓN-COLÓN**, *Associate Professor*, Ph.D., 2010, Colorado State University.

**MANUEL JIMÉNEZ-CEDEÑO**, *Professor*, Ph.D., 1999, Michigan State University.

**LUIS O. JIMÉNEZ-RODRÍGUEZ**, *Professor*, Ph.D., 1996, Purdue University.

**EDUARDO J. JUAN-GARCÍA**, *Professor*, Ph.D., 2001, Purdue University.

**VIDYA MANIAN**, *Associate Professor*, Ph.D., 2004, University of Puerto Rico – Mayagüez

**EFRAÍN O'NEIL-CARRILLO**, *Professor*, Ph.D., 1999, Arizona State University.

**LIONEL R. ORAMA-EXCLUSA**, *Professor*, Ph.D., 1997, Rensselaer Polytechnic Institute.

**EDUARDO ORTIZ-RIVERA**, *Professor*, Ph.D., 2006, Michigan State University.

**ROGELIO PALOMERA**, *Professor*, Docteur des Science, 1979, Swiss Federal Institute of Technology.

**HAMED PARSIANI**, *Professor*, Ph.D., 1979, Texas A&M University.

**ALBERTO RAMÍREZ**, *Professor*, Ph.D., 2002, University of Texas at Arlington.

**JOSÉ A. RIVERA-CARTAGENA**, *Professor*, Ph.D., 1992, The City University of New York.

**DOMINGO A. RODRÍGUEZ-RODRÍGUEZ**, *Professor*, Ph.D., 1988, City University of New York.

**RAFAEL RODRÍGUEZ-SOLÍS**, *Professor*, Ph.D., 1997, Pennsylvania State University.

**JOSÉ ROSADO-ROMÁN**, *Associate Professor*, Ph.D. 1999, Cornell University.

**NAYDA G. SANTIAGO-SANTIAGO**, *Associate Professor*, Ph.D., 2003, Michigan State University.

**GUILLERMO J. SERRANO-RIVERA**, *Professor*, Ph.D., 2007, Georgia Institute of Technology.

**MANUEL TOLEDO**, *Associate Professor*, Ph.D. 1995, Boston University.

**RAÚL TORRES-MUÑIZ**, *Professor*, Ph.D., 1998, University of Virginia.

**RAMÓN E. VÁSQUEZ-ESPINOSA**, *Professor*, Ph.D., 1984, Louisiana State University.

**JOSÉ FERNANDO VEGA-RIVEROS**, *Professor*, Ph.D. 1989, Syracuse University

## COURSES OF INSTRUCTION

### ELECTRICAL ENGINEERING

**INEL 3105. ELECTRICAL SYSTEMS ANALYSIS I.** Three credit hours. Three hours of lecture per week. Prerequisite: (MATE 3032 or MATE 3184) and INGE 3016. Corequisites: (FISI 3172 or FISI 3162) and (MATE 3063 or MATE 3185).

Analysis of direct current and alternating current linear electric circuits; laws and concepts that characterize their behavior.

**INEL 3115. INTRODUCTION TO ELECTRICAL ENGINEERING.** Two credit hours. One hour of conference and one two-hour laboratory per week. Prerequisite: First year student of Electrical Engineering program.

Basic concepts and applications in the live areas of specialization in electrical engineering: control systems, communications, electronics, power and applied electromagnetic. Exposure to basic tools in preparation

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for electrical engineering courses. Experiments in the five areas of specialization with design experiences.

**INEL 4021. COMMUNICATION SYSTEM THEORY I.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4095 and ININ 4010.

Elements of Signal Transmission theory; random signals and noise; introduction to modulation theory.

**INEL 4048. ELECTRICAL ENGINEERING PRACTICE.** Three credit hours. Thirty five hours per week for seven (7) or more weeks during the Summer or its equivalent during the semester. Prerequisite: authorization of the Director of the Department.

A course organized in cooperation with private industry or government to provide the student with practical experience in electrical engineering. The work performed by the student will be jointly supervised by the Academic Department and an appropriate official from the cooperating organization. An oral and written report will be required from the student upon completion of the project.

**INEL 4075. FUNDAMENTALS OF ELECTRICAL ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisites: (MATE 3063 or MATE 3185) and (FISI 3172 or FISI 3162). (Not for electrical or computer engineering students).

Laws and fundamental concepts that govern the behavior of electric and magnetic circuits; ideal models of resistors, voltage and current sources, capacitors and inductors; three-phase circuits and transformers.

**INEL 4076. FUNDAMENTALS OF ELECTRONICS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4075.

Fundamentals and applications of analog and digital electronics.

**INEL 4077. BASIC ELECTRONICS LABORATORY.** One credit hour. One three-hour laboratory per week. Corequisite: INEL 4076.

Description and use of basic equipment for electrical measurements in digital and analog circuits.

**INEL 4085. FUNDAMENTALS OF TRANSFORMERS AND ELECTRIC MACHINERY.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4075.

Electromechanical energy converters such as transformers; induction, synchronous and direct current machines; distribution systems where these converters are used.

**INEL 4086. TRANSFORMERS AND ELECTRIC MACHINERY LABORATORY.** One credit hour. One three-hour laboratory per week. Corequisite: INEL 4085. (Not for electrical or computer engineering students).

Voltage, current electrical and mechanical power measurements and other parameters related to the operation of single phase, three phase, and direct current equipment.

**INEL 4095. SIGNALS AND SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: INEL 4102 and MATE 4009.

Introduction to the mathematical representation of analog and discrete signals and systems. Study of Fourier series, the Fourier transform, and the Z transform applied to analog and discrete signals. Sampling of analog signals. Analysis of signals and frequency response of linear systems. Characterization of linear time-invariant systems of analog and discrete signals.

**INEL 4102. ELECTRICAL SYSTEMS ANALYSIS II.** Three credit hours. Three hours of lecture per week. Prerequisites: INEL 3105 and (FISI 3172 or FISI 3162) and INGE 3016. Corequisite: MATE 4009.

Network functions; circuit analysis by LAPLACE transforms and Fourier Series; two-port networks; Butterworth and Chebyshev filters; computer-aided analysis of these systems.

**INEL 4103. ELECTRICAL SYSTEMS ANALYSIS III.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 4009, INEL 4102 and INEL 4151.

Analysis of magnetic circuits and polyphase balanced systems; transformers; power transmission lines; computer-aided analysis of these systems.

**INEL 4115. ELECTRICAL MEASUREMENTS LABORATORY.** One credit hour. One two-hour laboratory per week. Corequisite: INEL 3105.

Experiments with electronic components and equipment; measurement techniques.

**INEL 4146. IONOSPHERIC RADIO WAVES PROPAGATION.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4152.

Introduction to magnetoionic theory of ionospheric radio wave propagation; physics of the ionosphere; the dispersion equation in the ionosphere; ray theory; nonlinear processes and discussion of some ionospheric experiments.

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**INEL 4151. ELECTROMAGNETICS I.** Three credit hours. Three hours of lecture per week. Prerequisites: (MATE 3063 or MATE 3185) and (FISI 3172 or FISI 3162). Corequisite: MATE 4009.

Static and time-varying electric and magnetic fields; dielectric, magnetic and conducting materials; capacitance, inductance and conductivity; magnetic circuits; dielectric and magnetic hysteresis; Maxwell's equations; wave equation.

**INEL 4152. ELECTROMAGNETICS II.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 4009 and INEL 4151.

Maxwell equations and the wave equation; plane electromagnetic waves in dielectric and conducting media; energy flow and the Poynting vector; wave polarization, reflection, refraction and diffraction. Guided waves; transmission lines; conductive and dielectric wave guides; Smith chart; impedance matching, cavity resonators; single antenna.

**INEL 4155. APPLIED ENGINEERING ELECTROMAGNETICS.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 4009 and INEL 4151.

Introduction to wave polarization, wave reflection and transmission at oblique incidence. Analysis of transmission lines, impedance matching and smith chart. Explanation of microstrip lines and two port network s-parameters. Analysis of waveguides, antennas and radar systems.

**INEL 4156. APPLIED ELECTROMAGNETICS LABORATORIES.** One credit hour. One two hour of laboratory per week. Corequisites: INEL 4152 or INEL 4155.

Demonstration of fundamental concepts in applied electromagnetic.

**INEL 4201. ELECTRONICS I.** Three credit hours. Three hours of lecture per week. Prerequisites: INEL 3105 and (FISI 3172 or FISI 3162).

Semiconductor device characteristics: semiconductor diodes, bipolar junction transistors and field effect transistors; analysis of basic digital circuits; analysis and design considerations of transistor amplifiers; introduction to integrated circuits.

**INEL 4202. ELECTRONICS II.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4201 and INEL 4102.

Analysis and design of multi-stage amplifiers, wave generation and power circuits; operational amplifier characteristics and applications.

**INEL 4205. LOGIC CIRCUITS.** Three credit hours. Three hours of lecture per week. Prerequisite: INGE 3016.

Boolean algebra, its theorems and postulates. Design of combinational circuits; minimization and reduction techniques, use of medium or large scale integration (MSI/LSI) in digital circuit design; analysis and design of sequential circuits; practical design considerations.

**INEL 4206. MICROPROCESSORS AND EMBEDDED SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: INEL 4205 and INEL 4201.

Architecture, organization and operation of embedded systems and their supporting devices: design of microprocessor/microcontroller-based systems.

**INEL 4207. DIGITAL ELECTRONICS.** Three credit hours. Three hours of lecture per week. Prerequisites: INEL 4201 and INEL 4205.

Theory of operation of transistor-transistor logic (TTL) and metal-oxide-semiconductor (MOS) gates; operation of semiconductor memories; programmable logic arrays (PLA); operational amplifiers; multivibrators; analog gates; analog to digital (A/D) and digital to analog (D/A) converters.

**INEL 4211. ELECTRONICS LABORATORY I.** One credit hour. One three-hour laboratory per week. Prerequisites: INEL 4115. Corequisite: INEL 4201.

Experiments with basic amplifiers and digital circuits. Design and testing of simple electronic circuits.

**INEL 4212. ELECTRONICS LABORATORY II.** One credit hour. One three-hour laboratory per week. Prerequisites: INEL 4211. Corequisite: INEL 4202.

Experiments and projects with electronic circuits emphasizing their design.

**INEL 4218. INTEGRATED CIRCUIT ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4201 and INGE 3045 and INEL 4205.

Basic concepts of integrated circuits with emphasis on very large scale integration (VLSI). Description of the steps associated with the design, modeling, simulation, and fabrication of silicon integrated circuitry pertaining to metal-oxide-semiconductor (MOS) and bipolar technologies.



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**INEL 4225. DIGITAL ELECTRONICS**

LABORATORY. One credit hour. One three-hour laboratory per week. Co-requisite: INEL 4207.

Experiments with digital electronics and analog circuits.

**INEL 4301. COMMUNICATIONS THEORY I.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4102 and ININ 4010.

Components and communications systems; Fourier transform analysis of filtered signals; NYQUIST theorem; analog to digital and digital to analog conversion processes; bandwidth; modulation and noise. Computer-aided analysis.

**INEL 4307. COMMUNICATION BETWEEN COMPUTERS.** Three credit hours. Three hours of lecture per week. Prerequisites: (INEL 4095 or INEL 4301) and INEL 4206 and (ININ 4010 or ININ 4011).

Computer network organization. Characteristics of voice grade channels used for digital communication. Synchronization and Multiplexing. Information codes and interfacing standards and protocols. Data encryption techniques. Distributed computing and local area networks.

**INEL/ICOM 4308. NETWORKING AND ROUTING FUNDAMENTALS.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3063 or authorization of the Director of the Department.

Study of the terminology of computer networks and their protocols, IP protocol addressing, and networking standards. Introduction to network design. Discussion and configuration of several routing protocols.

**INEL 4405. ELECTRIC MACHINES.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4103.

Electromechanical energy conversion; induction, synchronous and direct current machines.

**INEL 4406. ELECTRIC MACHINES LABORATORY.** One credit hour. One three-hours of laboratory per week. Prerequisites: INEL 4115 and INEL 4103.

Magnetic circuits; single phase transformers; three phase systems: load and transformers; single-phase and three-phase induction motors.

**INEL 4407. ELECTRICAL SYSTEMS DESIGN I.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4103 or INEL 4075.

Design of electrical systems for buildings; wiring systems, illumination, protection and grounding.

**INEL 4408. ELECTRICAL SYSTEMS DESIGN II.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4407.

Design of electrical systems for buildings: exterior illumination, signal systems, and emergency/ standby power equipment.

**INEL 4409. ILLUMINATION ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4103 or INEL 4075.

Interior and exterior illumination design. Development and application of methods on illumination techniques.

**INEL 4415. POWER SYSTEM ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4103. Corequisite: INEL 4405.

Formulation of bus admittance and bus impedance matrices; symmetrical components; symmetrical and unsymmetrical faults; load flow; economic operation of power systems.

**INEL 4416. POWER ELECTRONICS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4201 and INEL 4103.

Design of circuits for rectification, inversion, frequency conversion, direct current (D.C.) and alternating current (A.C.) machines control, and other non-motor applications using solid state power devices.

**INEL 4417. ALTERNATIVE POWER GENERATION.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4416. Co-requisite: INEL 4505.

Design of alternative power generation systems. Study of energy conservation and reuse, passive conservation, combined cycles, and cogeneration.

**INEL 4418. POWER ELECTRONICS LABORATORY.** One credit hour. One three hours of laboratory per week.

Design, control and practical experience in power electronics.

**INEL 4505. INTRODUCTION TO CONTROL SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4102 and MATE 4009.

Analysis of control systems and their mathematical models; analysis and design of control systems for single-input single-output plants; computer solution of problems will be emphasized.

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**INEL 4995. ELECTRICAL ENGINEERING PRACTICE FOR CO-OP STUDENTS.** Zero to nine credit hours. Prerequisite: authorization of the Director of the Department.

Practical experience in electrical engineering in cooperation with private industry or government to be jointly supervised by the academic department, the Co-op Program Coordinator, and an official from the cooperating organization. A written report will be required upon completion of each period of work.

**INEL 4998. UNDERGRADUATE RESEARCH.** One to six credit hours. Three to twenty-four hours of laboratory per week. Pre-requisite: fourth or fifth year student and authorization of the Director of the Department.

Participation, under the supervision of a faculty member acting as an investigator, in a research project.

### **Advanced Undergraduate and Graduate Courses**

**INEL 5046. PATTERN RECOGNITION.** Three credit hours. Three hours of lecture per week. Prerequisites: (INEL 4095 or INEL 4301) and (ININ 4010 or ININ 4011) or authorization of the Director of the Department.

Introduction to the field of pattern recognition, including statistical decision making, nonparametric decision making, nonparametric decision making, clustering techniques, artificial neural networks, learning techniques, evaluation of classification rules, and image analysis.

