



# 2022 IE Curricular Revision

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October 28, 2022



# IE Program Facts

- 696 students (Fall 2021)

Enrollment 2021-2022



- 15 professors

Faculty



- ABET, September 30, 2027

Accreditation



- 175 credits

Current Curriculum



- 5- year (10 semesters)

Program



- 7.2 years (2015-2021)

Average Time Completion Time



- 75% (at the time of graduation)

Employment Rate



## UPRM Fall 2021-2022

Programa Académico	Cantidad Estudiantes Matriculados
Ingeniería Mecánica - BC	1038
Biología - BC	772
<b>Ingeniería Industrial - BC</b>	<b>696</b>
Ingeniería Eléctrica - BC	642
Ingeniería Química - BC	631
Ingeniería Civil - BC	589
Ciencia Animal (Industria Pecuaria) - BCA	558
Ingeniería Computadoras - BC	544
Ingeniería de Software - BC	419
Microbiología Industrial - BC	410
Psicología - BA	340
Contabilidad - BCAA	277
Química - BC	269
Enfermería - BC	237
Mercadeo - BCAA	228
Agrimensura y Topografía - BC	228
Pre-Médica - BC	193
Agricultura General - BCA	161
Sistemas Computadorizados de Información	158
EDFI-Adiestramiento y Arbitraje - BA	157
Ciencias e Ingeniería de la Computación - B	157



## National ASEE 2020 - 2021 Engineering by the Numbers

Top 50 Institutions by Total Bachelor's Degrees awarded in Industrial/Manufacturing Engineering

Table 21: Top 50 Institutions by Total Bachelor's Degrees awarded in Industrial/Manufacturing Engineering

No	Institutions	Degrees Awarded
1	University of California, Berkeley	735
2	Georgia Institute of Technology	338
3	Purdue University	264
4	Texas A&M University	212
5	Virginia Polytechnic Institute and State University	205
6	University of Michigan	186
7	The Pennsylvania State University	183
8	Arizona State University	162
9	Clemson University	160
10	University of Illinois at Urbana-Champaign	152
11	University of Arizona	147
12	University of Florida	140
13	University of Central Florida	138
14	The Ohio State University	129
15	California Polytechnic State University, San Luis Obispo	126
16	West Virginia University	125
17	Auburn University	123
18	California State Polytechnic University, Pomona	120
19	Iowa State University	117
20	University of Virginia	108
21	University of Wisconsin-Madison	105
22	North Carolina State University	103
23	Lehigh University	102
24	University of Puerto Rico, Mayaguez Campus	94
25	Oregon State University	89
26	University of Southern California	87
27	Cornell University	86
28	University of Pittsburgh	85
29	University of Minnesota - Twin Cities	81
30	The University of Texas at El Paso	79
31	San Jose State University	73
32	Northwestern University	72
32	University of Oklahoma, Gallagher College of Engineering	72
34	Mississippi State University	69
35	Stanford University	67
36	Rutgers, The State University of New Jersey, School of Engineering	64
36	Texas State University	64
36	The State University of New York at Binghamton	64
39	University of Arkansas	63
40	Fu Foundation School of Engineering and Applied Science - Columbia University	62
41	Worcester Polytechnic Institute	59
42	Louisiana State University	56

146 Institutions included



## Highlights of proposed curriculum

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- Keeps the same graduates' profile
- Complies with ABET Criteria
- Provides necessary coursework to pass the Fundamental and Professional exams.
- Offers no reduction in free electives (12 credit hours)
- Complies with engineering common criteria (“parámetros comunes”)
- Reduces from 175 to 149 the number of total credits (15%)
- Reduces from 194 to 164 the number of contact hours (15%)

# Sources of Information

Systematic Course  
Assessment Process –  
Course Modules

Accreditation Process  
Feedback - ABET

Departmental  
Meetings – professors  
and student  
representatives

Feedback from  
employers – surveys &  
one-on-one  
conversations

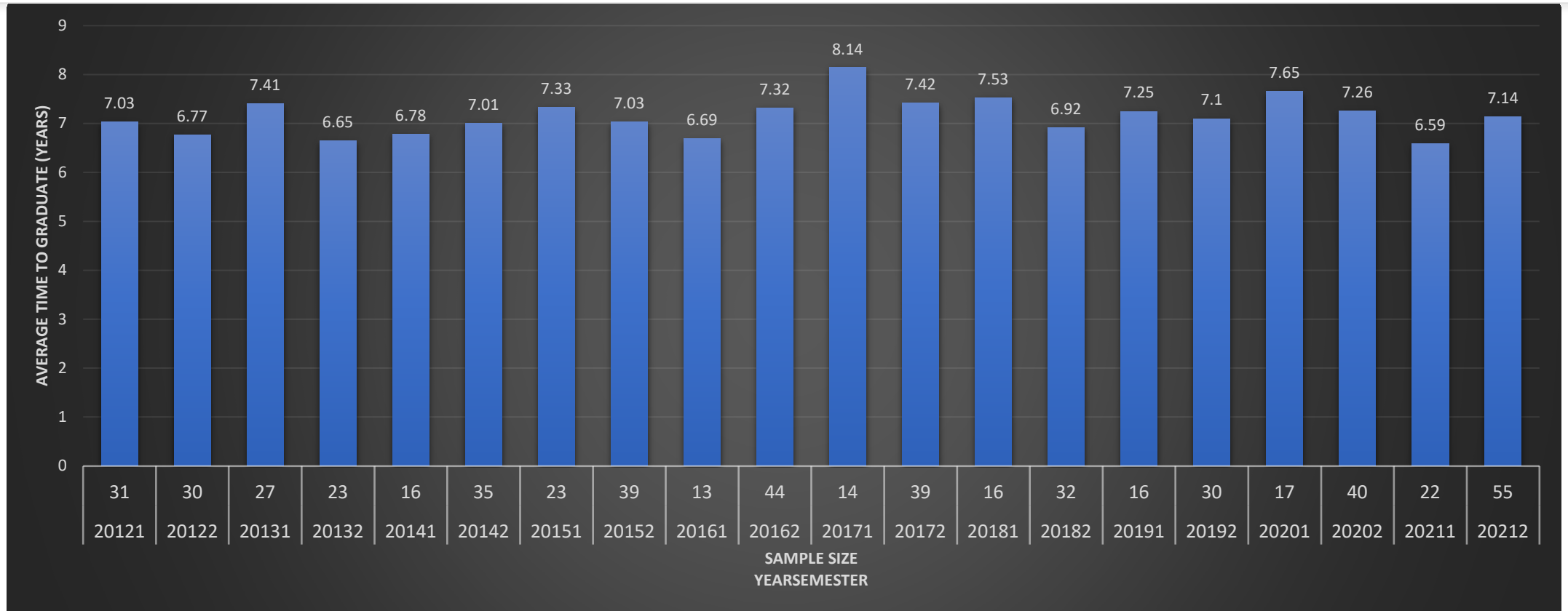
IE Industry  
Advisory Board  
Meetings

A blue pen with a silver-colored tip and clip is positioned diagonally across the frame. It rests on a document featuring a bar chart with several blue bars of varying heights. The background is a light blue grid. The text "Relevant Program Statistics" is overlaid in white, centered horizontally and partially obscured by the pen's tip.

