

COURSE SYLLABUS

1. General Information:

Alpha-numeric codification: INGE 5016
Course Title: Introduction to Materials Characterization
Number of credits: 3
Contact Period: 3 hours of lecture per week

2. Course Description:

English: 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.

Spanish: Discusión de la teoría y práctica de las técnicas de micro-caracterización, incluyendo microscopía óptica, análisis térmico, difracción de haz de electrones e interacciones inducidas por rayos-x y fotones. Explicación de las técnicas complementarias de análisis de superficies y métodos experimentales para diseño y selección de materiales metálicos, poliméricos, biológicos o materiales compuestos.

3. Pre/Co-requisites and other requirements:

INGE 3045 or INGE 4001 or INME 4107 or authorization of the Director of the Department.

4. Course Objectives:

After completing this course, the students should be able to:

- Identify the most suitable characterization technique relevant to specific materials analysis
- Analyze the capabilities and limitations of the techniques studied
- Characterize different types of materials from the chemical, physical, structural, and mechanical viewpoints.

5. Instructional Strategies:

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|---|--|--|-------------------------------------|
| <input checked="" type="checkbox"/> Conference | <input checked="" type="checkbox"/> Discussion | <input type="checkbox"/> Computation | <input type="checkbox"/> Laboratory |
| <input type="checkbox"/> Seminar with formal presentation | | <input type="checkbox"/> Seminar without formal presentation | |
| <input type="checkbox"/> Workshop | <input type="checkbox"/> Art workshop | <input type="checkbox"/> Practice | <input type="checkbox"/> Trip |
| <input type="checkbox"/> Thesis | <input type="checkbox"/> Special problems | <input type="checkbox"/> Tutoring | <input type="checkbox"/> Research |
| <input type="checkbox"/> Other, please specify: | | | |

6. Minimum or Required Resources Available:

Textbook, Laptop with camera, access to High Speed Internet.

7. Course time frame and thematic outline:

Outline of Topics	Contact Hours
Introduction to the physics and chemistry of micro-characterization techniques	3
Optical microscopy and introductory image analysis	6
Other surface and bulk analysis techniques	3
Chemical Characterization: Fourier Transform Infrared Spectroscopy (FTIR)	3
Chemical Characterization: Nuclear Magnetic Resonance (NMR) Spectroscopy	3
Mechanical Characterization: Nanoindentation	3
X-ray and photon-induced interactions	6
Viscoelasticity as a phenomenon; metals vs. polymers: structure & deformation. Mechanical behavior: Hookean vs. Viscoelastic response	3
Creep-recovery & Stress-relaxation. Mathematical representation and Mechanical models.	3
Viscoelasticity: Experimental Methods and ASTM Standards	3
Applications to the study of functional bulk and nanostructured materials	5
Evaluations	4
Total hours: (equivalent to contact period)	45

8. Grading System:

Quantifiable (letters) Not Quantifiable

9. Evaluation Strategies:

	Quantity	Percent
<input type="checkbox"/> Exams		
<input type="checkbox"/> Final Exam		
<input type="checkbox"/> Short Quizzes	0 - 2	0 - 25
<input checked="" type="checkbox"/> Oral Reports	0 - 1	0 - 25
<input type="checkbox"/> Monographies		
<input type="checkbox"/> Portfolio		
<input checked="" type="checkbox"/> Projects	0 - 4	50 - 100
Other, specify:		
TOTAL:		100%

10. Bibliography:

The following journal and books are available at the General Library:

- Materials Characterization, Elsevier Journal
- “Optical Techniques for Solid-State Materials Characterization”, Ed. Antoinette J . Taylor, CRC Press 2011, ISBN: 978-1-4398-1537-3, 978-1-4398-1437-6
- “Introduction to the Principles of Materials Evaluation”, David C . Jiles, CRC Press 2007, ISBN: 978-0-8493-7392-3, ISBN: 978-1-4200-0736-7
- “Functional Materials: Properties, Performance and Evaluation”, Ed. Ewa Klodzinska, Apple Academic Press 2015, ISBN: 978-1-77188-037-4, 978-1-4822-5415-0
- “Experimental Characterization of Advanced Composite Materials”, Fourth Edition, Leif A. Carlsson, Donald F. Adams, and R. Byron Pipes, CRC Press 2014, ISBN: 978-1-4398-4858-6, 978-1-4398-4859-3
- “Dekker Encyclopedia of Nanoscience and Nanotechnology”, Second Edition, Ed. Cristian I . Contescu and Karol Putyera, CRC Press 2008, ISBN: 978-0-8493-9639-7, 978-0-415-89129-5

11. Reasonable Accommodation (Law 51):

The University of Puerto Rico at Mayagüez (RUM) recognizes that each student has an inherited right to request reasonable accommodation according to Law 51: Law for Integral Educational Services for People with Disabilities. Every student has the right to receive reasonable accommodation if he/she presents the necessary evidence to be evaluated by the Office of Services to Students with Disabilities (OSEI-RUM), and the related information can be found at the following link: <https://www.uprm.edu/cms/index.php/page/85>. If your case is approved by OSEI-RUM, you will receive reasonable accommodation in your courses and evaluation, and you must contact each professor for course registered. For additional information contact OSEI-RUM at Sánchez Hidalgo 410 or via telephone 787-832-4040 extension 3107.

12. Academic Integrity:

The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Students General Bylaws (Board of Trustees Certification 13, 2009-2010) states that academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person answers to the questions of an oral or written exam by taking or getting someone else to take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure laid down in the UPR Students General Bylaws.—.

13. Policy Against Discrimination Based on Sex, Sexual Orientation, and Gender Identity:

The University of Puerto Rico prohibits discrimination based on sex, sexual orientation, and gender identity in any of its forms, including that of sexual harassment. According to the Institutional Policy Against Sexual Harassment at the University of Puerto Rico, Certification Num. 130, 2014-2015 from the Board of Governors, any student subjected to acts constituting sexual harassment, may turn to the Office of the Student Ombudsperson, the Office of the Dean of Students, and/or the Coordinator of the Office of Compliance with Title IX for an orientation and/or formal complaint.

14. Sexual Harassment: Certification 130-2014-2015 states:

Sexual harassment in the workplace and in the study environment is an illegal and discriminatory act and is against the best interests of the University of Puerto Rico. All persons who understand they have been subject to acts of sexual harassment at the University of Puerto Rico may file a complaint and request that the institution investigate, where necessary, and assume the corresponding action by the university authorities. If the complainant is a student, he or she must refer his or her complaint to the Office of the Student Ombudsperson or that of the Dean of Students.

15. Certification 06-43 of the Academic Senate states, "The academic guidelines for offering online courses," defines:

Traditional face-to-face courses are those that have less than 25% of the course's regular contact hours via the Internet. Therefore, a three-credit course will be considered "face to face" if, of the 45 hours of regular contact, 11 or less are taught via the Internet. According to certification 16-43 of the Academic Senate, a course may include up to 25% of its total contact hours via the Internet. The objective of this is so that all professors have this alternative in the case of any unscheduled eventuality.

Revised by:

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Approved by:



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