**INEL 5195. DESIGN PROJECT IN ELECTRICAL ENGINEERING.** Three credit hours. One hour of lecture and four hours of laboratory per week. Prerequisite: authorization of the Director of the Department.

Capstone design course in which students apply the fundamental knowledge in electrical engineering to solve engineering problems considering engineering standards and realistic design constraints.

**INEL 5205. INSTRUMENTATION.** Three credit hours. Three hours of lecture per week. Prerequisites: (INEL 4201 and INEL 4206) or authorization of the Director of the Department.

Signals from transducers; signal conditioning, data conversion and transmission; effects of noise. Data storage and display; use of microprocessors in instrumentation.

**INEL 5206. DIGITAL SYSTEMS DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4207 or authorization of the Director of the Department.

Design methods in combinational and sequential systems. Use of programmable logic devices in digital systems design. Analysis and design of system controllers.

**INEL 5207. ANALOG SYSTEMS DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisite: (INEL 4201 and INEL 4205) or authorization of the Director of the Department.

This course covers the design of applications using analog integrated circuits. A discussion on the characteristics of operational amplifiers is followed with a detailed overview of applications.

**INEL 5208. PRINCIPLES OF BIOMEDICAL INSTRUMENTS.** Four credit hours. Three hours of lecture and two hours of laboratory per week. Prerequisite: INEL 4202 or authorization of the Director of the Department.

Theoretical and practical aspects of the methods used to measure physiological events with emphasis in the cardiovascular, pulmonary, and nervous systems.

**INEL 5209. INTRODUCTION TO SOLID STATE ELECTRONICS.** Three credit hours. Three hours of conference per week. Prerequisite: authorization of the Director of the Department.

Basic operation principles of solid state electronic devices, physical phenomena and properties of solid materials involved in the analysis and design of such devices, detailed treatment of the most common elements used as diodes, transistor and controlled rectifiers.

**INEL 5218. INTRODUCTION TO MIXED-SIGNAL TESTING.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4201 or authorization of the Director of the Department.

Description and analysis of tester hardware, sampling theory for Digital Signal Processing (DSP), analog channels and sample channel testing, including testing for mixed signal circuits focused on A/D and D/A converters, focused calibration and test economics.

**INEL 5265. ANALOG INTEGRATED CIRCUIT DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisites: INEL 4201 or authorization of the Director of the Department.

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Analysis and design of analog and mixed-technology (analog-digital) circuits through the use of advanced computer-assisted design (CAD) techniques. Discussion of functional tests of analog integrated circuits.

**INEL 5295. DESIGN PROJECT IN ELECTRONIC SYSTEMS AND EMBEDDED HARDWARE.** Three credit hours. One hour of lecture and one three-hour laboratory per week. Prerequisite: authorization of the Director of the Department.

Capstone design course in which students apply the fundamentals of electronic systems and embedded hardware to solve electrical engineering problems considering engineering standards and realistic design constraints.

**INEL 5307. OPTICAL COMMUNICATIONS.** Three credit hours. Three hours of lecture per week. Prerequisites: INEL 4301 or authorization of the Director of the Department.

Optical communication principles; transmitter and receiver design; fiber optic channels.

**INEL 5309. DIGITAL SIGNAL PROCESSING.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4095 or authorization of the Director of the Department.

Signal classification, Z-Transform and discrete Fourier transform; matrix representation of digital filters and digital systems; digital filter design; discrete Fourier transform algorithms.

**INEL 5315. THEORY OF COMMUNICATIONS II.** Three credit hours. Three hours of lecture per week. Prerequisite: (INEL 4301 and (ININ 4011 or ININ 4010)) or authorization of the Director of the Department.

Information theory; coding theory; signal design; noise and probability of error.

**INEL/ICOM/SICI/COMP 5318. INTERMEDIATE ROUTING, SWITCHING AND WIDE AREA NETWORKS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL/ICOM/SICI/COMP 4308 or authorization of the Director of the Department.

Study and configuration of link state protocols. Study of intermediate level concepts such as switching, wide area network or WAN standards, virtual local area networks or VLAN, network design, and redundancy. Presentation and study of strategies for managing and saving address space such as variable length subnet masks and network address translation.

**INEL 5326. COMMUNICATION SYSTEM DESIGN: SIGNAL PROCESSING.** Three credit hours. One hour

of lecture and two two-hour laboratories per week. Prerequisite: INEL 5309 or authorization of the Director of the Department.

Block diagram design and simulation of communication systems. Design projects including: specification, evaluation and selection of alternatives, and implementation. Computer and laboratory work and written reports required.

**INEL 5327. IMAGE PROCESSING.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4095 or INEL 5309 or ICOM 4045 or authorization of the Director of the Department.

Mathematical representation of two dimensional digital signals. Two-dimensional filter design, image coding, image filtering, enhancement, and compression.

**INEL 5406. DESIGN OF TRANSMISSION AND DISTRIBUTION SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4415 or authorization of the Director of the Department.

Generation, transmission, and distribution of electric power. Reliability consumer services; overhead and underground lines.

**INEL 5407. COMPUTER AIDED POWER SYSTEM DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4415 or authorization of the Director of the Department.

Design of power systems using digital computers; load flow, economic load dispatch, symmetrical and unsymmetrical faults. Selection of breakers.

**INEL 5408. ELECTRICAL MOTORS CONTROL.** Three credit hours. Three hours of lecture per week. Prerequisites: (INEL 4405 and INEL 4416 and INEL 4505) or authorization of the Director of the Department.

Characteristics and selection criteria of alternating current (A.C.) and direct current (D.C.) motors; design and control of solid state drive systems; breaking methods; heating and duty cycle calculations. Performance calculations and design of closed loop controllers.

**INEL 5415. PROTECTION DESIGN FOR ELECTRICAL SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4415 or authorization of the Director of the Department.

Design and selection of protective devices used in electrical generation, transmission, and distribution systems such as: relays, fuses, breakers, reclosers, and arresters. Selection of other system components such as

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sectionalizers and throwovers. Protection and insulation coordination.

**INEL 5417. POWER ELECTRONICS APPLIED TO RENEWABLE ENERGY SYSTEM.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4416 or authorization of the Director of the Department.

Design of interfaces using topologies based on power electronics for photovoltaic and wind applications. Use of algorithms for maximum power point tracking; control of photovoltaic and wind systems, and its applications.

**INEL 5495. DESIGN PROJECT IN POWER SYSTEMS.** Three credit hours. One hour of lecture and one-four hour laboratory per week. Prerequisite: Authorization of the Director of the Department.

Major design experience in electric power systems. Application of power system fundamental to the design of a system incorporating engineering standards and realistic constraints. Use of computational tools for the design and analysis of electric power systems.

**INEL 5496. DESIGN PROJECTS IN POWER ELECTRONICS.** Three credit hours. One hour of lecture and one-four hour laboratory per week. Prerequisites: INEL 4416 or authorization of the Director of the Department.

Application of power electronics fundamentals to the design of a system incorporating engineering standards and realistic constraints. Use of the computational tools for the design and analysis of power electronics systems.

**INEL 5505. LINEAR SYSTEM ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4505 or authorization of the Director of the Department.

Linear spaces and matrices; state variables representations for linear continuous and discrete systems; the Z-transform and its application; controllability and observability; state estimators; stability.

**INEL 5506. PROCESS INSTRUMENTATION AND CONTROL ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: (INEL 4505 and INEL 4206) or authorization of the Director of the Department.

Design of process instrumentation and control systems, based on analog and digital instruments and mini or microcomputers. Standards and practical considerations emphasized.

**INEL 5508. DIGITAL CONTROL SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: INEL 4505 or authorization of the Director of the Department.

Analysis and design of digital control systems; stability, controllability and observability of discrete systems. Practical considerations when implementing a digital control system.

**INEL 5516. AUTOMATION AND ROBOTICS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4206 or ININ 4057 or authorization of the Director of the Department.

Analysis and design of automated pneumatic systems using programmable controllers. Programming of industrial robots.

**INEL 5595. DESIGN PROJECT IN CONTROL SYSTEMS.** Three credit hours. One hour of lecture and one three-hour laboratory per week. Prerequisite: authorization of the Director of the Department.

Capstone design course in which students apply the fundamentals of control systems to solve engineering problems considering engineering standards and realistic design constraints.

**INEL 5605. ANTENNA THEORY AND DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisites: ((INEL 4155 or INEL 4152) and (INEL 4095 or INEL 4301)) or authorization of the Director of the Department.

Radiation mechanism. Types of antennas; impedance; radiation patterns; antenna arrays. Antenna measurements.

**INEL 5606. MICROWAVE ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisites: ((INEL 4155 or INEL 4152) and (INEL 4095 or INEL 4301)) or authorization of the Director of the Department.

Rectangular and circular waveguides; passive components, tubes, and solid-state devices components, tubes, and solid-state devices used in microwave systems.

**INEL 5608. RADIO FREQUENCIES (RF) SPECTRUM MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4151 or authorization of the Director of the Department.

Analysis of the most relevant issues related to the RF spectrum management, including regulations at national and international levels, the geophysical fundamentals of wave propagation, the power budget equation,

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engineering aspects about antennas and active and passive sensors, introduction to the services that use the spectrum (satellite communications, radio astronomy, Earth exploration) and the agencies that regulate them.

**INEL 5616. WIRELESS COMMUNICATION.** Three credit hours. Three hours of lecture per week. Prerequisites: ((INEL 4155 or INEL 4152) and (INEL 4095 or INEL 4301)) or authorization of the Director of the Department.

Study of cellular radio and personal wireless communications, multiple access techniques for the efficient use of the radio spectrum, and wide-area wireless systems. Description of some wireless systems and their standards. Effects of EM radiation on health. Development of modulation and diversity methods to facilitate signal transmission and to improve quality of reception.

**INEL 5625. COMMUNICATION SYSTEM DESIGN: CIRCUITS AND ANTENNAS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 5306 or INEL 5305 or authorization of the Director of the Department.

Design of communication circuits and antennas. Several design projects including: specification, evaluation and selection of alternatives and implementation. Written reports and computer use required.

**INEL 5629. TELECOMMUNICATIONS ELECTRONICS.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisites: (INEL 4152 and INEL 4301 and INEL 4201) or authorization of the Director of the Department.

Study of the theory of operation of radio frequency (RF) and microwave devices and components. Fundamentals of RF design to understand the operation of the diverse components of telecommunications systems.

**INEL 5995. SPECIAL PROBLEMS.** One to six credit hours. Prerequisite: Authorization of the Director of the Department.

Investigations and special problems in Electrical Engineering or related fields, open to outstanding Electrical Engineering students.

## COMPUTER ENGINEERING

**ICOM/COMP 4009. SOFTWARE ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 4035.

Techniques used during the software development cycle; specification, design, testing, documentation and maintenance. Use of a procedure oriented language in the design and implementation of a software project.

**ICOM 4015. ADVANCED PROGRAMMING.** Three credit hours. Three hours of lecture and one two hour laboratory per week. Prerequisite: INGE 3016.

Advanced programming techniques applied to the solution of engineering problems; extensive use of subprograms, logical and specification statements. Principles of multiprogramming, multiprocessing, and real-time systems.

**ICOM 4017. COMPUTER-BASED INFORMATION SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 4035.

Analysis and design of computer-based management information systems; communication theory and the flow of information within organizations; methods and procedures of gathering, disseminating and controlling information; integrated Electronic Data Processing versus batch-controlled system; the development and installation of information processing systems.

**ICOM 4029. COMPILER CONSTRUCTION.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisite: ICOM 4036.

Techniques involved in the analysis of source languages and the generation of efficient object codes with emphasis on the components of a compiler.

**ICOM 4035. DATA STRUCTURES.** Three credit hours. Three hours of lecture per week and one two hour laboratory per week. Prerequisite: ICOM 4015 and MATE 3031 and ICOM 4075.

Data structures in programming languages, representation of information as data. List in linear, orthogonal, strings and array distribution, collection, and sorting data. Tree structures. Techniques for storage allocation, distribution, collection, and sorting data.

**ICOM 4036. STRUCTURE AND PROPERTIES OF PROGRAMMING LANGUAGES.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 4035.

Comparative study of programming styles, including imperative, object-oriented, functional, logic, and concurrent programming. Concepts of data encapsulation and inheritance. Formal specification of the syntactic structure of a language. Context-free grammars and parse trees.

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**ICOM 4038. ALGORITHM DESIGN AND ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 4035.

Study of asymptotic analysis of mathematical expressions and strategies to derive closed-form solutions of recurrence equations, Intractability, NP-completeness, and their application to estimating the runtime or space requirements of algorithms. Strategies for designing correct and efficient algorithms. Emphasis on the study of algorithms for sorting, searching, string processing, operations on graphs, optimization problems, and numerical processes.

**ICOM 4046. DIGITAL PROCESSING OF SIGNALS.** Three credit hours. Three hours of lecture per week. Prerequisite: (INEL 4301 and INEL 4205).

The Z transform and Discrete-Signals; the Discrete Fourier transform; the Fast Fourier Transform; Digital Filter Design.

**ICOM 4048. PRACTICAL EXPERIENCE IN COMPUTER ENGINEERING.** Three credit hours. Prerequisite: authorization of the Director of the Department.

Practical experience in computer engineering projects in cooperation with an organization to be supervised jointly by a member of the department and an appropriate official from the cooperating organization. Oral and written reports are required.

**ICOM 4066. SOFTWARE PROJECT MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 4009.

Discussion of techniques and tools for estimation, planning, monitoring, documentation, evaluation, refinement, and quality control of software. Development of skills for the effective administration of complex software engineering projects. Practice in project administration.

**ICOM 4075. FOUNDATIONS OF COMPUTING.** Three credit hours. Three hours of lecture per week. Corequisites: INGE 3016.

Discussion of mathematical foundations frequently encountered in computer science and engineering, with an emphasis in problem solving, algorithms and computing models. Topics include relationships between data and sets, proof techniques, operators and functions, basic logic and circuits, graph theory and organization of computational processes, elements of discrete probability and random events as they appear in computing. Examples from across the computing discipline are used to illustrate the underlying mathematical foundations.

**ICOM 4215. COMPUTER ARCHITECTURE AND ORGANIZATION.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL 4206.

Architectural aspects of general purpose computers: instruction sets, addressing models, data types, registers, support for programming languages and operating systems. Comparative study of commercial architectures. Organizational aspects of general purpose computers: central processing unit, microprogramming, arithmetic and logic units, memory systems, input/output systems.

**ICOM 4217. EMBEDDED SYSTEMS DESIGN.** Four credit hours. Three hours of lecture and two hours of laboratory per week. Prerequisite: INEL 4206 and INEL 4207 or authorization of the Director of the Department.

Development of microprocessor based systems for embedded applications. Interfacing of peripherals such as displays, keypads, digital-to-analog and analog-to-digital converters among others. Hardware and software design will be emphasized.