# Relevant Program Statistics



# Time to graduate (in years)



Data from IE graduates, excluding “programa articulado”

# Issues related to the “time-to-graduate” statistic



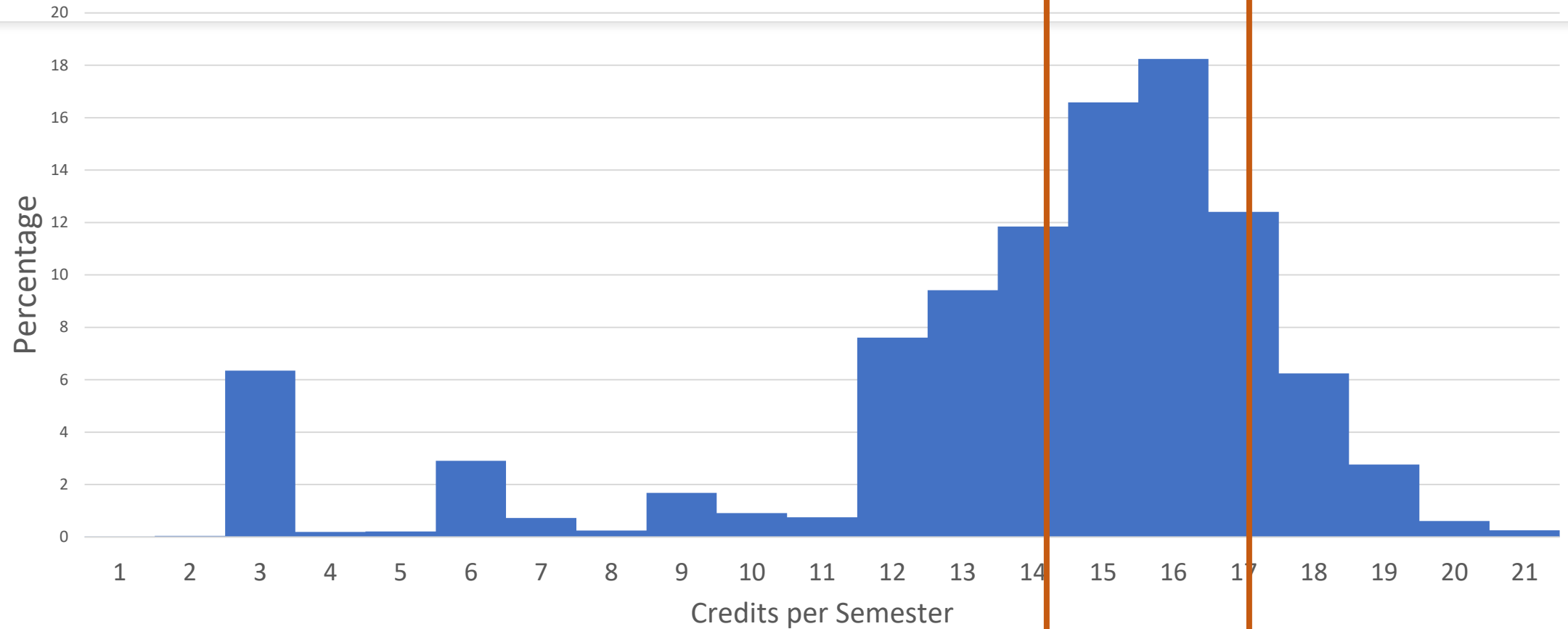
PERCENT OF STUDENT OBTAINING THE DEGREE ON-TIME (5 YEARS) OR IN OR LESS THAN 150% OF THE TIME (7.5 YEARS)  
(80%-85% IN 7.5 YEARS OR LESS, 2%-3% IN 5 YEARS OR LESS)



COST OF THE DEGREE FOR STUDENTS  
(24-27 CREDIT HOURS: \$3,915 IN CREDITS, \$18K-\$22K IN LIVING EXPENSES)