**INEL/ICOM 4308. NETWORKING AND ROUTING FUNDAMENTALS.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3063 or authorization of the Director of the Department.

Study of the terminology of computer networks and their protocols, IP protocol addressing, and networking standards. Introduction to network design. Discussion and configuration of several routing protocols.

**ICOM 4995. COMPUTER ENGINEERING PRACTICE FOR COOP STUDENTS.** Zero to nine credit hours. Prerequisite: authorization of the Director of the Department.

Practical experience in computer engineering in cooperation with an organization to be supervised jointly by the academic department, the COOP Program Coordinator, and a representative from the cooperating organization.

**ICOM 4998. UNDERGRADUATE RESEARCH.** One to six credit hours. Three to twenty-four hours of laboratory per week. Pre-requisite: fourth or fifth year student and authorization of the Director of the Department.

Participation, under the supervision of a faculty member acting as an investigator, in a research project.

### **Advanced Undergraduate and Graduate Courses**

**ICOM 5007. OPERATING SYSTEMS PROGRAMMING.** Four credit hours. Three hours of lecture and one-three hour laboratory per week. Prerequisites:

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(ICOM 4035 and INEL 4206) or authorization of the Director of the Department.

Concepts of operating systems, multiprogramming, multiprocessing, batch, partitioned, and real time. Organizational and processing of file systems. Study of queueing theory and information flow control.

**ICOM/COMP 5015. ARTIFICIAL INTELLIGENCE.** Three credit hours. Three hours of conference per week. Prerequisite: ICOM 4035.

An introduction to the field of artificial intelligence: LISP language, search techniques, games, vision, representation of knowledge, inference and process of proving theorems, natural language understanding.

**ICOM 5016. DATABASE SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 4035 or authorization of the Director of the Department.

Study of database system architectures; design and implementation of database applications; conceptual and representational models; SQL and the relational model; functional dependencies and normalization; transaction processing.

**ICOM 5017. OPERATING SYSTEM AND NETWORK ADMINISTRATION AND SECURITY.** Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: (INEL 4307 and ICOM 5007) or authorization of the Director of the Department.

Practical experience in the administration and security of operating systems and networks. Design and development of measures for the detection of and response to attacks on such systems.

**ICOM 5018. CRYPTOGRAPHY AND NETWORK SECURITY.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 5007 or authorization of the Director of the Department.

Study of the theoretical and practical aspects of computer systems and network security. Threat models and vulnerabilities of computer systems and networks to attacks such as: hackers, malicious code, Trojan horses, viruses, and worms. Methods and techniques to defend against attacks and minimize their damage. Cryptographic techniques, physical and operational security policies, and management-related issues.

**ICOM 5025. OBJECT-ORIENTED SOFTWARE DEVELOPMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: ICOM 4035 or authorization of the Director of the Department.

Discussion of the fundamental concepts of object-oriented programming. Analysis, design, and development of object-oriented software. Study of object-oriented languages.

**ICOM 5026.COMPUTER NETWORKS.** Three credit hours. Three hours of lecture per week. Prerequisite: ICOM 5007 or authorization of the Director of the Department.

Study of computer communication including the OSI and Internet layering models and networking protocols at subnetwork, network, transport, and application layers. Analysis of media and standards applied to computer networks as well as the software, hardware, and terminology associated with data communications.

**ICOM 5035. COMPUTER GRAPHICS.** Four credit hours. Three hours of lecture and two hours of laboratory per week. Prerequisites: ICOM 4035 or authorization of the Director of the Department.

The analysis, creation and rendering of 3D models and animations using computer graphics: geometric modeling and transformations, rendering algorithms, animation, illumination models, image formation, antialiasing, and ray tracing.

**ICOM 5047. COMPUTER ENGINEERING DESIGN.** Three credit hours. One hour of lecture and four hours of laboratory per week. Prerequisites: ((ICOM 4009 or ICOM 5016) and (ICOM 5217 or INEL 5206 or INEL 5265) and ICOM 4215 and ICOM 5007 and INEL 4301 and INEL 4207)) or authorization of the Director of the Department.

Capstone course in which student teams design a project to solve a complete computer engineering problem considering engineering standards and realistic constraints. The project should integrate both hardware and software concepts.

**ICOM 5104. COMPUTATIONAL SYSTEMS BIOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: (ICOM 5016 and INGE 5036) or authorization of the Director of the Department.

Study of fundamental concepts, models and computational methods for the analysis of biological networks. Discussion of theoretical foundations of networks and their use in biology systems modeling and simulation. Construction of networks from data and qualitative methods for their dynamic simulations and systems analysis.

**INEL/ICOM/SICI/COMP 5318. INTERMEDIATE ROUTING, SWITCHING AND WIDE AREA NETWORKS.** Three credit hours. Three hours of lecture per week. Prerequisite: INEL/ICOM/SICI/COMP 4308 or authorization of the Director of the Department.

Study and configuration of link state protocols. Study of intermediate level concepts such as switching, wide area network or WAN standards, virtual local area networks or VLAN, network design, and redundancy. Presentation and study of strategies for managing and saving address space such as variable length subnet masks and network address translation.

**ICOM 5995. SPECIAL PROBLEMS.** One to six credit hours. Two to four hours of research per week per credit. Prerequisite: authorization of the Director of the Department.

Research and problem-solving in computer engineering or related fields.

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## DEPARTMENT OF ENGINEERING SCIENCES AND MATERIALS

The Department of Engineering Sciences and Materials integrates an interdisciplinary faculty who are responsible for teaching basic introductory engineering courses. This centralized department offers common and fundamental engineering courses under one administration; providing an efficient platform outside of the specialized department.

Those courses related to basic Engineering Science are as follows: Engineering Graphics, Computer Programming, Numerical Methods, Applied Mechanics, Fluid Mechanics, Engineering Materials and Ocean Engineering. A broad, yet in-depth, knowledge of all of these areas is indispensable in every field of engineering, not only for further studies, but also for the successful practice of the engineering profession. The Department of Engineering Sciences and Materials also offers interdisciplinary elective courses which are well within the competence of its faculty.

Research in engineering sciences and engineering education is an integral part of each professor's involvement in this department. In particular, the department is experiencing considerable growth in research on materials science, bioengineering, ocean engineering, applied mechanics and engineering education. In these fields, elements of applied physics, chemistry, biology, and civil, electrical and mechanical engineering are applied. As a result of their inherent interdisciplinary backgrounds, our faculty members have been instrumental in developing cross-cutting collaborations with other science and engineering departments.

### Mission

The mission of the Department of Engineering Sciences and Materials is to collaborate with the UPRM Engineering programs by offering and developing fundamental and applied undergraduate courses, and by leading graduate programs in Applied Mechanics, Materials Science and Engineering, Ocean Engineering, and Engineering Education within an interdisciplinary and research-intensive environment. All educational and research activities respond to current and anticipated technical and societal needs of Puerto Rico and the world.

### Vision

The Department of Engineering Sciences and Materials will be the interdisciplinary hub at UPRM to academically support and advance the UPRM Engineering programs and lead nationally recognized synergistic graduate and research programs in Engineering and Applied Sciences.

### DEPARTMENTAL FACULTY

**EDUARDO AÑESES-MÉNDEZ**, *Assistant Professor*, M. Arch. 1996, Universidad Autónoma de Guadalajara.

**MARCO A. AROCHA-ORDOÑEZ**, *Professor*, Ph.D., 1995, University of California - Davis.

**JOSÉ R. ARROYO-CARABALLO**, *Professor*, Ph.D., 1999, University of Puerto Rico-Mayagüez.

**IVÁN J. BAIGÉS-VALENTÍN**, *Professor*, Ph.D., 1995, University of Florida - Gainesville.

**BÁRBARA O. CALCAGNO-PIZZARELLI**, *Professor*, Ph.D., 2010, University of Wisconsin-Madison.

**MIGUEL CANALS-SILANDER**, *Professor*, Ph.D., 2008, University of Hawaii - Manoa.

**CARMEN CASTAÑEYRA**, *Assistant Professor*, M.S.I.E., 1990, University of Puerto Rico - Mayagüez.

**MARÍA D. CORTÉS DELGADO**, *Assistant Professor*, Ph.D., 2014, Sunny at Buffalo, New York.

**JOSÉ E. CRESPO-BADILLO**, *Assistant Professor*, M. Arch, 1997, State University of New York - Buffalo.

**YANG LI**, *Professor*, Ph.D., 1993, University of Science and Technology, Beijing (China).

**CARLOS MARÍN-MARTÍN**, *Professor*, Ph.D., 2003, Rensselaer Polytechnic Institute.

**LUIS A. MONTEJO-VALENCIA**, *Professor*, Ph.D., 2008, North Carolina State University.

**AGNES M. PADOVANI-BLANCO**, *Professor*, Ph.D., 2002, Georgia Institute of Technology.

**CHRISTOPHER PAPADOPOULOS**, *Professor*, Ph.D., 1999, Cornell University.

**OSCAR J. PERALES-PÉREZ**, *Professor*, Ph.D., 1998, University of Tohoku, Sendai (Japan).

**ARTURO PONCE-ROMÁN**, *Associate Professor*, Ph.D., 2015, Nova Southeastern University.

**GENOCK PORTELA-GAUTHIER**, *Professor*, Ph.D., 2004, University of Puerto Rico-Mayagüez.



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**MARIO RIVERA-BORRERO**, *Professor*, Ph.D., 1997, Virginia Polytechnic Institute.

**SYLVIA RODRÍGUEZ-ABUDO**, *Associate Professor*, Ph.D., 2014, University of New Hampshire.

**MAREK RYSZ**, *Professor*, Ph.D., 1981, Technical University of Cracow (Poland).

**AIDSA I. SANTIAGO-ROMÁN**, *Professor*, Ph.D., 2009, Purdue University.

**WILMA SANTIAGO**, *Professor*, M. Arch., 1992, University of Wisconsin.

**JEANNETTE SANTOS-CORDERO**, *Professor*, Ph.D., 1995, Louisiana State University.

**BASIR SHAFIQ**, *Professor*, Ph.D., 1996, University of Illinois - Chicago.

**O. MARCELO SUÁREZ**, *Professor*, Ph.D., 2000, University of Wisconsin-Madison.

**FREYA TOLEDO-FERIA**, *Professor*, M.S.I.E., 1985, University of Massachusetts-Amherst.

**OSWALD N. C. UWAKWEH**, *Professor*, Ph.D., 1990, Université De Nancy1 (France).

**AIDCER L. VIDOT-VEGA**, *Professor*, Ph.D., 2008, North Carolina State University.

## COURSES OF INSTRUCTION

### MATERIALS SCIENCE AND ENGINEERING

**INGE 3007. HISTORY OF TECHNOLOGY.** Three credit hours. Three hours of lecture per week.

Introduction to the history of technology and engineering, from the Stone Age to the Industrial Revolution, emphasizing the relationships between technology, energy, and society. Focuses on Western history and cultures; with examples from Puerto Rico. Includes field trips and student presentations.

**INGE 3011. ENGINEERING GRAPHICS I.** Two credit hours. One hour of lecture and two one-and-one-half-hour laboratories per week.

Principles of graphic language: Fundamentals of delineation, analysis and solution of space problems, symbols and standards as applied in engineering. Freehand drawing as a tool for visualization. Principles of orthographic projection, sections, auxiliary views and conventional practices. Pictorial drawings: axonometric, oblique and perspective. Introduction to descriptive geometry. Hand and computer-aided drawing.

**INGE 3012. ENGINEERING GRAPHICS II.** Two credit hours. Two two-hours of lecture-drawing periods per week. Prerequisite: INGE 3011.

Underlying principles of the graphic language: fundamentals of delineation, analysis and solution of space problems, symbols and standards as applied to engineering, spatial geometry: distances between planes and lines, angles between lines and planes, rotation problems. Introduction to graphical mathematics and nomography.

**INGE 3016. ALGORITHMS AND COMPUTER PROGRAMMING.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3005 or MATE 3143 or MATE 3172 or MATE 3174.

Development of algorithms and their implementation in a structured high level language. Programming techniques applied to the solution of engineering and mathematical problems.

**INGE 3017. COMPUTED AIDED GRAPHICS.** Two credit hours. Two two-hour lecture-laboratory per week.

Fundamentals of computer aided graphics in engineering. Description of the equipment, use of commercial solid modeling programs, modeling of geometric figures and documentation.

**INGE 3025. INTRODUCTION TO COMPUTERS.** Three credit hours. Two hours of lecture and two hours of computation per week. Prerequisite: MATE 3031 or MATE 3144 or MATE 3183.

Fundamental principles of programming and use of computers with special emphasis on digital computers. Application to engineering problems.

**INGE 3031. ENGINEERING MECHANICS STATICS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3031 or MATE 3144 or MATE 3183.

Analysis of force systems; the laws of equilibrium; analysis of simple structures; distributed loads; friction; centroids and moments of inertia.

**INGE 3032. ENGINEERING MECHANICS DYNAMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 3031 and (FISI 3161 or FISI 3171).

Kinematics of particles and rigid bodies; relations among force, mass and acceleration; kinetics of particles and rigid bodies; work and energy; impulse and momentum.

**INGE 3035. ENGINEERING MECHANICS.** Three credit hours. Three hours of lecture per week. Prerequisite: MATE 3031 or MATE 3144 or MATE 3183. Corequisite: FISI 3161 or FISI 3171.

Analysis of force systems; the laws of equilibrium; friction; centroids and moments of inertia. Kinematics and dynamics of particles and rigid bodies.

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**INGE 3045. MATERIALS SCIENCE FOR ELECTRICAL ENGINEERS.** Three credit hours. Three hours of lecture per week. Prerequisite: QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134). Corequisite: FISI 3162 or FISI 3172.

Principles that determine the properties of conductors, semiconductors, and insulators. Electromechanical properties; diffusion, electrical conduction, thermal conduction; magnetic and optical properties.

**INGE/INME 3809. CREATIVE DESIGN I.** Three credit hours. Two hours of lecture and one two-hour laboratory per week.

Introduction to the underlying principles and methodologies of engineering graphics communications, as a tool for the solution of engineering problems: Fundamentals of graphic visualization, sketching, PC-based Computer-Aided-Design (CAD), and technical presentations. An introduction to computer-aided-design software will include principles of parametric solid modes of mechanical parts and assemblies including dimensions and tolerances. Solid modeling is the tool for visualization, and analysis of engineering problems.

**INGE 4001. ENGINEERING MATERIALS.** Three credit hours. Three hours of lecture per week. Prerequisites: (QUIM 3002 or QUIM 3042) or (QUIM 3132 and QUIM 3134)) and (FISI 3161 or FISI 3171).

A study of the basic principles that govern the properties and behavior of engineering materials; atomic structures, interatomic forces, amorphous and crystalline structures; phase transformations; mechanical properties; the study of the capabilities and limitations of different materials; metals, polymers, ceramics and composites; introduction to corrosion.

**INGE 4010. FLUID MECHANICS (WITH LABORATORY).** Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisites: INGE 3032 and MATE 3063.

Study of fluid mechanics, the development of its fundamental equations, and its applications. Dimensional analysis and similitude between models and prototypes, non-viscous and viscous flows, and internal and external flows. Laboratory practice is included on phenomena and properties of fluids, hydrostatics, hydrodynamics, turbomachinery, and compressible flow.

**INGE 4011. MECHANICS OF MATERIALS I.** Three credit hours. Three hours of lecture per week. Prerequisite: INGE 3031 and (MATE 3032 or MATE 3184).

Stresses and strains due to axial, torsional, and bending loads; shear and moment diagrams.

**INGE 4012. MECHANICS OF MATERIALS II.** Three credit hours. Three hours of lecture per week. Prerequisite: INGE 4011 and (MATE 3063 or MATE 3185).

Analysis of statically determinate and indeterminate beams; stresses due to combined loads; stress and strain transformation; column theory.

**INGE 4015. FLUID MECHANICS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 3032 and (MATE 3063 or MATE 3185).

Elements of mechanics of fluids and fluid statics. Development of the fundamental equations of fluid mechanics and its applications. Introduction to dimensional analysis and similitude. Motion of ideal and real fluids including internal and external viscous flows. Introduction to the use of hydraulic machinery.

**INGE 4016. FLUID MECHANICS LABORATORY.** One credit hour. One three-hour laboratory period per week. Corequisite: INGE 4015.

Laboratory work supplementing classroom instruction in mechanics of fluid phenomena, measuring devices and techniques, and the testing of fluid machinery.

**INGE 4019. INTRODUCTION TO MECHANICS OF MATERIALS.** Four credit hours. Four hours of lecture per week. Prerequisites: INGE 3031 and MATE 3063.

Stresses and strains due to axial, torsional, and flexural loads; shear and moment diagrams; stress and strains transformations; stresses due to combined loadings.

**INGE 4035. NUMERICAL METHODS APPLIED TO ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 3016 and (MATE 3063 or MATE 3185).

Discussion and application of numerical mathematical methods for engineering analysis. Use of software for the application of numerical methods for modeling experimental data, finding roots or equations, function interpolation, curve fitting, numerical differentiation and integration, solution of systems of linear and nonlinear equations; and the solution of ordinary and partial differential equations.

**INGE/INME 4046. FUNDAMENTALS OF VIBRATION.** Three credit hours. Three hours of lecture per week. Prerequisite: INGE 3032. Co-requisite: MATE 4009.

Study of the theory of vibration for single- and two-degree-of-freedom systems. Free vibration analysis, response to harmonic and non-harmonic excitations, design for vibration control, and introduction to matrix analysis of multi-degree-of-freedom systems.

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**INGE 4998. UNDERGRADUATE RESEARCH.** One to six credit hours. Three to twenty-four hours of laboratory per week. Pre-requisite: fourth or fifth year student and authorization of the Director of the Department.

Participation, under the supervision of a faculty member acting as an investigator, in a research project.

### **Advanced Undergraduate Course**

**INGE 5005. STABILITY AND PROCESSING OF MATERIALS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 4001 or INGE 3045 or INME 4107 or authorization of the Director of the Department.

Discussion of materials' stability driven by thermodynamics and kinetics considerations such as microstructural evolution and interparticle interactions. Discussion of interfaces and their roles during materials syntheses and processing at different stages. Discussion of governing and operational phenomena at multi-length scales during synthesis and processing (ranging from nanomaterials to bulk materials processing) such as diffusion, sintering, and solidification.

**INGE 5015. THEORY AND MANAGEMENT OF SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisite: third year standing or higher or authorization of the Director of the Department.

Introduction to the systems approach and to systems analysis. Analytical methods applicable to interactive contexts, such as economic and ecological systems and to organizations. Topics include: Problem formulation, information management, evaluation and selection of alternatives, implementation and monitoring of solutions.

**INGE 5016. INTRODUCTION TO MATERIALS CHARACTERIZATION.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 4001 or INGE 3045 or INME 4107 or authorization of the Director of the Department.

Discussion of the theory and practice of micro-characterization techniques, including optical microscopy, thermal analysis, electron beam diffraction, and x-ray and photon-induced interactions. Explanation of the complementary surface analysis techniques as experimental methods for design and selection of metals, polymers, composites and biological materials.

**INGE 5020. INTRODUCTION TO CERAMIC MATERIALS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 4001 or INGE 3045 or INME 4107 or authorization of the Director of the Department.

Introduction to the fundamental principles of ceramic materials including their crystalline structure, electronic and ionic defects and subsequent transport phenomena, microstructure, mechanical properties, processing and diverse modern applications. Study of related topics such as glass formation and applications of nanostructured ceramic materials.

**INGE 5027. OCEAN WAVE DYNAMICS FOR ENGINEERS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 4015 or authorization of the Director of the Department.

Analysis of surface waves focused on the engineering applications of ocean wave dynamics. Discussion and application of the physical and mathematical fundamentals which govern the behavior of ocean waves. Application of statistics and extreme wave analysis to develop design wave criteria.

**INGE 5028. ENGINEERING VIBRATIONS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE-INME 4046- Fundamentals of Vibrations and (INGE 4019-Introduction to Mechanics of Materials or INGE 4012-Mechanics of Materials II or authorization of the Director of the Department.

Discussion of the vibration theory of discrete and continuous systems. Use of techniques, principles and methodology to solve practical problems of engineering vibrations with an emphasis on analytical tools and computational approaches. Analysis of modeling and response of discrete and continuous systems; use of matrix methods for the solution of discrete systems; use of eigenvalue problem analysis for discrete and continuous systems; use of numerical methods in vibration analysis; applications of finite element methods for the analysis of vibrations of systems and nonlinear vibrations.

**INGE 5037. APPLIED SIGNAL PROCESSING FOR ENGINEERING MECHANICS.** Three credit hours. Three hours of lecture per week. Prerequisites: (INGE 3016 and MATE 3063) or authorization of the Director of the Department.

Practical introduction to signal processing, including time-domain, frequency-domain, and time-frequency domain approaches. Development of skills to manipulate, analyze, and extract useful and reliable information from different types of signals. Practical applications of methods and principles including signal de-noising, outlier analysis, vibration based system identification, irregularities detection, system health monitoring and non-stationary signals characterization.

**INGE 5040. ENGINEERING ACOUSTICS.** Three credit hours. Three hours of lecture per week. Prerequisites: (MATE 4009 and (INGE 3032 or INGE 3035)) or authorization of the Director of the Department.

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Basic acoustics theory and practice, modeling of acoustic sources, sound propagation and transmission, acoustics measurements, sound in enclosed spaces, design of sound enclosures and barriers and design of muffling devices.

**INGE 5065. MATERIALS SELECTION.** Three credit hours. Two hour of lecture and two hours of laboratory per week. Prerequisites: INGE 3045- Materials Science for Electrical Engineers or INGE 4001- Engineering Materials or INME 4107- Materials Science and Engineering or authorization of the Director of the Department.

Discussion of the concepts, tools, and procedures related to the materials selection process to provide the conceptual basis needed for the decision-making process in the selection of materials in engineering applications. Use of materials selection software. Discussion of engineering materials and their structure-property-performance relationship. Use of case studies for the application of basic concepts in materials selection and the application of materials selection charts. Discussion of multiple constraints and compound objectives. The concepts of process selection as well as aesthetics and industrial design will also be discussed.

**INGE 5066. RECYCLING OF MATERIALS.** Three credit hours. Three hours of lecture per week. Prerequisite: INGE 4001 or INGE 3045 or INME 4007 or authorization of the Director of the Department.

Analysis of the recycling situation in the global context and its laws and regulations. Design of separation and collection centers for recyclable waste materials including electronic devices, aluminum cans, bottles, plastics, steel, tires, construction debris, and hazardous wastes. Planning of processing facilities.

**INGE 5075. NANOMATERIALS AND FINE PARTICLES PROCESSING.** Three credit hours. Three hours of lecture per week. Prerequisite: INGE 4001 or INGE 3045 or INME 4007 or authorization of the Director of the Department.

Study of the nanoscale and the perspective of nanotechnology, nanomaterials, and their properties. Fundamentals and practice of particle nucleation and growth. Analysis of conditions leading to particle stability and the formation of solid solutions at the micro- and nanosize scale. Fundamental and industrial applications such as ceramics, magnetic materials, semiconductors, ferroelectrics, optical materials, catalysts, pigments, and biological and medical devices. Study of nanotechnology and its relation with the environment.

**INGE 5085. MATERIAL SCIENCE AND ENGINEERING SEMINAR.** One credit hour. One hour of lecture per week. Prerequisites: INGE 4001 or INGE

3045 or INME 4107 or authorization of the Director of the Department.

Oral and written presentations about materials science and engineering topics.

**INGE 5095. BIOMECHANICS OF THE MUSCULOSKELETAL SYSTEM.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 3032 or INGE 3035 or authorization of the Director of the Department.

Study of the mechanisms of human musculoskeletal system. Analysis of the highly complex and intricate movements of various joints in the body. Study of the mechanical properties of bones, cartilages, tendons, ligaments and muscles that comprise a joint. Analysis techniques of static and dynamic equilibrium that explain the musculoskeletal interactions which causes joint movement.

**INGE 5104. NANOMEDICINE FUNDAMENTALS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 4001 or INGE 3045 or INME 4107 or authorization of the Director of the Department.

Overview of the distinctive features of nanotechnology and their application to biomedical problems. Contrasts among macro/micro/nano to bring out the unique properties of nanotechnology in medicine. Introduction to cutting-edge of nanomedical technologies for sensing and imaging, drug delivery, and therapeutic applications will be addressed.

**INGE 5185. INTRODUCTION TO COASTAL ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 4015-Fluid Mechanics or authorization of the Director of the Department.

Analysis of waves, including linear wave theory, wave transformation, wave statistics, and wave-induced flows. Analysis of the dynamics of tides, currents, and sea level variations and extreme events, the effects of coastal processes on cross-shore and alongshore sediment transport, on coastal morphology, and on the different types of coastal engineering stabilization measures. Design of beach nourishment and inlet stabilization. Discussion of the fundamental design considerations for coastal engineering structures.

**INGE 5996. SPECIAL TOPICS.** One to six credit hours. One to six hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study of selected topics in general engineering. The selection and scope of the topics shall be in accordance with the interests and needs of the students.

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## DEPARTMENT OF INDUSTRIAL ENGINEERING

The Industrial Engineering Department offers a program leading to a Bachelor of Science degree in Industrial Engineering. It is a five-year program which prepares professionals for the practice of Industrial Engineering in Puerto Rico and elsewhere.

Graduates from the Industrial Engineering program are instrumental in planning, designing, implementing and evaluating products, services, and systems which integrate people, materials, equipment, and information for the progress and improvement of the quality of life of humankind. They insure that these products, services, or systems can be provided economically with the required level of quality necessary for satisfying society's needs. The Industrial Engineer draws upon knowledge and skills mostly from the areas of mathematics and the physical, social, physiological and computer sciences, together with principles and methods of engineering analysis and design.

The Bachelor of Science Program in Industrial Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

### Mission

To develop industrial engineering leaders known for their commitment, integrity, and respect. We serve the Puerto Rican and international communities with excellence by:

- providing an educational experience that nurtures industrial engineering professionals known for their solid technical capability, critical thinking skills, and social responsibility through a rigorous educational experience;
- creating knowledge by performing basic and applied research;
- stimulating and influencing the efficiency of governmental processes and services;
- supporting and improving manufacturing and service industries;

### Vision

Strengthen our position as the preferred alternative for the Puerto Rican community and become recognized internationally for forming Industrial Engineering professionals of global impact. We aim to be a model

of excellence in education, research, and administration processes.

### SLOGAN

Industrial Engineers make complex decisions simple.

### PROGRAM EDUCATIONAL OBJECTIVES

The Program Educational Objectives of the Industrial Engineering undergraduate program established that few years after graduation, graduates of this program will accomplish the following:

1. Be known as assertive, ethical, and independent critical thinkers.
2. Make contributions to their organization based on experience that builds on their IE education.
3. Adapt to changing needs in their profession.
4. Be recognized as leaders in the organization.

### STUDENT OUTCOMES

The Industrial Engineering program students should demonstrate:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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Graduates from the Industrial Engineering program are prepared to work in manufacturing, service and governmental organizations. Employers of some of our industrial engineering graduates include:

- Manufacturing industries such as pharmaceuticals, textiles, food processing, electronics, clothing and shoes, health and hospital related products.
- Services industries such as: banks, hospitals, supermarket chains, furniture chains, communications, managerial consultants, system developers, public utilities, and cooperatives.
- Government agencies.

### **GENERAL EDUCATION STUDENT LEARNING OUTCOMES**

The general education student learning outcomes for our department are aligned with several student outcomes (please refer to ABET (1)-(7)). Our students should demonstrate ability in the following areas: written communication (3), oral communication (3), quantitative reasoning (1), scientific reasoning (1), information literacy (4), technological competence (2, 4), and critical analysis and reasoning (2, 4).

### **COURSES THAT FULFILL THE GENERAL EDUCATION REQUIREMENTS**

The general education component includes 51 credits hours: 5 credits hours in pre-calculus (MATE 3005), 8 credit hours in sciences (QUIM 3031, QUIM 3133, QUIM 3132, QUIM 3134), 15 credit hours in socio-technical electives courses (selected from a list of approved courses), 12 credit hours in oral and written communication in English (INGL 3102, INGL 3102, INGL 3201, and one of the following options INGL 3202, INGL 3209 or INGL 3191), 6 credit hours in Spanish (ESPA 3101, ESPA 3102), 2 credit hours in Physical Education courses (selected from a list of courses), and a 3 credit hour course in Principles of Economics I (ECON 3021).

### **FACILITIES**

#### **UPRM Model Factory**

The UPRM Model Factory integrates modern equipment, materials, and people into a manufacturing system. Its mode of operation is through

interdisciplinary working teams from several engineering and business disciplines. This is a coordinated effort between Industrial, Electrical & Computer, and Mechanical Engineering. The goals of these laboratory facilities are to provide the following:

- Basic training to students through course labs and project initiatives
- Practice based experiences dealing with all aspects of an actual manufacturing system.
- A space where local manufacturing industry issues can be studied.
- A place where modern production technology and techniques can be studied as they are applied in an integrated manufacturing system.
- The opportunity to assist local manufacturers in the development of their production system.
- Incubator facilities where products and process can be developed or improved.
- Serve as a meeting place where people from several disciplines can meet and learn to work in teams, and get an appreciation for the technical aspects of the other's area of knowledge.

Currently, this laboratory houses a for-profit manufacturing activity and provides students with an exemplary manufacturing experience inside the university. The factory hosts a surface mount technology (SMT) printed circuit assembly (PCA) line and a three-axes CNC milling machine in which production and prototype runs are performed.