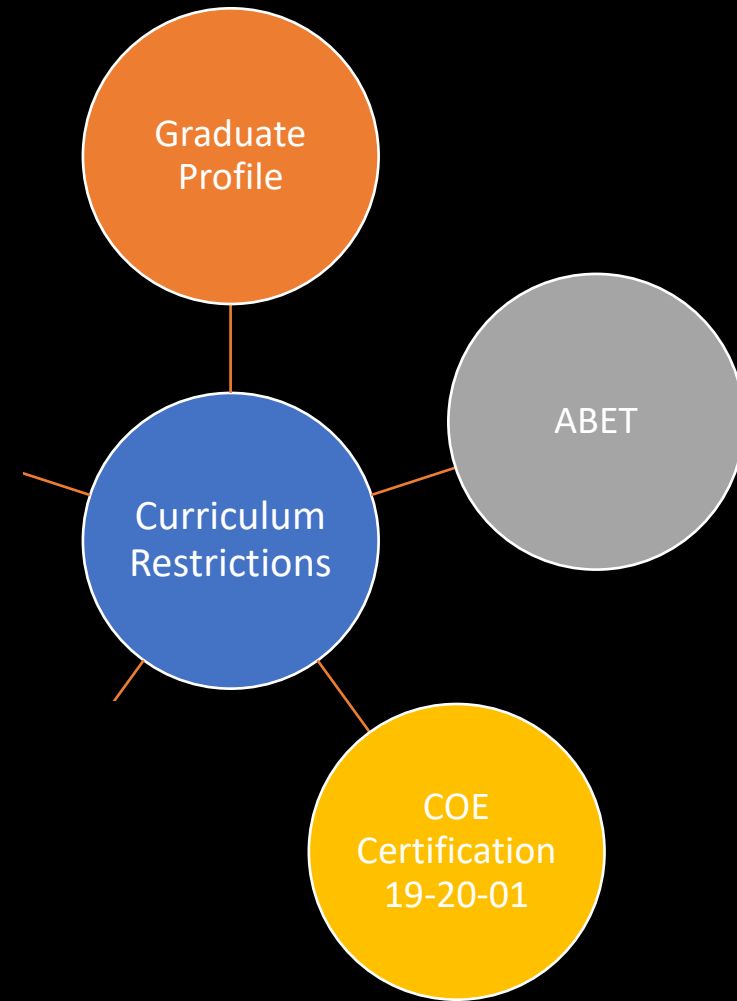
# Credits per Semester



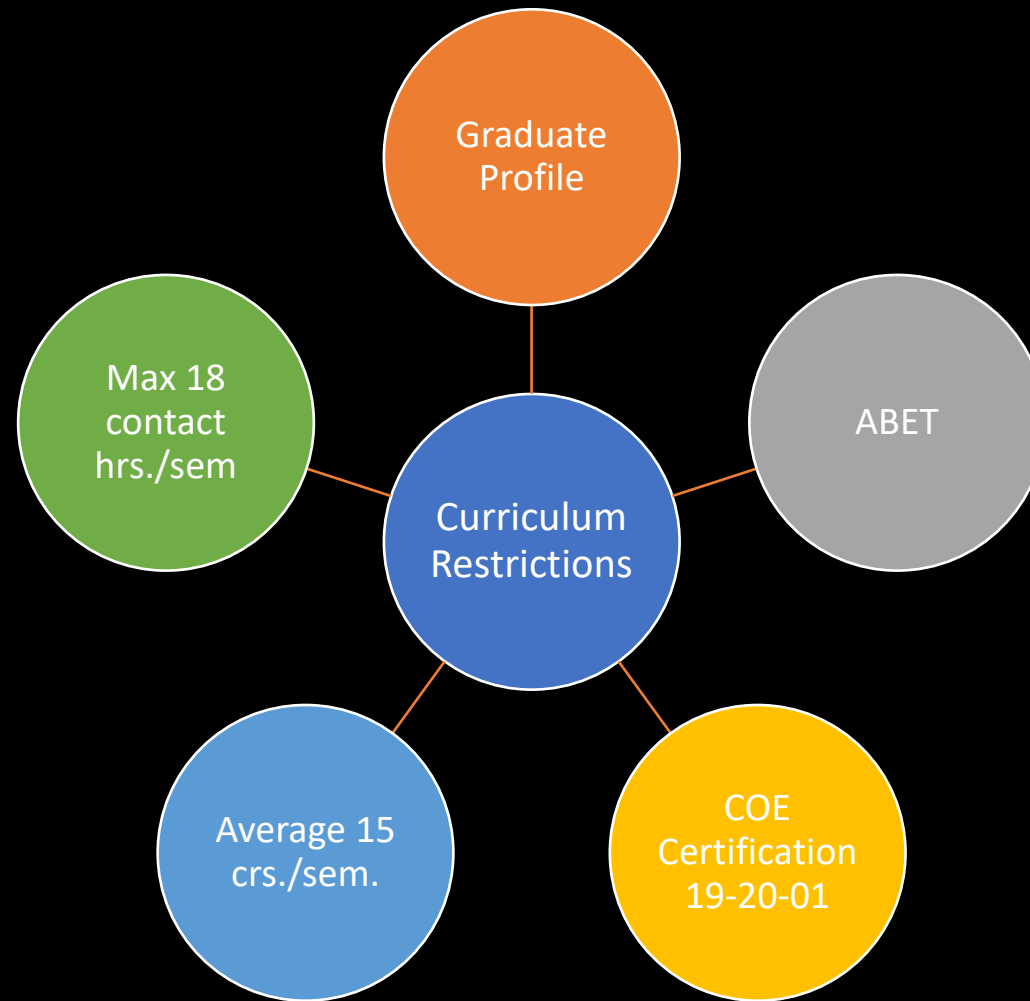
Data from academic years 2011-2021

# Curriculum Hard Restrictions

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# Curriculum Restrictions Used in the Design





Changes per Area

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# Mathematics

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No changes proposed



*20 Credits total*

# Sciences

## Chemistry

Eliminate QUIM 3132 General Chemistry II and QUIM 3134 General Chemistry Laboratory II, from the list of required courses

## Chemistry

### Current

QUIM 3131 + QUIM  
3133 GENERAL  
CHEMISTRY I + LAB



QUIM 3132 + QUIM  
3134 GENERAL  
CHEMISTRY II + LAB

*Credits: 8*

### Proposed

QUIM 3131 + QUIM  
3133 GENERAL  
CHEMISTRY I + LAB

*Credits: 4*

# Sciences

Physics  
No change

## Physics

### Current

FISI 3171 + FISI  
3173 PHYSICS I  
+ LAB



FISI 3172 + FISI  
3174 PHYSICS  
II + LAB

*Credits: 10*

### Proposed

FISI 3171 + FISI  
3173 PHYSICS I  
+ LAB



FISI 3172 + FISI  
3174 PHYSICS  
II + LAB

*Credits: 10*



# Social sciences, humanities, behavioral sciences, and education

Decrease the number of required  
electives in social sciences,  
humanities, behavioral sciences,  
and education to 6 credits (from  
15), and increase the number of  
required electives in ethics to 3  
(from 0).

## Current

### Electives

Electives in social  
sciences, humanities,  
behavioral sciences,  
and education

*Credits: 15*

### Ethics

Elective in  
ethics

*Credits: 0*

## Proposed

Electives in social  
sciences, humanities,  
behavioral sciences,  
and education

*Credits: 6*

Elective in  
ethics

*Credits: 3*

# Languages

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Require students in the  
“intermediate sequence” to have  
at least 3 credits in INGL 3250  
*Public Speaking* or INGL 3236  
*Technical Communication*

## Sequence

## Proposed

Basic

Same

Intermediate

Require 3 credits from:

INGL 3250 Public Speaking

INGL 3236 Technical Communication

Advanced

Same

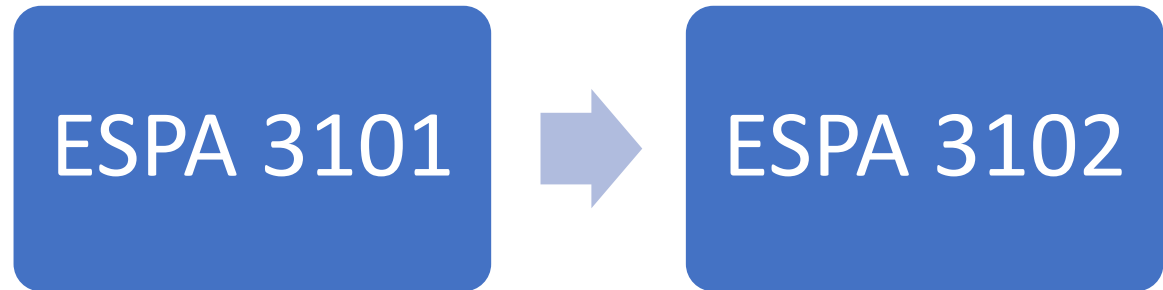
*Credits: 12*

# Languages

Spanish

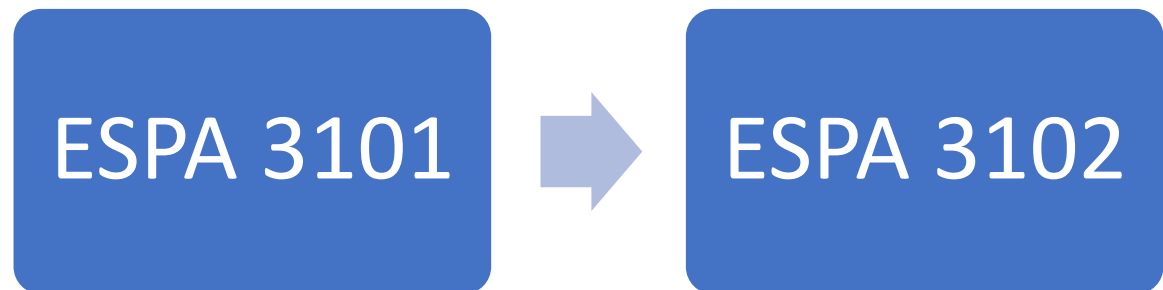
No changes proposed.

Current



*Credits: 6*

Proposed



*Credits: 6*

# Engineering Fundamentals

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Divide engineering fundamental courses in 19 required credits and 6 elective credits. This reduces the credits in the area from a total of 37, to a total of 25.

## General Idea

Move from a strict set of required courses to a smaller set of required courses and a list of elective courses

# Engineering Fundamentals

Divide engineering fundamental courses in 19 required credits and 6 elective credits. This reduces the credits in the area from a total of 37, to a total of 25.

**Current required** courses kept as **required**

Course	Cr.
INGE 3011 ENGINEERING GRAPHICS I	2
INGE 3031 ENGINEERING MECHANICS STATICS	3
ININ 4010 PROBABILITY AND STATISTICS FOR ENGINEERS	3
ININ 4015 ENGINEERING ECONOMIC ANALYSIS	3
INGE 3016 ALGORITHMS AND COMPUTER PROGRAMMING OR CIIC 3015 INTRODUCTION TO COMPUTER PROGRAMMING I	3 - 4



Required



Elective  
(pick 6  
credits)

# Engineering Fundamentals

Divide engineering fundamental courses in 19 required credits and 6 elective credits. This reduces the credits in the area from a total of 37, to a total of 25.