As for-profit initiatives are defined, students receive pay for their involvement, similar to a COOP experience. These students are then ideal candidates for course projects and summer and COOP internship in related endeavors. Such young but experienced graduates are then positioned to initiate new business ventures or play lead roles in interested recruiters. Various companies (notably Hewlett Packard, Fuji America and FeatureCam) have contributed to this initiative, which has been active for over ten years.

#### **Human Factors/Ergonomics and Work Measurement Lab**

This laboratory has been designed to provide students with hands on experience in the analysis and evaluation of humans and their working environment. Tasks are simulated and evaluated based on anthropometrics, cardiovascular, and force requirements. The laboratory is equipped with modern equipment for the analysis of work systems and computers with software for the analysis of manual

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material handling activities. The following is a list of some of the equipment available in the laboratory.

- Computers with licenses of ErgoIntelligence for analysis and evaluation of workstation design as well as the analysis of lifting tasks with the NIOSH lifting guide,
- Chatillon digital force measurement gauges and equipment for the analysis of pushing and pulling tasks,
- Hand dynamometers and pinch gauges to measure hand force,
- Anthropometers and calipers for the collection of anthropometric data,
- Heart rate meters and a treadmill for the evaluation of cardiovascular requirements of physical tasks,
- Electromyography with data collection software for the analysis of muscular activity,
- Goniometers and data collection software for the analysis of flexion, extension, and rotation of body members,
- Heat stress monitors and Wet-bulb globe temperature meter for the analysis of environmental variables,
- Dosimeters and sound level meters for the evaluation of noise levels,
- Photometers for studies of illumination,
- Stop watches and digital recording equipment for Time Study and Work Measurement analysis, among many others.

### **Manufacturing Automation Lab**

This teaching-learning facility is the hands-on laboratory for the Real Time Process Control course. Students design, build, and control scaled models, mainly emulating real manufacturing operations. The emphasis is in the use of programmable logic controllers (PLC), industrial sensors and actuators, pneumatics, and computer-based human machine interfaces.

The lab is equipped with 20 workstations with all the necessary software and hardware. The facility is available for demonstration and custom trainings.

### **Statistical Quality Control Lab**

The lab is equipped with Statistical software for data analysis, design of experiments, and validation procedures. It can also provide hands-on demonstrations for applied statistics courses and for simulation courses.

### **Bio-Industrial Engineering Lab (Bio IE Lab)**

The Bio IE Lab focuses on the use of engineering analysis methods to extract biological knowledge from scientific in-silico, in-vitro and in-vivo experiments. The laboratory integrates high computing capabilities and state-of-the-art algorithms to lead data-based biological discovery. The lab work relates statistical, soft-computing and optimization techniques to biological data analysis. In particular, the search and discovery of biomarkers of cancer is a central line of work of the Bio IE lab. Located in the Industrial Engineering Department, the laboratory is equipped with four MacPro workstations and one iMac capable of running UNIX, Mac and Windows software.

### **Lean Logistics (LELO) Lab**

The Lean Logistics (LELO) Lab is a student-centered lab seeking to provide hands-on experience while creating practical research-based solutions to contemporary logistics problems, particularly those of Latin American countries. Currently the lab has three main streams of research: facility logistics, humanitarian logistics, and supply chain networks security. Consulting and training at the supply chain, facility, or production line level are available through the lab. The LELO lab is partly funded by the National Science Foundation and Department of Homeland Security.

### **Socially Responsible Operations (SRO) Research Center**

Socially Responsible Operations Research Center (SRO) mission is to foster a new generation of innovative decision makers committed to issues that have a direct impact on the wellbeing of our society. The center strategy is to utilize the synergy created by the interaction and collaboration amongst research groups to create a culture of innovation and problem solving of societal issues. The research groups associated with the center are: Improving Design Decisions in Engineering & Applied Systems (IDDEAS), Integrative Solutions for High Dimensions (iSoHD), Governmental Operational & Logistics Decisions, and International Service Systems Engineering Research (ISSER).

### **Computing and Information Infrastructure**

The Department of Industrial Engineering has a modern computing and information technology infrastructure. Servers running on Windows Server 2008 and Mac OSX platforms support the computing infrastructure. There are two servers dedicated to the

development of WEB-based applications. The other servers support all software packages and general applications used by the students in the IE courses.

The center has 36 stations connected to the Department's local area network and to the Internet. It serves as a general purpose computing facility and training center. It provides printing and plotting capabilities. The ININ Computer Center's schedule is variable depending on the number of graduate students available to supervise facilities.

An additional workstation is available as a remote desktop to students and faculty for use with simulations and computing demanding software. A virtual computing center should be available soon to allow access to software 24 hours 7 days a week.

## PROGRAM OF STUDY

### INDUSTRIAL ENGINEERING CURRICULUM

#### FIRST YEAR

##### First Semester

| Number     | Credits  | Course                         |
|------------|----------|--------------------------------|
| *MATE 3005 | 5        | Pre-Calculus                   |
| QUIM 3131  | 3        | General Chemistry I            |
| QUIM 3133  | 1        | General Chemistry Laboratory I |
| *INGL 3--- | 3        | First year course in English   |
| *ESPA 3101 | 3        | Basic course in Spanish I      |
| INGE 3011  | <u>2</u> | Engineering Graphics I         |
|            | 17       |                                |

##### Second Semester

| Number     | Credits  | Course                          |
|------------|----------|---------------------------------|
| MATE 3031  | 4        | Calculus I                      |
| QUIM 3132  | 3        | General Chemistry II            |
| QUIM 3134  | 1        | General Chemistry Laboratory II |
| *INGL 3--- | 3        | First year course in English    |
| *ESPA 3102 | 3        | Basic course in Spanish II      |
| ELECTIVE   | 3        | **Sociohumanistic Elective      |
| EDFI ----  | <u>1</u> | Physical Education Elective     |
|            | 18       |                                 |

#### SECOND YEAR

##### First Semester

| Number    | Credits | Course               |
|-----------|---------|----------------------|
| MATE 3032 | 4       | Calculus II          |
| FISI 3171 | 4       | Physics I            |
| FISI 3173 | 1       | Physics Laboratory I |

|           |          |                                     |
|-----------|----------|-------------------------------------|
| INGL 3--- | 3        | Second year course in English       |
| INGE 3016 | 3        | Algorithms and Computer Programming |
| INGE 3031 | <u>3</u> | Engineering Mechanics-Static        |
|           | 18       |                                     |

##### Second Semester

| Number    | Credits  | Course                                   |
|-----------|----------|--|
| MATE 3063 | 3        | Calculus III                             |
| FISI 3172 | 4        | Physics II                               |
| FISI 3174 | 1        | Physics Laboratory II                    |
| INGE 3032 | 3        | Engineering Mechanics-Dynamics           |
| ININ 4010 | 3        | Probability and Statistics for Engineers |
| INGE 4001 | 3        | Engineering Materials                    |
| EDFI ---- | <u>1</u> | Physical Education Elective              |
|           | 18       |  |

#### THIRD YEAR

##### First Semester

| Number    | Credits  | Course                                    |
|-----------|----------|---|
| MATE 4145 | 4        | Linear Algebra and Differential Equations |
| ININ 4020 | 3        | Applied Industrial Statistics             |
| ININ 4077 | 4        | Work Systems Design                       |
| INEL 4075 | 3        | Fundamentals of Electrical Engineering    |
| INME 4055 | <u>3</u> | Manufacturing Processes                   |
|           | 17       |   |

##### Second Semester

| Number    | Credits  | Course  |
|-----------|----------|---|
| INME 4056 | 1        | Manufacturing Processes Laboratory            |
| INEL 4076 | 3        | Fundamentals of Electronics                   |
| ININ 4015 | 3        | Engineering Economic Analysis                 |
| ININ 4150 | 4        | Introduction to Models in Operations Research |
| INGL 3--- | 3        | Second year course in English                 |
| ININ 4009 | <u>4</u> | Work Measurement                              |
|           | 18       |   |

#### FOURTH YEAR

##### First Semester

| Number    | Credits | Course                                  |
|-----------|---------|---|
| INGE 4011 | 3       | Mechanics of Materials I                |
| INME 4045 | 3       | General Thermodynamics for Engineers    |
| INEL 4077 | 1       | Basic Electronics Laboratory            |
| ECON 3021 | 3       | Principles of Economics: Microeconomics |



|           |          |  |
|-----------|----------|--|
| ININ 4155 | 4        | Design and Analysis of Production Systems and Inventory Management |
| ININ 4087 | <u>4</u> | Cost Management  |
|           | 18       |  |

## Second Semester

| Number    | Credits  | Course   |
|-----------|----------|--|
| ININ 4018 | 3        | Discrete-Event System Simulation               |
| ININ 4027 | 3        | Design and Analysis of Engineering Experiments |
| ININ 4040 | 3        | Facilities Layout and Design                   |
| ININ 4078 | 3        | Statistical Quality Control                    |
| ELECTIVE  | <u>3</u> | **Sociohumanistic Elective                     |
|           | 15       |  |

## FIFTH YEAR

### First Semester

| Number    | Credits  | Course                             |
|-----------|----------|------------------------------------|
| ININ 4017 | 3        | Computer-based Information Systems |
| ININ 4057 | 3        | Real Time Process Control          |
| ININ 4079 | 3        | Design Project                     |
| ELECTIVE  | 3        | Industrial Engineering Elective    |
| ELECTIVE  | 3        | **Sociohumanistic Elective         |
| ELECTIVES | <u>3</u> | Free Elective                      |
|           | 18       |                                    |

### Second Semester

| Number    | Credits  | Course                          |
|-----------|----------|---------------------------------|
| ELECTIVE  | 3        | Industrial Engineering Elective |
| ELECTIVE  | 6        | **Sociohumanistic Elective      |
| ELECTIVES | <u>9</u> | Free Electives                  |
|           | 18       |                                 |

## Total credits required for this program: 175

- \* Refer to the Academic Regulations section for information on Advanced Placement.
- \*\* The fifteen (15) credit hours of Sociohumanistic electives will be selected by the student, with the advisor's approval, from a list of recommended courses.
- ^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## DEPARTMENTAL FACULTY

**NOEL ARTILES-LEÓN**, *Professor*, Ph.D., 1988, Iowa State University.

**SONIA BARTOLOMEI-SUÁREZ**, *Professor*, Ph.D., 1996, Pennsylvania State University.

**RAFAEL BLANES-SÁNCHEZ**, *Instructor*, B.S., 1966, University of Puerto Rico.

**MAURICIO CABRERA-RÍOS**, *Professor*, Ph.D., 2002, Ohio State University.

**HÉCTOR CARLO-COLÓN**, *Professor*, Ph.D., 2007, University of Michigan-Ann Arbor.

**VIVIANA CESANÍ-VÁZQUEZ**, *Professor*, Ph.D., 1998, University of Wisconsin, Madison.

**SAYLISSE DÁVILA-PADILLA**, *Associate Professor*, Ph.D., 2010, Arizona State University.

**MERCEDES FERRER-ALAMEDA**, *Associate Professor*, MEMS, 1993, University of Puerto Rico at Mayagüez.

**DAVID R. GONZÁLEZ-BARRETO**, *Professor*, Ph.D., 1996, Pennsylvania State University.

**WILLIAM HERNÁNDEZ-RIVERA**, *Professor*, Ph.D., 1996, Texas A&M University.

**MARÍA DE LOS A. IRIZARRY-SERRANO**, *Professor*, Ph.D., 1996, North Carolina State University.

**LOURDES A. MEDINA-AVILÉS**, *Associate Professor*, Ph.D., 2012, Pennsylvania State University.

**ALEXANDRA MEDINA-BORJA**, *Associate Professor*, Ph.D., 2002, Virginia Polytechnic Institute and State University.

**MAYRA MÉNDEZ-PIÑERO**, *Professor*, Ph.D., 2009, Texas A&M University.

**OMELL PAGÁN-PARÉS**, *Professor*, Doctor of Engineering, 1995, Universidad Politécnica de Madrid.

**CRISTINA POMALES-GARCÍA**, *Professor*, Ph.D., 2006, University of Michigan-Ann Arbor.

**NAZARIO RAMÍREZ-BELTRÁN**, *Professor*, Ph.D., 1988, Texas A&M University.

**PEDRO RESTO-BATALLA**, *Professor*, Ph.D., 1982, Texas A&M University.

**BETZABÉ RODRÍGUEZ-ÁLAMO**, *Professor*, Ph.D., 2010, University of Michigan-Ann Arbor.

**AGUSTÍN RULLÁN-TORO**, *Professor*, Ph.D., 1990, Lehigh University.

**WANDALIZ TORRES GALARZA**, *Associate Professor*, Ph.D., 2011, Arizona State University.

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## COURSES OF INSTRUCTION

### INDUSTRIAL ENGINEERING

**ININ 3100. INTRODUCTION TO INDUSTRIAL ENGINEERING.** One credit hour. One hour of lecture per week.

Introduction to the industrial engineering profession. Discussion of the function of industrial engineers, the technical areas that they should master, examples of typical problems they solve, and their professional opportunities and perspectives. Introduction to the code of engineering ethics and relevant professional societies.

**ININ 4007. INDUSTRIAL ORGANIZATION AND MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3063 and ECON 3021.

Principles of design and control; decision models in engineering and industrial systems.

**ININ 4009. WORK MEASUREMENT.** Four credit hours. Three hours of lecture and one two-hour laboratory per week. Prerequisites: ININ 4077 and ININ 4020.

Theory and practice of work measurement systems; time studies using direct observations; predetermined time systems and work sampling; formula construction, line balancing, and learning curves.

**ININ 4010. PROBABILITY AND STATISTICS FOR ENGINEERS.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: MATE 3032 and (INGE 3016 or CIIC 3011).

Descriptive statistics. Probability theory. Discrete and continuous random variables and distributions and their applications in engineering. Sample statistics and their distributions. Applications to engineering problems. Hypothesis testing and confidence intervals. Emphasis on the use of statistical computer packages and their use in engineering.

**ININ 4015. ENGINEERING ECONOMIC ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 3032.

Criteria and techniques of economic analysis as related to decision making in engineering projects where time and money are the primary trade-offs. Discounted cash flows; comparison of alternatives using equivalent annual cost, present worth, or rate of return; break-even analysis, depreciation, tax effects, replacement, sensitivity, and risk analysis.

**ININ 4016. INDUSTRIAL SAFETY.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4077.

The fundamental of safety engineering, accident analysis and prevention, and accident cost determination; analysis of the accident problem in Puerto Rico. Emphasis is placed on the development of a philosophy of safety.

**ININ 4017. COMPUTER-BASED INFORMATION SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 3016.

Analysis and design of computer-based information systems; database logical and physical models; database language; user interface; Internet; common applications to industrial engineering.

**ININ 4018. DISCRETE-EVENT SYSTEM SIMULATION.** Three credit hours. Three hours of lecture per week. Prerequisites: (ININ 4022 or ININ 4150) and ININ 4020.

Modeling the interrelationship between component of systems by means of computer programs; generation of random variables using computers; use of special purpose simulation languages. Input and output analysis. Emphasis on problem-solving using modern simulation packages.

**ININ 4020. APPLIED INDUSTRIAL STATISTICS.** Three credit hours. Three hours of lecture per week. Prerequisites: ININ 4010 and MATE 3063.

Application of advanced statistical concepts in engineering. Joint probability functions, goodness of fit test, regression analysis, multicollinearity, design and analysis of industrial experiments. Emphasis on the use of statistical computer packages and their use in engineering.

**ININ 4021. DETERMINISTIC MODELS IN OPERATIONS RESEARCH.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4010 and (MATE 4145 or MATE 4031).

Formulation and solution of linear programming problems: the Simplex method, duality and sensitivity analysis; transportation problems; Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT); integer programming problems: branch and bound; linearization of non-linear objective functions; shortest route and maximum flow algorithms.

**ININ 4022. PROBABILISTIC MODELS IN OPERATIONS RESEARCH.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4020.

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Simulation techniques; queuing theory; application to industrial systems problems.

**ININ 4027. DESIGN AND ANALYSIS OF ENGINEERING EXPERIMENTS.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4020.

Fundamental principles in the design and analysis of engineering experiments: randomized blocks, latin squares, split plots, factorial experiments, fractional factorials; confounding and response surface methodology.

**ININ 4029. HUMAN BEHAVIOR IN WORK ORGANIZATIONS.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4077.

Cognitive theories and behavioral principles which attempt to explain, predict, and control individual and group behavior in work organizations.

**ININ 4035. HUMAN RESOURCES PLANNING.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4077.

Selection, training, utilization and control of human resources. Optimum systems designs.

**ININ 4039. PRODUCTION PLANNING AND CONTROL I.** Three credit hours. Three hours of lecture per week. Prerequisites: ININ 4020 and ININ 4021. Corequisite: ININ 4015.

Analysis and design of production-inventory systems: Forecasting (Multiple regression and time series analysis), aggregate production planning, master production schedule, inventory systems and their models, project control. Computer applications in these areas.

**ININ 4040. FACILITIES LAYOUT AND DESIGN.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: ININ 4009 and (ININ 4039 or ININ 4155) and (ININ 4021 or ININ 4150). Co-requisite: ININ 4015.

Planning facilities layout and materials handling systems, analytical and computerized solution of problems in the design of physical facilities.

**ININ 4046. INDUSTRIAL ENGINEERING PRACTICE.** Three credit hours. Thirty five hours per week for seven (7) or more weeks during the Summer or its equivalent during the semester. Prerequisite: authorization of the Director of the Department.

A course organized in cooperation with private industry or government to provide the student with practical experience in industrial engineering. The work performed by the student will be jointly supervised by the

Academic Department and an appropriate official from the cooperating organization. An oral and written report will be required from the student upon completion of the project.

**ININ 4050. PRINTED CIRCUIT BOARD ASSEMBLY.** Three credit hours. Three hours of lecture per week. Prerequisites: (QUIM 3132 and QUIM 3134) and (FISI 3172 and FISI 3174) or authorization of the Director of the Department.

Interdisciplinary experience to provide engineering students with a basic understanding of the manufacturing processes required to populate a printed circuit board focusing on surface mount technology. Lectures will include a discussion of processes, required tooling, the process, underlying scientific principles, use of mathematical models, and independent process variables which impact product quality.

**ININ 4057. REAL TIME PROCESS CONTROL.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisites: INGE 3016 and INEL 4076. Corequisites: INME 4055 and (INEL 4077 or INME 4031).

Use of computer-based controllers to control processes using digital and analog signals.

**ININ 4075. PRODUCTION PLANNING AND CONTROL II.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4039.

Evaluation and design of computerized systems for planning and controlling production. Material requirements planning, bill of materials, inventory accuracy and cycle counting, feasible master production plan, capacity planning, shop floor control, integrity requirements of the data bases, systems implementation. Formation of product families, group technology, just in time, kanban system, production synchronization, integration of production control systems.

**ININ 4077. WORK SYSTEMS DESIGN.** Four credit hours. Three hours of lecture and one two-hour laboratory per week. Prerequisite: ININ 4010.

Strategies and models used in work systems design including methods engineering, human factors, and ergonomics.

**ININ 4078. STATISTICAL QUALITY CONTROL.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: ININ 4020.

Statistical control of the quality of processes; statistical methods for quality improvement; univariate and multivariate control charts for variables; attribute control charts; process capability studies; gage and measurement

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studies; setting specification limits; analysis and design of sampling inspection plans; mil. Std. 105e, rectifying inspection plans.

**ININ 4079. DESIGN PROJECT.** Three credit hours. Three hours of laboratory per week. Prerequisites: ININ 4015 and ININ 4040 and (ININ 4022 or ININ 4150) and authorization of the Director of the Department.

Development and presentation of a system design project.

**ININ 4085. ACCOUNTING FOR ENGINEERS.** Three credit hours. Three hours of lecture per week. Prerequisite: ECON 3021.

Basic accounting concepts and systems; uses and limitation of accounting data in the solution of managerial and financial problems; interpretation and use of accounting information for decision making.

**ININ 4086. COST ANALYSIS AND CONTROL.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4085.

Methods used in industry for budgeting, recording, analyzing, and controlling costs; profit planning; design and operation of cost systems; standard cost; and financial statement analysis.

**ININ 4087. COST MANAGEMENT.** Four credit hours. Four hours of lecture per week. Prerequisite: ININ 4010.

Study of techniques to estimate, manage, and control costs in engineering projects, in service and manufacturing organizations. Discussion of case studies and use of computer applications to solve problems.

**ININ 4090. INTERDISCIPLINARY APPROACHES TO PROJECT MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: ADMI 4085 - Fundamentals of Project Management.

Study and application of the fundamental techniques of project management. Participation in the management of an actual public or private project using and interdisciplinary approach. Field work required.

**ININ 4150. INTRODUCTION TO MODELS IN OPERATIONS RESEARCH.** Four credit hours. Four hours of lecture per week. Prerequisite: ININ 4010 and (MATE 4145 or MATE 4031).

Theoretical foundation and algorithms to formulate and solve linear programming and basic queueing problems. Formulation of real life problems, and introduction of optimization methods for their solution. Development of computational skills through the use of software to solve solving the formulated problems.

**ININ 4155. DESIGN AND ANALYSIS OF PRODUCTION SYSTEMS AND INVENTORY MANAGEMENT.** Four credit hours. Four hours of lecture per week. Prerequisites: ININ 4020. Co-requisite: ININ 4015 and ININ 4150.

Study of analytical tools for the design and improvement of production and inventory systems. Discussion of topics such as forecasting techniques, aggregate production planning, inventory models, master production scheduling, material requirements planning, capacity planning, and shop floor control systems, among others.

**ININ 4810. CONCURRENT ENGINEERING.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4077 or INEL 4206 or INME 4011 or INQU 4001.

Introduction to concurrent engineering topics, and its role in modern engineering, design for manufacturing, how concurrent engineering affects product life-cycle issues, safety and integrity in design and manufacturing, maintenance, product disposal and product costing. Case studies. Students will work in interdisciplinary teams applying concepts in the design of products and production facilities to manufacture a product.

**ININ 4995. ENGINEERING PRACTICE FOR CO-OP STUDENTS.** Three to nine credit hours. Prerequisites: Have approved at least 48 credits and have received orientation about the Coop plan. Be registered in the Industrial Engineering program.

Practical experience in industrial engineering in cooperation with private industry or government to be jointly supervised by the academic department, the co-op program coordinator, and an official from the cooperating organization. A written report will be required upon completion of each period of work.

**ININ 4996. SPECIAL PROBLEMS.** One to three credit hours. One to three laboratory periods per week. Prerequisite: authorization of the Director of the Department.

Investigations and special problems in Industrial Engineering or related fields. Open only to outstanding students in the field of Industrial Engineering.

**ININ 4998. UNDERGRADUATE RESEARCH.** One to six credit hours. Three to twenty-four hours of laboratory per week. Pre-requisite: fourth or fifth year student and authorization of the Director of the Department.

Participation, under the supervision of a faculty member acting as an investigator, in a research project.

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## Advanced Undergraduate and Graduate Courses

**ININ 5005. MODERN OPTIMIZATION METHODS.** Three credit hours. Three hours of lecture per week. Prerequisites: ININ 4021 or ININ 4150 or authorization of the Director of the Department.

Advanced undergraduate course addressed to industrial engineering students to studies the most common heuristic search methods. Topics such as simulated annealing, genetic algorithms, tabu search, and combinatorial and continuous optimization problems are discussed. The main techniques and their variations presented and are critically discussed. Key papers from the literature, including applications, are discussed.

**ININ 5006. SYSTEMS ENGINEERING AND ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisites: ININ 4015 or ININ 4007 or INCI 4055 or INCI 4026 or authorization of the Director of the Department.

Introduction to the design of systems considering their lifecycle from conceptualization until disposal, including the basic theory of systems lifecycle management. Study of techniques to evaluate the design of systems that could be industrial, mechanical, electronic, or organizational, with application to multiple disciplines.

**ININ 5007. COMPLEX SYSTEMS MODELING AND SYSTEM DYNAMICS.** Three credit hours. Two hours of lecture and two hours of laboratory per week. Prerequisites: ININ 4021 or ININ 4150 or authorization of the Director of the Department.

Introduction to modeling of system dynamics for the analysis of business decisions with a focus on industrial, service and public policy applications, particularly those decisions forced by structural changes, policies and strategies that affect how the system behaves. Includes the conceptual tools to understand the structure and dynamics of complex systems.

**ININ 5009. LEAN SIX SIGMA METHODOLOGY.** Three credit hours. Three hours of lecture per week. Prerequisites: (ININ 4078 and (ININ 4039 or ININ 4155)) or authorization of the Director of the Department.

Discussion of the basic principles of lean and six sigma methodologies to maximize the value of a product or service focusing primarily on customer satisfaction. Use of the DMAIC methodology as a structured way to integrate the tools of industrial engineering to solve problems related to processes and systems improvement.

**ININ 5105. INTRODUCTION TO MEDICAL DEVICE DESIGN METHODS.** Three credit hours. Three hours of lecture per week. Prerequisites: ININ 4020 or INME

4055 or INEL 4205 or INQU 4008 or authorization of the Director of the Department.

Discussion of fundamental methods for medical device development. Study of the process of medical device development, from concept to marketing. Analysis of procedures of product definition, design, risk management, production planning and market introduction, FDA (Food and Drug Administration) regulations, and intellectual property protection. Case studies illustrating important considerations to manage the complexities of the development process are included.

**ININ 5405. STATISTICAL METHODS IN BIOINFORMATICS.** Three credit hours. Three hours of lecture per week. Prerequisites: ININ 4010 or ININ 5559 or INCI 4136 or AGRO 5005 or ESMA 3101 or ESMA 4001 or ESMA 4006 or ESTA 3002 or authorization of the Director of the Department.

Study and application of statistical methods related to bioinformatics analysis including sequence analysis, gene expression and phylogenetic trees. Use of methods such as inferential statistics, statistical modeling, clustering analysis and Markovian processes.

**ININ 5505. TOTAL QUALITY MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4078 or authorization of the Director of the Department.

Introduction to innovative philosophies in total quality control. The impact of leadership, organizational infrastructure and client satisfaction on quality management. Utilization and management of information, personnel, processes and product design for continuous quality improvement.

**ININ 5559. ENGINEERING STATISTICS.** Three credit hours. Three hours of lecture per week. Prerequisites: (MATE 3032 and INGE 3016) or authorization of the Director of the Department.

Development of probability theory for scientific and engineering inference. Discrete and continuous random variables and distributions and their applications in engineering. Hypothesis testing and confidence intervals. Regression analysis. Applications to engineering problem solving.

**ININ 5565. MEASUREMENT AND PREDICTION OF PRODUCT RELIABILITY.** Three credit hours. Three hours of lecture per week. Prerequisite: ININ 4020 or authorization of the Department.

Introduction to reliability theory; system analysis; constant failure rate models; time dependent failure rate models; state dependent systems; availability;

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maintainability; complete and censored data analysis (parameter estimation and distribution fitting); prediction of reliability.

**ININ 5575. SEQUENCING AND SCHEDULING OF RESOURCES.** Three credit hours. Three hours of lecture per week. Prerequisites: ININ 4021 or ININ 4150 or authorization of the Director of the Department.

Conceptual and practical aspects involved in the scheduling of resources. Examples and applications drawn from areas such manpower, computer, and transportation.

**ININ 5595. DESIGN AND MANAGEMENT OF SERVICES PROCESSES.** Three credit hours. Three hours of lecture per week. Prerequisites: ININ 4009 and (ININ 4039 or ININ 4155 or authorization of the Director of the Department).

Industrial engineering techniques and models to design and manage the operations of service organizations or services processes in manufacturing enterprises. Development, evaluation, and implementation of alternative solutions to the operational problems of service organizations. Use of models and techniques in marketing, quality assurance and management, work measurement and design, operations research, production planning and control, engineering economics, human resources, management information systems, and facilities layout.

**ININ 5997. SELECTED TOPICS IN INDUSTRIAL ENGINEERING.** One to six credit hours. One to six hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Discussion of selected topics in Industrial Engineering or related fields.

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## DEPARTMENT OF MECHANICAL ENGINEERING

The College of Engineering offers a five-year program leading to a Bachelor of Science degree in Mechanical Engineering. The program is administered by the Department of Mechanical Engineering.

Mechanical engineers are present in almost every industry. For example, a mechanical engineer might work in product development. In this case, mechanical engineers either enhance current products, or design new ones. Efficiency and performance are two criteria that a mechanical engineer would try to maximize. Most fundamentally, they apply the principles of two physics' fields—mechanics and heat—to the design of machines. Heat is one of the principal forms in which we use energy, so mechanical engineering is fundamental to all processes in which energy is produced and used. The field of mechanics is divided into the sub-fields of *solid mechanics* and *fluid mechanics*, and both of these sub-fields are basic to mechanical engineering.

Students wishing to develop a strong engineering basis to their work in Bioengineering, Aerospace Engineering, Automotive Engineering and Renewable Energy are encouraged to pursue their interests in the Department of Mechanical Engineering. These engineering areas are interdisciplinary fields that include design, dynamics, solid mechanics, controls, fluid mechanics, heat and mass transfer, thermodynamics, robotics and manufacturing.