**Current required**  
coursework kept as required,  
but modified

Current Courses	Cr.
INEL 4075 FUNDAMENTALS OF ELECTRICAL ENGINEERING	3
INEL 4076 FUNDAMENTALS OF ELECTRONICS	3
INEL 4077 BASIC ELECTRONICS LABORATORY	1

Proposed Course	Cr.
INEL 4078 CIRCUITS AND ELECTRONICS	4



Required



Elective  
(pick 6  
credits)

# Engineering Fundamentals

Divide engineering fundamental courses in 19 required credits and 6 elective credits. This reduces the credits in the area from a total of 37, to a total of 25.

## Proposed required coursework summary



Required

Course	Cr.
INGE 3011 ENGINEERING GRAPHICS I	2
INGE 3031 ENGINEERING MECHANICS STATICS	3
ININ 4010 PROBABILITY AND STATISTICS FOR ENGINEERS	3
ININ 4015 ENGINEERING ECONOMIC ANALYSIS	3
INGE 3016 ALGORITHMS AND COMPUTER PROGRAMMING OR CIIC 3015 INTRODUCTION TO COMPUTER PROGRAMMING I	3 - 4
INEL 4078 CIRCUITS AND ELECTRONICS	4



# Engineering Fundamentals

Divide engineering fundamental courses in 19 required credits and 6 elective credits. This reduces the credits in the area from a total of 37, to a total of 25.

## Current required courses moved to elective course

Course	Cr.
INGE 3032 ENGINEERING MECHANICS DYNAMICS	3
INGE 4001 ENGINEERING MATERIALS	3
INGE 4011 MECHANICS OF MATERIALS I	3
INME 4045 GENERAL THERMODYNAMICS FOR ENGINEERS	3
INME 4055 MANUFACTURING PROCESSES	3
INME 4056 MANUFACTURING PROCESSES LABORATORY	1



Required



Elective  
(pick 6  
credits)

# Engineering Fundamentals

Divide engineering fundamental courses in 19 required credits and 6 elective credits. This reduces the credits in the area from a total of 37, to a total of 25.

## Courses not currently required and added to elective course list

### Course

CIIC 3075 FUNDAMENTALS OF COMPUTING

CIIC 4010 ADVANCED PROGRAMMING

INGE 4019 INTRODUCTION TO MECHANICS OF MATERIALS (ALT. INGE 4011)

INGE 4015 FLUID MECHANICS

INGE 4035 NUMERICAL METHODS APPLIED TO ENGINEERING

INGE 5015 THEORY AND MANAGEMENT OF SYSTEMS

INME 4108 MATERIAL SCIENCE AND ENGINEERING (ALT. INGE 4001)

INME 4001 THERMODYNAMICS I (ALT. INME 4045)

INME 4065 PRODUCT DESIGN

INEL 4205 LOGIC CIRCUITS

INCI 4005 AGRICULTURAL SURVEYING



Required



Elective  
(pick 6  
credits)

# Engineering Fundamentals

Divide engineering fundamental courses in 19 required credits and 6 elective credits. This reduces the credits in the area from a total of 37, to a total of 25.

## Proposed elective course list, summary



Elective  
(pick 6  
credits)

### Course

INGE 3032 ENGINEERING MECHANICS DYNAMICS

INGE 4001 ENGINEERING MATERIALS

INGE 4011 MECHANICS OF MATERIALS I

INME 4045 GENERAL THERMODYNAMICS FOR ENGINEERS

INME 4055 MANUFACTURING PROCESSES

INME 4056 MANUFACTURING PROCESSES LABORATORY

CIIC 3075 FUNDAMENTALS OF COMPUTING

CIIC 4010 ADVANCED PROGRAMMING

INGE 4019 INTRODUCTION TO MECHANICS OF MATERIALS (ALT. INGE 4011)

INGE 4015 FLUID MECHANICS

INGE 4035 NUMERICAL METHODS APPLIED TO ENGINEERING

INGE 5015 THEORY AND MANAGEMENT OF SYSTEMS

INME 4108 MATERIAL SCIENCE AND ENGINEERING (ALT. INGE 4001)

INME 4001 THERMODYNAMICS I (ALT. INME 4045)

INME 4065 PRODUCT DESIGN

INEL 4205 LOGIC CIRCUITS

INCI 4005 AGRICULTURAL SURVEYING

# Engineering Specialty

Redistribution of topics in two  
subspecialty areas and addition of  
Capstone seminar course

Courses in Current Curriculum		
Course	Cr.	Hrs.
ININ 4077 Work Systems Design	4	5
ININ 4009 Work Measurement	4	5



Courses in Proposed Curriculum		
Course	Cr.	Hrs.
ININ 4071 Ergonomics and Human Factors in Work Systems Design	3	4
ININ 4072 Methods and Work Measurement	3	4

*ABET Accreditation Criteria 2022-2023 > Industrial and Similarly  
Named Engineering Programs > Curriculum*

“The curriculum must include the topical areas of productivity analysis, operations research, probability, statistics, engineering economy, and **human factors**.”

# Engineering Specialty

Redistribution of topics in two  
subspecialty areas and addition of  
Capstone seminar course

## Courses in Current Curriculum

Course	Cr.	Hrs.
ININ 4150 Introduction to Models in Operations Research	4	4
ININ 4018 Discrete-Event System Simulation	3	3



## Courses in Proposed Curriculum

Course	Cr.	Hrs.
ININ 4021 Deterministic Models in Operations Research	3	3
ININ 5025 Queueing Systems and Simulation	4	4

### *OR – Related*

Redistribution of areas.

Deterministic topics: ININ 4021

Stochastic topics: ININ 5025

# Engineering Specialty

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Redistribution of topics in two  
subspecialty areas and addition of  
Capstone seminar course

Courses in Current Curriculum		
Course	Cr.	Hrs.
ININ 4079 Design Project	3	3



Courses in Proposed Curriculum		
Course	Cr.	Hrs.
ININ 4999 Introduction to Design Project	1	1
ININ 4079 Design Project	3	3

## *Capstone – Related*

A seminar course in preparation of Capstone Project will be required.  
Purpose: Student preparation for a Capstone project (industry experience)

# Physical Education, Kinesiology

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No changes proposed

## Courses in Proposed Curriculum

Course	Cr.
Physical education elective	2



# Free Electives

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No changes proposed

## Courses in Proposed Curriculum

Course	Cr.
Free Electives	12

# Microeconomy Requisite

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Removed from required course

ECON 3021 not required, added to  
elective in social sciences,  
humanities, behavioral sciences and  
economics elective

Cr. 3

# FIRST YEAR

## CURRENT First Semester

Δ	Number	Credits	Contact	Course
	* MATE 3005	5	5	Pre-Calculus
	QUIM 3131	3	3	General Chemistry I
	QUIM 3133	1	3	General Chemistry Laboratory I
	* INGL 3---	3	3	First year course in English
	* ESPA 3101	3	3	Basic course in Spanish I
	INGE 3011	2	4	Engineering Graphics I
		17	21	

## Second Semester

Δ	Number	Credits	Contact	Course
	MATE 3031	4	4	Calculus I
II	QUIM 3132	3	3	General Chemistry II
II	QUIM 3134	1	3	General Chemistry Laboratory II
	* INGL 3---	3	3	First year course in English
	* ESPA 3102	3	3	Basic course in Spanish II
	** ELECTIVE	3	3	Socio-Humanistic Elective
	EDFI ----	1	1	Physical Education Elective
		18	20	

## PROPOSED First Semester

Δ	Number	Credits	Contact	Course
	* MATE 3005	5	5	Pre-Calculus
II	QUIM 3131	3	3	General Chemistry I
II	QUIM 3133	1	3	General Chemistry Laboratory I
	* INGL 3---	3	3	First year course in English
	* ESPA 3101	3	3	Basic course in Spanish I
		15	17	