Mechanical engineering is a growing field, as technology and mechanization continues to grow and improve. Mechanical engineers can work in a large variety of fields and settings, making them very versatile and employable. Many of the technological advances that we now take for granted were made in collaboration with mechanical engineers. Some examples are: Agricultural Mechanization, Air Conditioning and Refrigeration, Space Exploration, Bioengineering, Computer Aided Design Technology, Electronic Products, Power Generation, Airplanes, and Automobiles.

### Mission

Enabling the preparation and formation of mechanical engineering leaders for Puerto Rico and the world by encouraging creativity, teaching analytical ability, inculcating professional ethics and ingraining lifelong learning.

### Vision

Influence the frontiers of Mechanical Engineering locally and globally through competency, coherence and commitment.

### Program Educational Objectives

Based on the major program objectives, and after surveying our constituents, the following general skills and competencies are required of our graduates during the first five years after graduation. These skills and competency requirements constitute the Program Educational Objectives (PEOs):

1. Interact and function in a multicultural and multidisciplinary environment.
2. Address the challenges of fast moving changes and newly emerging areas in the profession.
3. Provide quality and ethical contributions to the profession, society and engineering knowledge base.
4. Become leaders and team-builders.
5. Be self-motivated to pursue life-long learning.

The Bachelor of Science Program in Mechanical Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

### Student Outcomes

The ME program adheres to the 1-7 Student Outcomes of the Engineering Accreditation Commission of ABET. These outcomes are defined as the skills and competencies that students are required to have at the time of graduation, and are given below:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety,

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- and welfare, as well as global, cultural social, environmental, and economic factors
  3. an ability to communicate effectively with a range of audiences
  4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
  5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
  6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
  7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

### **Emphases Areas (Cert. 69)**

Students graduating in or after Fall 2014-15 may elect to complete one optional emphases within Mechanical Engineering. A BSME emphasis, will indicate high academic achievement in the area of specialization. The general requirements of the emphases areas are:

- A 3.0 GPA ('B' average) must be earned for the three technical electives within the emphasis;

#### Aerospace Engineering (AE)

The goal of the emphasis area is to educate mechanical engineering students to identify and solve aerospace-related problems in the fields of structures, propulsion and aerodynamics.

Aerospace Engineering can be defined as the combination of aeronautical engineering and astronautical engineering. Aeronautical Engineering deals with the whole field of analysis, design, manufacturing, maintenance, testing, and use of aircraft. It involves the knowledge of aerodynamics, structures, propulsion, flight mechanics, avionics, and other related areas. Astronautical engineering is closely allied to aeronautics, but is concerned with the flight of vehicles in space, beyond the earth's atmosphere, and includes the study and development of rocket engines, artificial satellites, and spacecraft for the exploration of outer space. As there is a certain

degree of technology overlap between the two fields, the term Aerospace is often used to describe them both. Hence, Aerospace Engineering can be defined as the analysis, design, manufacturing, and use of aircraft and/or spacecraft. Aerospace Engineering is a very diverse field with a multitude of commercial, industrial and government applications.

Typical Aerospace Engineering programs are designed for students who desire to learn about flight, whether in the atmosphere or in space. Programs typically begin with basic study of engineering principles, such as structures, thermodynamics, statics, and design and as the programs progress, students move on to the study of propulsion, control systems, and aerodynamics. Graduates gain a high level of technical expertise that will serve them well in various engineering occupations, such as those within industry and government.

### **Student profile**

Students completing the emphasis area will have the ability to apply fundamental principles (e.g., math, science, and engineering) and use analytical and numerical methods to solve problems in aerospace sciences.

### **Learning Objectives**

Throughout the emphasis area, students will be exposed to the following educational and learning objectives:

1. Apply knowledge of mathematics, science and engineering.
2. Identify, formulate and solve aerospace engineering problems.
3. Use the techniques, skills, and modern engineering tools necessary for aerospace engineering practice.
4. Communicate effectively in aerospace-related team projects.

### **Course sequence**

Students must take the following courses in order to complete the AE emphases area:

INME 4705 Applied Aerodynamics  
INME 4707 Gas Turbine Thermodynamics. & Propulsion  
INME 4709 Aircraft Performance  
INME 4717 Introduction to Aircraft Structural Analysis  
INME 5707 Gas Turbine System Operation  
INME 5717 Aircraft Structural Analysis and Design



Choose one of the following:

INME 4039 in an Aerospace Engineering Topic

INME 4995 in an Aerospace Engineering Topic

INME 4998 in an Aerospace Engineering Topic

INME5015 in an Aerospace Engineering Topic

## PROGRAM OF STUDY

### MECHANICAL ENGINEERING CURRICULUM

#### FIRST YEAR

##### First Semester

| Number       | Credits  | Course                         |
|--------------|----------|--------------------------------|
| QUIM 3131    | 3        | General Chemistry I            |
| QUIM 3133    | 1        | General Chemistry Laboratory I |
| *INGL 3---   | 3        | First year course in English   |
| *ESPA 3101   | 3        | Basic course in Spanish I      |
| INGE 3809    | 3        | Creative Design I              |
| **Socio Hum. | <u>3</u> | Elective                       |
|              | 16       |                                |

##### Second Semester

| Number     | Credits  | Course                          |
|------------|----------|---------------------------------|
| MATE 3031  | 4        | Calculus I                      |
| QUIM 3132  | 3        | General Chemistry II            |
| QUIM 3134  | 1        | General Chemistry Laboratory II |
| *INGL 3--- | 3        | First year course in English    |
| ESPA 3102  | 3        | Basic course in Spanish II      |
| INME 3810  | <u>2</u> | Creative Design II              |
|            | 16       |                                 |

#### SECOND YEAR

##### First Semester

| Number    | Credits  | Course                        |
|-----------|----------|-------------------------------|
| MATE 3032 | 4        | Calculus II                   |
| FISI 3171 | 4        | Physics I                     |
| FISI 3173 | 1        | Physics Laboratory I          |
| INGL 3--- | 3        | Second year course in English |
| INGE 3031 | <u>3</u> | Engineering Mechanics-Statics |
|           | 15       |                               |

##### Second Semester

| Number     | Credits  | Course                         |
|------------|----------|--------------------------------|
| MATE 3063  | 3        | Calculus III                   |
| FISI 3172  | 4        | Physics II                     |
| FISI 3174  | 1        | Physics Laboratory II          |
| ^INGL 3--- | 3        | Second year course in English  |
| INGE 3032  | 3        | Engineering Mechanics-Dynamics |
| EDFI ---   | <u>1</u> | Physical Education Elective    |
|            | 15       |                                |

#### THIRD YEAR

##### First Semester

| Number       | Credits  | Course                              |
|--------------|----------|-------------------------------------|
| MATE 4009    | 3        | Ordinary Differential Equations     |
| INGE 3016    | 3        | Algorithms and Computer Programming |
| INME 4001    | 3        | Thermodynamics I                    |
| INGE 4019    | 4        | Mechanics of Materials              |
| **Socio Hum. | <u>3</u> | Elective                            |
|              | 16       |                                     |

##### Second Semester

| Number    | Credits  | Course                            |
|-----------|----------|-----------------------------------|
| INGE 4010 | 4        | Fluid Mechanics                   |
| INME 4005 | 3        | Mechanism Design                  |
| INME 4002 | 3        | Thermodynamics II                 |
| INEL 4075 | 3        | Fundamentals of Electrical Eng    |
| INME 4107 | <u>4</u> | Materials Science and Engineering |
|           | 17       |                                   |

#### FOURTH YEAR

##### First Semester

| Number    | Credits  | Course                                  |
|-----------|----------|---|
| INME 4210 | 3        | Systems Dynamics                        |
| INEL 4076 | 3        | Fundamentals of Electronics             |
| INME 4011 | 3        | Design of Machine Elements I            |
| INME 4015 | 3        | Heat Transfer                           |
| ECON 3021 | <u>3</u> | Principles of Economics: Microeconomics |
|           | 15       |   |

##### Second Semester

| Number       | Credits  | Course                                 |
|--------------|----------|--|
| ININ 4007    | 3        | Industrial Organization and Management |
| INME 4055    | 3        | Manufacturing Processes                |
| INME 4056    | 1        | Manufacturing Process Lab              |
| INME 4012    | 3        | Design of Machine Elements II          |
| ELECTIVE     | 3        | Free Elective                          |
| **Socio Hum. | <u>3</u> | Elective                               |
|              | 16       |  |

#### FIFTH YEAR

##### First Semester

| Number       | Credits  | Course                                     |
|--------------|----------|--|
| INME 4235    | 2        | Instrumentation and Measurement Laboratory |
| INME ----    | 3        | Design Elective                            |
| INME ----    | 3        | Technical or Design Elective               |
| ELECTIVE     | 3        | Free Elective                              |
| ELECTIVE     | 3        | Free Elective                              |
| **Socio Hum. | <u>3</u> | Elective                                   |
|              | 17       |  |

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## Second Semester

| Number    | Credits        | Course                       |
|-----------|----------------|------------------------------|
| INME 4236 | 2              | Thermal Science Laboratory   |
| INME 4057 | 4              | Engineering Design           |
| INME ____ | 3              | Design Elective              |
| INME ____ | 3              | Technical or Design Elective |
| ELECTIVE  | 3              | Free Elective                |
| EDFI      | $\frac{1}{16}$ | Physical Education Elective  |

## Total credits required for this program: 159

- \* Refer to the Academic Regulations section for information on Advanced Placement.
- \*\* The twelve (12) credit hours of Sociohumanistic electives will be selected by the student, with the advisor's approval, from a list of recommended courses.
- ^ Only for students who are in the Basic Sequence; choose from the following courses: INGL 3191, INGL 3202 or INGL 3209.

## DEPARTMENTAL FACULTY

**J. GUILLERMO ARAYA**, *Associate Professor*, Ph.D., 2008, Rensselaer Polytechnic Institute.

**JAYANTA BANERJEE**, *Professor*, Ph.D., 1969, University of Waterloo.

**PABLO CÁCERES-VALENCIA**, *Professor*, Ph.D., 1985, University of Wales.

**SILVINA CANCELOS**, *Professor*, Ph.D., 2007, Rensselaer Polytechnic Institute.

**SANDRA COUTÍN**, *Professor*, Ph.D., 1996, Kansas State University.

**RUBÉN DÍAZ**, *Professor*, Ph.D., 2005, University of California, Berkeley.

**DAVID B. DOONER**, *Professor*, Ph.D., 1991, University of Florida, Gainesville.

**GUSTAVO GUTIÉRREZ**, *Professor*, Ph.D., 2002, University of Wisconsin-Milwaukee.

**YI JIA**, *Professor*, Ph.D., 1994, Harbin Institute of Technology, Harbin, China.

**FREDERICK A. JUST-AGOSTO**, *Professor*, Ph.D., 1997, Virginia Polytechnic Institute and State University.

**JOSE LUGO**, *Associate Professor*, Ph.D., 2013, University of Notre Dame.

**MARCO MENEGOZZO**, *Assistant Professor*, Ph.D., 2015, University of Padova, Italy

**NÉSTOR L. PÉREZ-BARRIOS**, *Professor*, Ph.D., 1988, University of Idaho.

**FERNANDO PLA-BARBY**, *Emeritus Professor*, Ph.D., 1978, University of Texas, Austin.

**PEDRO QUINTERO**, *Professor*, Ph.D., 2007, University of Maryland.

**PEDRO RESTO**, *Associate Professor*, Ph.D., 2012, University of Wisconsin, Madison.

**FRANCISCO RODRÍGUEZ-ROBLES**, *Professor*, Ph.D., 2003, University of Dayton.

**DAVID SERRANO**, *Professor*, Sc.D., 1987, Massachusetts Institute of Technology.

**PAUL A. SUNDARAM**, *Professor*, Ph.D., 1988, The Ohio State University.

**SHEILLA TORRES NIEVES**, *Associate Professor*, Ph.D., 2011, Rensselaer Polytechnic Institute.

**RICKY VALENTÍN**, *Professor*, Ph.D., 2003, University of Maryland.

## COURSES OF INSTRUCTION

### MECHANICAL ENGINEERING

**INGE/INME 3809**. CREATIVE DESIGN I. Three credit hours. Two hours of lecture and one two-hour laboratory per week.

Introduction to the underlying principles and methodologies of engineering graphics communications, as a tool for the solution of engineering problems: Fundamentals of graphic visualization, sketching, PC-based Computer-Aided-Design (CAD), and technical presentations. An introduction to computer-aided-design software will include principles of parametric solid modes of mechanical parts and assemblies including dimensions and tolerances. Solid modeling is the tool for visualization, and analysis of engineering problems.

**INME 3810**. CREATIVE DESIGN II. Two credit hours. Two hours of lecture per week. Prerequisite: (INGE 3809 or INME 3809) or INGE 3011.

Product dissection uses hands-on dissection exercises to develop in students the ability to understand a machine in not only its functionality but also in terms of its history, social impact, the design methodology, the marketing constraints and the customer needs. Use of proper technical vocabulary to describe mechanical and

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electrical components. Learn oral, written and hand sketching communication skills.

**INME 4001. THERMODYNAMICS I.** Three credit hours. Three hours of lecture and one hour of tutorage per week. Prerequisites: (QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134)) and (FISI 3174 or FISI 3164) and (FISI 3172 or FISI 3162).

A study of the fundamental laws of thermodynamics as applied to closed and open systems. Properties, equations of state, processes and basic cycles.

**INME 4002. THERMODYNAMICS II.** Three credit hours. Three hours of lecture and one hour of tutorage per week. Prerequisite: INME 4001.

The application of the fundamental concepts of thermodynamics to the study of power and refrigeration cycles and combustion processes. Introduction to gas dynamic: concepts, nonreactive mixtures and psychrometrics.

**INME 4003. DESIGN OF THERMAL AND FLUID SYSTEMS.** Three credit hours. Three hours of lecture per week. Prerequisites: INME 4001 and INME 4015.

Analysis and design of piping systems and heat exchangers. Selection of pumps and fans. Systems simulation and modeling.

**INME 4005. MECHANISM DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 3032 and (INGE 3017 or INME 3810).

Fundamental concepts of the kinematic analysis of basic mechanics, such as linkages, cams, gears, and flexible connectors.

**INME 4006. DYNAMICS OF MACHINERY.** Three credit hours. Two hours of lecture and one two-hour computation or demonstration period per week. Prerequisites: MATE 4009 and INME 4005.

A study of static and inertia forces in machinery; free and forced vibration isolation; balancing of rotors; critical speed of shafts.

**INME 4009. AUTOMATIC CONTROLS.** Three credit hours. Two hours of lecture and one two-hour laboratory per week. Prerequisites: MATE 4009 and INGE 3032 and INEL 4075 and (INEL 3105 or INEL 4005).

Use, calibration and sensitivity of instruments for measuring temperature, pressure, volume, strain, and fluid flow: analysis of electrical, electronic, hydraulic, mechanical and pneumatical servomechanisms; control systems and their characteristics, such as: response, sensitivity and stability.