## Second Semester

Δ	Number	Credits	Contact	Course
	MATE 3031	4	4	Calculus I
	INGE 3011	2	4	Engineering Graphics I
	* INGL 3---	3	3	First year course in English
	** ELECTIVE	3	3	Socio-Humanistic Elective
	* ESPA 3102	3	3	Basic course in Spanish II
		15	17	

## SECOND YEAR

### CURRENT First Semester

Δ	Number	Credits	Contact	Course
	MATE 3032	4	4	Calculus II
	FISI 3171	4	4	Physics I
	FISI 3173	1	2	Physics Laboratory I
	INGL 3---	3	3	Second year course in English
V	INGE 3016	3	3	Algorithms and Computer Programming
	INGE 3031	3	3	Engineering Mechanics-Static
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		18	19	

### Second Semester

Δ	Number	Credits	Contact	Course
	MATE 3063	3	3	Calculus III
	FISI 3172	4	4	Physics II
	FISI 3174	1	2	Physics Laboratory II
V	INGE 3032	3	3	Engineering Mechanics-Dynamics
	ININ 4010	3	4	Probability and Statistics for Engineers
V	INGE 4001	3	3	Engineering Materials
	EDFI ----	1	1	Physical Education Elective
		<hr/> <hr/>	<hr/> <hr/>	
		18	20	

### PROPOSED First Semester

Δ	Number	Credits	Contact	Course
	MATE 3032	4	4	Calculus II
	FISI 3171	4	4	Physics I
	FISI 3173	1	2	Physics Laboratory I
V	CIIC 3015	4	5	Introduction to Computer Programming I
	INGL 3---	3	3	English Second Year or Elective
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		16	18	

### Second Semester

Δ	Number	Credits	Contact	Course
	MATE 3063	3	3	Calculus III
	FISI 3172	4	4	Physics II
	FISI 3174	1	2	Physics Laboratory II
	ININ 4010	3	4	Probability and Statistics for Engineers
	INGL 3---	3	3	English Second Year or Elective
	EDFI ----	1	1	Physical Education Elective
		<hr/> <hr/>	<hr/> <hr/>	
		15	17	

# THIRD YEAR

## CURRENT

### First Semester

Δ	Number	Credits	Contact	Course
	MATE 4145	4	5	Linear Algebra and Differential Equations
	ININ 4020	3	3	Applied Industrial Statistics
VI	ININ 4077	4	5	Work Systems Design
V	INEL 4075	3	3	Fundamentals of Electrical Engineering
V	INME 4055	3	3	Manufacturing Processes
		17	19	

### Second Semester

Δ	Number	Credits	Contact	Course
V	INME 4056	1	3	Manufacturing Processes Laboratory
V	INEL 4076	3	3	Fundamentals of Electronics
	ININ 4015	3	3	Engineering Economic Analysis
VI	ININ 4150	4	4	Introduction to Models in Operations Research
	INGL 3---	3	3	Second year course in English
VI	ININ 4009	4	5	Work Measurement
		18	21	

## PROPOSED

### First Semester

Δ	Number	Credits	Contact	Course
VI	ININ 4071	3	4	Ergonomics and Human Factors in Work Systems Design
	ININ 4020	3	3	Applied Industrial Statistics
	MATE 4145	4	5	Linear Algebra and Differential Equations
	INGE 3031	3	3	Engineering Mechanics Statics
	ININ 4015	3	3	Engineering Economic Analysis
		16	18	

### Second Semester

Δ	Number	Credits	Contact	Course
VI	ININ 4021	3	3	Deterministic Models in Operations Research
VI	ININ 4072	3	4	Methods and Work Measurement
V	INEL 4078	4	5	Circuits and Electronics
	EDFI ----	1	1	Physical Education Elective
V ***	INGE/INME	3	3	Elective in General or Mechanical Engineering
		14	16	

## FOURTH YEAR

### CURRENT First Semester

Δ	Number	Credits	Contact	Course
V	INGE 4011	3	3	Mechanics of Materials I
V	INME 4045	3	3	General Thermodynamics for Engineer
V	INEL 4077	1	3	Basic Electronics Laboratory
IX	ECON 3021	3	3	Principles of Economics I
	ININ 4155	4	4	Design and Analysis of Production Systems and Inventory Management
	ININ 4087	4	4	Cost Management
		<hr/> <hr/>	<hr/> <hr/>	
		18	20	

### Second Semester

Δ	Number	Credits	Contact	Course
VI	ININ 4018	3	3	Discrete-Event System Simulation
	ININ 4027	3	3	Design and Analysis of Engineering Experiments
	ININ 4040	3	4	Facilities Layout and Design
	ININ 4078	3	4	Statistical Quality Control
**	ELECTIVE	3	3	Socio-Humanistic Elective
		<hr/> <hr/>	<hr/> <hr/>	
		15	17	

### PROPOSED First Semester

Δ	Number	Credits	Contact	Course
VI	ININ 5025	4	4	Queueing Systems and Simulation
	ININ 4155	4	4	Production and Inventory Management
	ININ 4078	3	4	Statistical Quality Control
	ININ ----	3	3	Industrial Engineering Elective
		<hr/> <hr/>	<hr/> <hr/>	
		14	15	

### Second Semester

Δ	Number	Credits	Contact	Course
	ININ 4017	3	3	Computer-Based Information Systems
	ININ 4027	3	3	Design and Analysis of Engineering Experiments
	ININ 4040	3	4	Facilities Layout and Design
**	ELECTIVE	3	3	Socio-Humanistic Elective
VI	ININ 4999	1	1	Introduction to Design Project
	ELECTIVE	3	3	Free Elective
		<hr/> <hr/>	<hr/> <hr/>	
		16	17	

## FIFTH YEAR

### CURRENT First Semester

Δ	Number	Credits	Contact	Course
	ININ 4017	3	3	Computer-based Information Systems
	ININ 4057	3	4	Real Time Process Control
	ININ 4079	3	3	Design Project
	ININ ----	3	3	Industrial Engineering Elective
**	ELECTIVE	3	3	Socio-Humanistic Elective
	ELECTIVE	3	3	Free Elective
		<hr/> <hr/>	<hr/> <hr/>	
		18	19	

### Second Semester

Δ	Number	Credits	Contact	Course
	ININ ----	3	3	Industrial Engineering Elective
III	** ELECTIVE	6	6	Socio-Humanistic Elective
	ELECTIVE	9	9	Free Electives
		<hr/> <hr/>	<hr/> <hr/>	
		18	18	

### PROPOSED First Semester

Δ	Number	Credits	Contact	Course
	ININ 4079	3	3	Design Project
III	** ELECTIVE	3	3	Elective in Ethics
	ELECTIVE	3	3	Free Elective
	ININ 4087	4	4	Cost Management
		<hr/> <hr/>	<hr/> <hr/>	
		13	13	