**INME 4011. DESIGN OF MACHINE ELEMENTS I.** Three credit hours. Three hours of lecture per week. Prerequisites: (INGE 4012 and INGE 4001 and INME 4005) or (INME 4107 and INGE 4019 and INME 4005).

Application of strength of materials and material science in machine element design. Introduction and use of static and dynamic failure theories in the design of machine elements.

**INME 4012. DESIGN OF MACHINE ELEMENTS II.** Three credit hours. Three hours of lecture per week. Prerequisites: INME 4011 and (INME 4007 or INME 4107).

Analysis and design of specific machine components including screws, nuts, springs, gears, bearing, shafts, brakes, clutches, and couplings.

**INME 4015. HEAT TRANSFER.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 4009 and INGE 3016 and (INME 4001 or INME 4045) and (INGE 4015 or INGE 4010).

Fundamentals of steady and unsteady conduction, forced and natural convention and radiation. Introduction to heat exchangers.

**INME 4018. ENERGY CONVERSION.** Three credit hours. Three hours of lecture per week. Prerequisites: INME 4015, INEL 4076 and INME 4002.

A study of the different methods of energy conversion. The course will cover the basic theoretical concepts, and will include discussions on conventional and modern devices for energy conversion, such as steam generators, internal combustion engines, turbines, thermoionic and thermoelectric systems, fuel cells, thermonuclear plants, and lasers.

**INME 4019. ENERGY AUDITING AND MANAGEMENT.** Three credit hours. Three hours of lecture per week. Prerequisite: INME 4001 or INQU 4011.

Fundamental concepts of energy engineering; principles and methods related to the use, conservation, auditing and management of energy sources.

**INME 4027. POWER PLANT ENGINEERING.** Three credit hours. Two hours of lecture and three of computation per week. Prerequisites: INME 4002 and INME 4015.

The application of fundamental concepts of thermal sciences and economics to the analysis of power generating stations; emphasis on steam and gas systems.

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**INME 4031. MACHINE SCIENCE LABORATORY.** Two credit hours. One two-hour laboratory per week. Prerequisites: INME 4015, INEL 4076 and INME 4002.

Experiments and projects in the areas of machine science: synthesis and analysis of kinematics chains, shafts, gears, torque loading in bolt assemblies, dynamic and static loading, fatigue and other failure mechanisms. Introduction to applied statistics and design of experiments, use of transducers, sensors and computer-based data acquisition systems for collecting and evaluating data related to position, velocity, acceleration, force, torque, mechanical vibrations, and sound level.

**INME 4035. REFRIGERATION AND AIR CONDITIONING.** Three credit hours. Three hours of lecture per week. Prerequisites: INME 4015 and INME 4002.

A comprehensive study of the fundamentals of air conditioning; psychometric calculations; comfort, health and industrial processes requirements; heating and cooling loads; air conditioning equipment and its selection.

**INME 4037. INTERNAL COMBUSTION ENGINES.** Three credit hours. Three hours of lecture per week. Prerequisite: INME 4015.

A presentation and study of modern spark-ignition and compression-ignition engines, including types and characteristics; operating power cycles; combustion phenomena; engine performance; heat losses and efficiencies.

**INME 4039. MECHANICAL ENGINEERING PRACTICE.** Three credit hours. Thirty five hours per week for seven (7) or more weeks during the summer or its equivalent during the semester. Prerequisite: authorization of the Director of the Department.

A course organized in cooperation with private industry or government to provide the student with practical experience in mechanical engineering. The work performed by the student will be jointly supervised by the Academic Department and an appropriate official from the cooperating organization. An oral and written report will be required from the student upon completion of the project.

**INME 4045. GENERAL THERMODYNAMICS FOR ENGINEERS.** Three credit hours. Three hours of lecture per week. Prerequisites: (FISI 3172 or FISI 3162 or FISI 3012) and (QUIM 3002 or QUIM 3042 or (QUIM 3132 and QUIM 3134)).

Fundamental laws and principles of thermodynamics and their application in engineering. Thermodynamic and

energetic concepts, properties of pure substances, heat transfer, heat engines.

**INGE/INME 4046. FUNDAMENTALS OF VIBRATION.** Three credit hours. Three hours of lecture per week. Prerequisite: INGE 3032. Co-requisite: MATE 4009.

Study of the theory of vibration for single- and two-degree-of freedom systems. Free vibration analysis, response to harmonic and non-harmonic excitations, design for vibration control, and introduction to matrix analysis of multi-degree-of-freedom systems.

**INME 4055. MANUFACTURING PROCESSES.** Three credit hours. Three hours of lecture per week. Prerequisite: INGE 4001 or INME 4107.

Different manufacturing processes and machine- tools; influence of the method of fabrication upon the properties of materials; computer and numerical control of machine-tools; use of plastics.

**INME 4056. MANUFACTURING PROCESSES LABORATORY.** One credit hour. One three-hour laboratory per week. Corequisite: INME 4055.

Demonstrations and operation of machine-tools in modern manufacturing.

**INME 4057. ENGINEERING DESIGN.** Four credit hours. Two hours of lecture and two three-hour periods of computation per week. Prerequisites: INME 4002 and (INME 4007 or INME 4107) and INME 4012 and INME 4015.

Formulation, design and analysis of engineering projects; creative aspects of design; design methodology, safety, liability and patents. Technical presentation, both oral and written.

**INME 4058. COMPUTER AIDED DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisites: INME 4012 and INME 4015.

Study of the principles of computer aided engineering design applied to mechanical engineering problems. Introduction to finite element and design optimization techniques. Use of programming and commercial software to design mechanical system.

**INME 4065. PRODUCT DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisites: authorization of the Director of the Department.

Factors affecting a product design: composition, cost, reliability, quality, maintainability, manufacturability,

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and aesthetics. These factors are applied in a project design.

**INME 4107. MATERIALS SCIENCE AND ENGINEERING** Four credit hours. Three hours of lecture and two hours of laboratory per week. Prerequisites: QUIM 3132 and QUIM 3134 and FISI 3171.

A study of the relationship of the mechanical properties of materials to their micro and macro structure, with emphasis on the application of materials in the fields on engineering.

**INME 4210. SYSTEM DYNAMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: MATE 4009 and (INGE 4010 or INGE 4015) and [(INGE 4019 or (INGE 4011 and INGE 4012))] and INEL 4075. Corequisite: INME 4015.

Study of dynamic systems in the mechanical linear-rotational, electrical, hydraulic, thermal and electromechanical domain. Modeling of linear dynamic systems, linearization of non-linear systems, use of analytical tools to predict the dynamic behavior of systems. Use of Laplace transform, block algebra, frequency diagrams and simulation in the analysis and design of dynamic systems.

**INME 4235. MECHATRONICS LABORATORY.** Two credit hours. One hour of lecture and one three-hour laboratory per week. Prerequisites: INME 4210 and INME 4011 and INME4002 and INEL4076. Co-requisite: INME 4015 and INME 4012.

Experiments and exercises in instrumentation, calibration, statistical methods, data acquisition, and computer interfacing to design, and monitor systems with the use of control theory, electronics and computing.

**INME 4236. THERMAL SCIENCE LABORATORY.** Two credit hours. One three-hour laboratory per week. Prerequisite: INME 4235.

Experiments and projects in the thermal sciences discipline including the areas of thermodynamics, heat transfer and fluid mechanics. Transducers, sensors and data acquisition systems are used to measure temperature, flow rate, pressure, voltage and electrical current in various systems and applications.

**INME 4705. APPLIED AERODYNAMICS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 3016 and (INGE 4010 or (INGE 4015 and INGE 4016)) and (MATE 4009 or MATE 4145).

Analysis of fluid flow behavior around a rigid body by applying the continuity, momentum and energy

equations, two-dimensional potential flow, and the panel method. Analysis of finite wings models using two- and three-dimensional lifting theory and vortex lattice solutions. Study of compressibility effects to analyze fluid flow behavior around transonic wings. Introduction to computational fluid dynamics.

**INME 4707. GAS TURBINE THERMODYNAMICS AND PROPULSION.** Three credit hours. Three hours of lecture per week. Prerequisites: INME 4002 or INQU 4012 or INME 4045 and INGE 4010 and (INGE 4015 and INGE 4016) and INGE 3016 and MATE 4009 or MATE 4145. Corequisite: INME 4002.

Study of how concepts of thermodynamics, fluid mechanics, aerodynamics, and compressible flow theory are applied to the analysis and design of aircraft jet engines. Analysis of gas turbine using jet engine familiarization, cycle analysis, propulsion and turbomachinery theories. Study of jet engine performance using energy budgets and its optimization in the jet engine cycle. Discussion of actual industry testing applications.

**INME 4709. AIRCRAFT PERFORMANCE.** Three credit hours. Three hours of lecture per week. Prerequisites: (INGE 3032 or INGE 3035) and (MATE 4009 or MATE 4145) and INGE 3016.

Study of performance and design characteristics of conventional aircraft using atmospheric properties, and the concepts of lift and drag. Design for specified flight conditions and the flight conditions for best performance using the physical characteristics of an aircraft. Analysis of level flight performance, rates of climb, service and absolute ceilings, range, take-off and landing, and turn performance.

**INME 4717. INTRODUCTION TO AIRCRAFT STRUCTURAL ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisites: INGE 3016 and (INGE 3035 or INGE 3032) and (MATE 4009 or MATE 4145).

Introduction and application of solid mechanics to analyze aerospace structures. Study of aircraft components and their design philosophy. Environmental load design diagrams. Development and application of elasticity to describe the stress, strain, and displacement fields of one- and two-dimensional problems in aerospace structures. Analysis of bending, shear and torsional theories for arbitrary, multimaterial, and multicell wing cross-sections. Analysis of thin-walled single and multicell stiffened shell sections using analytical and numerical solutions.

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**INME 4810. DESIGN AND TECHNIQUES FOR AUTOMATION.** Three credit hours. Two hours of lecture and three hours of laboratory per week. Prerequisite: INME 4055.

Introduction to automatic assembly systems. Design of products for ease of assembly. Analysis and design of special purpose automated equipment for parts manufacture, assembly, packaging or general industrial automation. Design of automatic assembly systems and their integration using programmable logic controller technology.

**INME 4850. INTRODUCTION TO ROBOTICS.** Three credit hours. Three hours of lecture per week. Prerequisite: INME 4011.

Analysis and design of mechanical manipulators by means of kinematic and dynamic models. Use of the direct or inverse kinematics analysis techniques to calculate the position of the robot tool, the required joint variables, and to perform workspace analysis and trajectory and motion planning.

**INME 4995. ENGINEERING PRACTICE FOR COOP STUDENTS.** Zero to nine credit hours. Prerequisite: authorization of the Director of the Department.

Practical experience in mechanical engineering in cooperation with private industry or government to be jointly supervised by the academic department, the co-op program coordinator, and an official from the cooperating organization. A written report will be required upon completion of each period of work.

**INME 4998. UNDERGRADUATE RESEARCH.** One to six credit hours. Three to twenty-four hours of research per week. Pre-requisite: fourth or fifth year student and authorization of the Director of the Department.

Participation, under the supervision of a faculty member acting as an investigator, in a research project.

#### **ADVANCED UNDERGRADUATE COURSES**

**INME 5005. LUBRICATION.** Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Fundamental principles and concepts of lubrication theory; hydrostatic and hydrodynamic lubrication; examples of journal and thrust bearing design, using both the hydrostatic and hydrodynamic principles; considerations in boundary lubrication.

**INME 5007. SOLAR ENERGY APPLICATIONS.** Three credit hours. Three hours of lecture per week.

Prerequisite: INME 4015 or INQU 4001 or authorization of the Director of the Department.

Fundamentals of solar radiation, its measurement, and methods of estimation. Selected topics on heat transfer relevant to systems design applications of solar energy such as flat plate and focusing collectors, energy storage systems, heating and cooling systems, power systems, and distillation processes.

**INME 5008. CORROSION.** Three credit hours. Three hours of lecture per week. Prerequisite: INME 4007 or INME 4107 or authorization of the Director of the Department.

Electrochemical principles and corrosion mechanisms; protection and prevention of corrosion in metals; the effects of temperature, environment, and metallurgical factors.

**INME 5015. SELECTED TOPICS IN MECHANICAL ENGINEERING.** One to six credit hours. One to six hours of lecture per week. Prerequisite: authorization of the Director of the Department.

A study of certain selected topics in mechanical engineering not covered by other existing courses.

**INME 5018. MATERIALS FAILURE ANALYSIS.** Three credit hours. Three hours of lecture per week. Prerequisites: ((INME 4012 and INME 4007) or (INME 4012 and INME 4107)) or authorization of the Director of the Department.

Materials science concepts used to identify, correct and prevent failure due to the improper use of materials or to problems in manufacturing processes. In depth study of failure mechanisms such as fatigue, wear, creep, and corrosion.

**INME 5025. METALS FATIGUE.** Three credit hours. Three hours of lecture per week. Prerequisite: INME 4007 or INME 4107 or authorization of the Director of the Department.

Nature of metal fatigue; modern approaches to design of mechanical components for repeated loadings; importance of residual stresses and stress concentrations; analysis of cumulative damage and life prediction; cycle counting and sequence of events.

**INME 5707. GAS TURBINE SYSTEM OPERATION.** Three credit hours. Three hours of lecture per week. Prerequisites: ((INME 4002 or INME 4045 or INQU 4012) and INGE 3016 and INME 4707) or authorization of the Director of the Department.

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Study of jet engine performance using energy budgets and its optimization in the jet engine cycle. Study of turbomachine components, such as compressors, combustors, turbines and nozzles, as integrated into a system that produces power aircrafts. Development of a thermodynamic model for a turbofan engine to investigate design and off-design behavior, and the response to external and internal parameters. Study the influence of design criteria such as structural integrity, emissions, acoustics, and operationally-stable throttle response on the integration process.

**INME 5717. AIRCRAFT STRUCTURAL ANALYSIS AND DESIGN.** Three credit hours. Three hours of lecture per week. Prerequisites: (INME 4717 and (INGE 4019 or INGE 4012)) or authorization of the Director of the Department.

Application of work and energy principles, and numerical methods, to the design of flight vehicles. Study of deflection and load analysis using the principle of virtual work, principle of contemporary virtual work, analytical weak form solutions, and the finite element formulation. Wing design considering: fatigue, aeroelasticity, divergence, environmental loads, aerospace materials, dynamic stability of thin-walled compression members, and structural dynamics.

**INME 5995. SPECIAL PROBLEMS.** One to six credit hours. One to six hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Researches and special problems in Mechanical Engineering and related fields.

**INME 5996. SPECIAL PROBLEMS II.** One to six credit hours. One hour of lecture per week per credit. Prerequisite: authorization of the Director of the Department.

Study of special problems in Mechanical Engineering and related fields.

**INME 5997. SELECTED TOPICS II.** One to six credit hours. One to six hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study of selected topics in mechanical engineering or related fields.