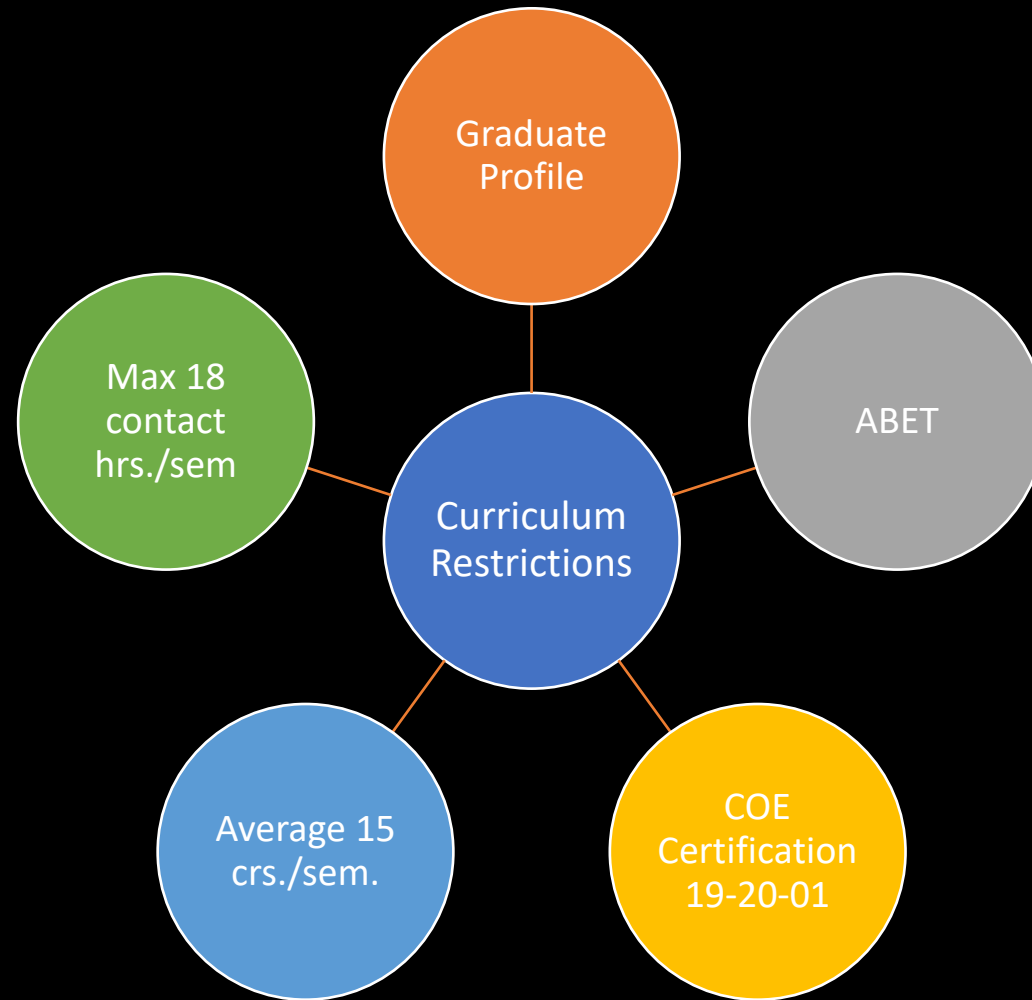
### Second Semester

Δ	Number	Credits	Contact	Course
	ININ 4057	3	4	Real Time Process Control
	ININ ----	3	3	Industrial Engineering Elective
V	*** INGE/INME	3	3	Elective in General or Mechanical Engineering
	ELECTIVE	3	3	Free Elective
	ELECTIVE	3	3	Free Elective
		<hr/> <hr/>	<hr/> <hr/>	
		15	16	

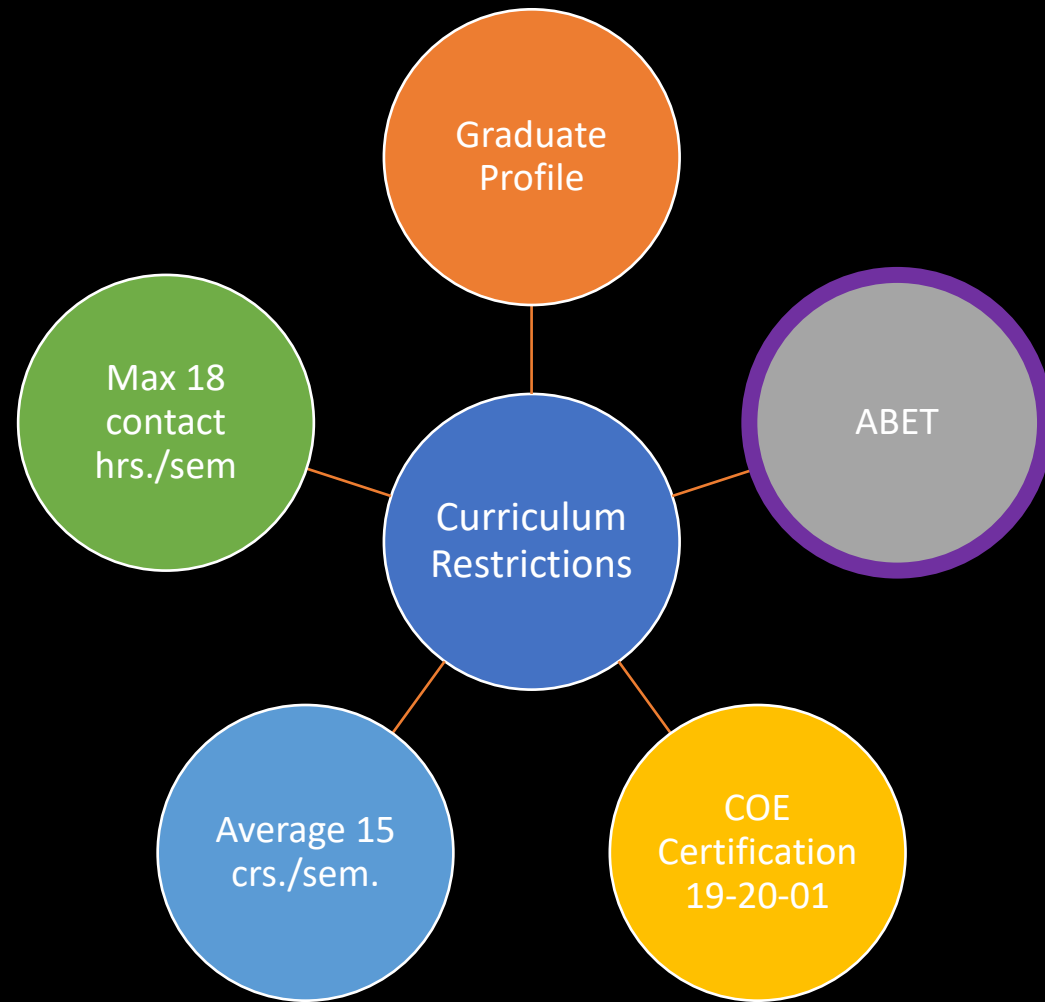




# Curriculum Restrictions Used in the Design- Verification



# Curriculum Restrictions Used in the Design- Verification

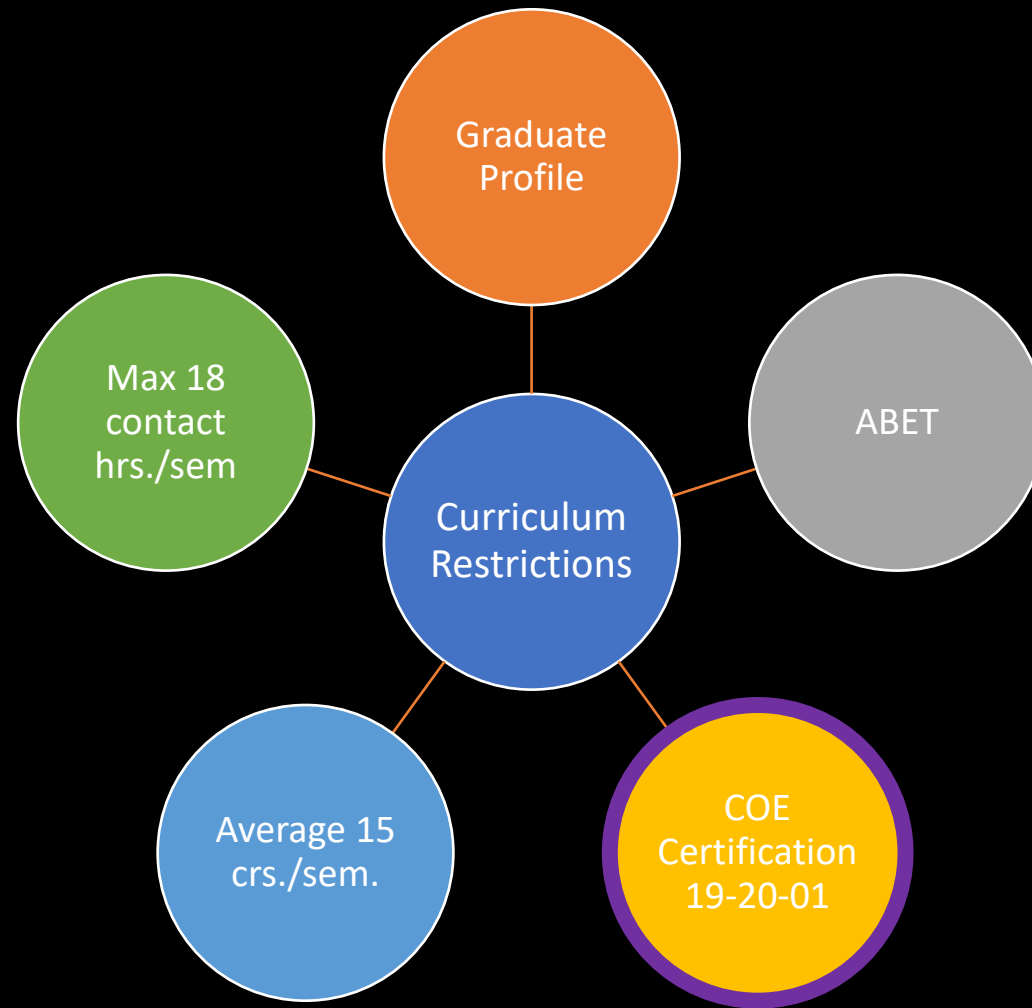


# Accreditation ABET, Check

Criterion 5. Engineering Curriculum	Proposed	Credits	
a. a <b>minimum of 30</b> semester credit hours (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program.	MATE 3031; MATE 3032; MATE 3063; MATE 4145; ININ 4010; QUIM 3131; QUIM 3132; FISI 3171; FISI 3172; FISI 3173; FISI 3174	32	
b. a <b>minimum of 45</b> semester credit hours (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design, and utilizing modern engineering tools.	INGE 3011; INGE 3016 OR CIIC 3015; INGE 3031; INEL 4078; ININ 4015; ENG. Electives (6)	22	67
	ININ 4017; ININ 4020; ININ 4021; ININ 5025; ININ 4027; ININ 4040; ININ 4057; ININ 4071; ININ 4072; ININ 4078; ININ 4087; ININ 4155; ELECTIVES (6)	45	
c. a <b>broad education component</b> that complements the technical content of the curriculum and is consistent with the program educational objectives.	Social sciences and humanities electives (9); Free electives (12); Phy. Edu. (2); Languages (18)	41	
d. a <b>culminating major engineering</b> design experience that 1) incorporates appropriate engineering standards and multiple constraints, and 2) is based on the knowledge and skills acquired in earlier course work.	ININ 4079; ININ 4999	4	

IE Curriculum	
The curriculum must include design, analysis, operation and improvement of integrated systems that produce or supply products or services in an effective, efficient, sustainable and socially responsible manner.	ININ 4071, ININ 4072, ININ 4155, ININ 4040, ININ 5025, ININ 4078, ININ 4079
The curriculum must utilize real-world experiences and business perspectives.	ININ 4040, ININ 5025, ININ 4079
The curriculum must include the topical areas of	
productivity analysis	ININ 4155
operations research	ININ 4021, ININ 5025
probability	ININ 4010
statistics	ININ 4010, ININ 4020
engineering economy	ININ 4015
human factors	ININ 4071

# Curriculum Restrictions Used in the Design- Verification



# “Parámetros communes”

Colegio de Ingeniería  
Comité de Asuntos Académicos  
Call Box 9000, Mayagüez, PR 00681-9000  
<https://www.uprm.edu/engineering/>



## Hoja de Cotejo (CERTIFICACION NÚMERO 19-20-01) de Parámetros Comunes para los Programas Académicos del Colegio de Ingeniería

Programa académico bajo consideración: Bachillerato en Ciencias en Ingeniería Industrial (0503)

Evaluación de Cursos y Horas Crédito del Currículo Propuesto			
Codificación y Título de Cursos en Ciencias Básicas		Créditos	Tipo <sup>1</sup> (R,E)
QUIM 3131: General Chemistry I		3	R
QUIM 3133: General Chemistry Laboratory I		1	R
FISI 3171: Physics I		4	R
FISI 3172: Physics II		1	R
FISI 3173: Physics Laboratory I		4	R
FISI 3174: Physics Laboratory II		1	R
Total de Horas Crédito para Cursos en Ciencias Básicas		14	
Codificación y Título de Cursos de Matemáticas		Créditos	Tipo (R,E)
MATE 3005: Pre-Calculus		5	R
MATE 3031: Calculus I		4	R
MATE 3032: Calculus II		4	R
MATE 3063: Calculus III		3	R
MATE 4145: Differential Equations & Linear Algebra		4	R
Total de Horas Crédito para Cursos de Matemáticas		20	
Codificación y Título de Cursos de Áreas Temáticas		Créditos	Tipo (R,E)
Probabilidad y estadísticas	ININ 4010	3	R
Economía ingenieril	ININ 4015	3	R
Diseño creativo, visualización o gráficas en diseño ingenieril	INGE 3011	2	R
Algoritmos y programación de computadoras	INGE 3016 o CIIC 3015	3 - 4	R
Total de Horas Crédito para Cursos de Áreas Temáticas		11-12	
Cursos relacionados a las ciencias sociales, ciencias de la conducta, educación, economía, kinesiólogía o las humanidades (Educación General)		Créditos	Tipo (R,E)
Ciencias Sociales, Humanidades y Filosofía		6	E
Educación Física		2	R
Idiomas		18	R
Electivas libre		12	E
Total de Horas Crédito para Cursos de Educación General		26	
Total de Horas Crédito para Cursos de Electivas Libres		12	
Codificación y Título de Cursos en el tema de ética		Créditos	Tipo (R,E)
La lista de cursos para satisfacer los créditos de ética está disponible en el siguiente enlace:		3	R

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Codificación y Título de Cursos en Ciencias Básicas		Créditos	Tipo <sup>1</sup> (R,E)
QUIM 3131: General Chemistry I		3	R
QUIM 3133: General Chemistry Laboratory I		1	R
FISI 3171: Physics I		4	R
FISI 3172: Physics II		1	R
FISI 3173: Physics Laboratory I		4	R
FISI 3174: Physics Laboratory II		1	R
Total de Horas Crédito para Cursos en Ciencias Básicas		14	
Codificación y Título de Cursos de Matemáticas		Créditos	Tipo (R,E)
MATE 3005: Pre-Calculus		5	R
MATE 3031: Calculus I		4	R
MATE 3032: Calculus II		4	R
MATE 3063: Calculus III		3	R
MATE 4145: Differential Equations & Linear Algebra		4	R
Total de Horas Crédito para Cursos de Matemáticas		20	
Codificación y Título de Cursos de Áreas Temáticas		Créditos	Tipo (R,E)
Probabilidad y estadísticas	ININ 4010	3	R
Economía ingenieril	ININ 4015	3	R
Diseño creativo, visualización o gráficas en diseño ingenieril	INGE 3011	2	R
Algoritmos y programación de computadoras	INGE 3016 o CIIC 3015	3 - 4	R
Total de Horas Crédito para Cursos de Áreas Temáticas		11-12	
Cursos relacionados a las ciencias sociales, ciencias de la conducta, educación, economía, kinesiólogía o las humanidades (Educación General)		Créditos	Tipo (R,E)
Ciencias Sociales, Humanidades y Filosofía		6	E
Educación Física		2	R
Idiomas		18	R
Electivas libre		12	E
Total de Horas Crédito para Cursos de Educación General		26	
Total de Horas Crédito para Cursos de Electivas Libres		12	
Codificación y Título de Cursos en el tema de ética		Créditos	Tipo (R,E)
La lista de cursos para satisfacer los créditos de ética está disponible en el siguiente enlace:		3	R

# “Parámetros comunes”

<a href="https://www.uprm.edu/engineering/accepted-ethics-courses-faculty-of-engineering/">https://www.uprm.edu/engineering/accepted-ethics-courses-faculty-of-engineering/</a>		
<b>Total de Horas Crédito para Cursos de Ética</b>	<b>3</b>	
<b>Codificación y Título de Cursos en la ruta crítica (acompañe anejo)</b>	<b>Créditos</b>	<b>Año/ Semestre</b>
MATE 3005: Pre-Calculus	5	1er/1er
MATE 3031: Calculus I	4	1er/2ndo
MATE 3032: Calculus II	4	2ndo/1er
MATE 3063: Calculus III	3	2ndo/2ndo
MATE 4145: Linear Algebra and Differential Equations	4	3er/1er
ININ 4021: Deterministic Models in Operations Research	3	3er/2ndo
ININ 4155: Production and Inventory Management	4	4to/1er
ININ 4040: Facilities Layout and Design	4	4to/2ndo
ININ 4999: Intro to Design Project	1	4to/2ndo
ININ 4079: Design Project	3	5to/1er
<b>Total de Cursos en la Secuencia de la(s) Ruta(s) Crítica(s)</b>	<b>10</b>	
<b>Cotejo de elementos incluidos en la propuesta de revisión curricular</b>		
Indique si la propuesta de revisión curricular incluye cada uno de los siguientes elementos:	<b>Sí</b>	<b>No</b>
▪ Ruta crítica de los cursos correspondientes al programa de estudio	✓	
▪ Un curso de Experiencia Capstone	✓	
▪ Un total de al menos 12 horas-crédito para cursos de áreas temáticas	✓	
▪ La secuencia de cursos de matemáticas comienza con Cálculo I, en el segundo semestre del primer año de estudios (sugerido).	✓	
▪ El programa cumple con el parámetro mínimo (24 horas-crédito para programas de agrimensura y topografía o 30 horas-crédito para programas de ingeniería) en destrezas cuantitativas en matemáticas y ciencias básicas.	✓	
▪ La revisión curricular requiere modificaciones de cursos o creación de cursos nuevos en su departamento. Si aplica, incluya una tabla con la codificación, título y créditos de estos cursos.	✓	
▪ La revisión curricular requiere modificaciones de cursos o creación de cursos nuevos de otros departamentos (Eg. INGE, MATE, QUIM). Si aplica, incluya una tabla con la codificación, título y créditos de estos cursos.	✓	
▪ Un total de al menos 6 horas-crédito en cursos relacionados a las ciencias sociales, ciencias de la conducta, educación, economía o las humanidades.	✓	



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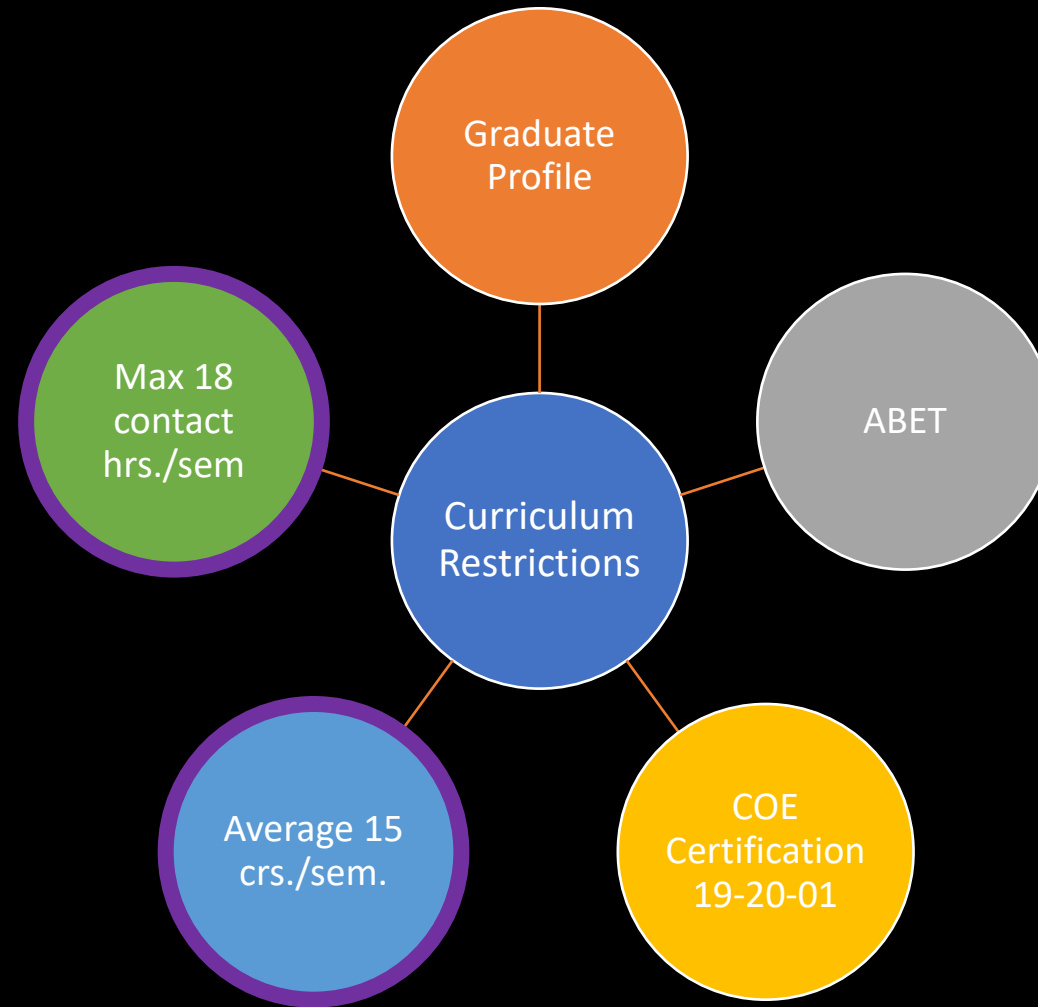


- Un total de al menos 3 horas-crédito adicionales del mínimo de cursos establecido anteriormente en un curso en el tema de la ética, a seleccionarse del siguiente enlace:  
<https://www.uprm.edu/engineering/accepted-ethics-courses-faculty-of-engineering/>

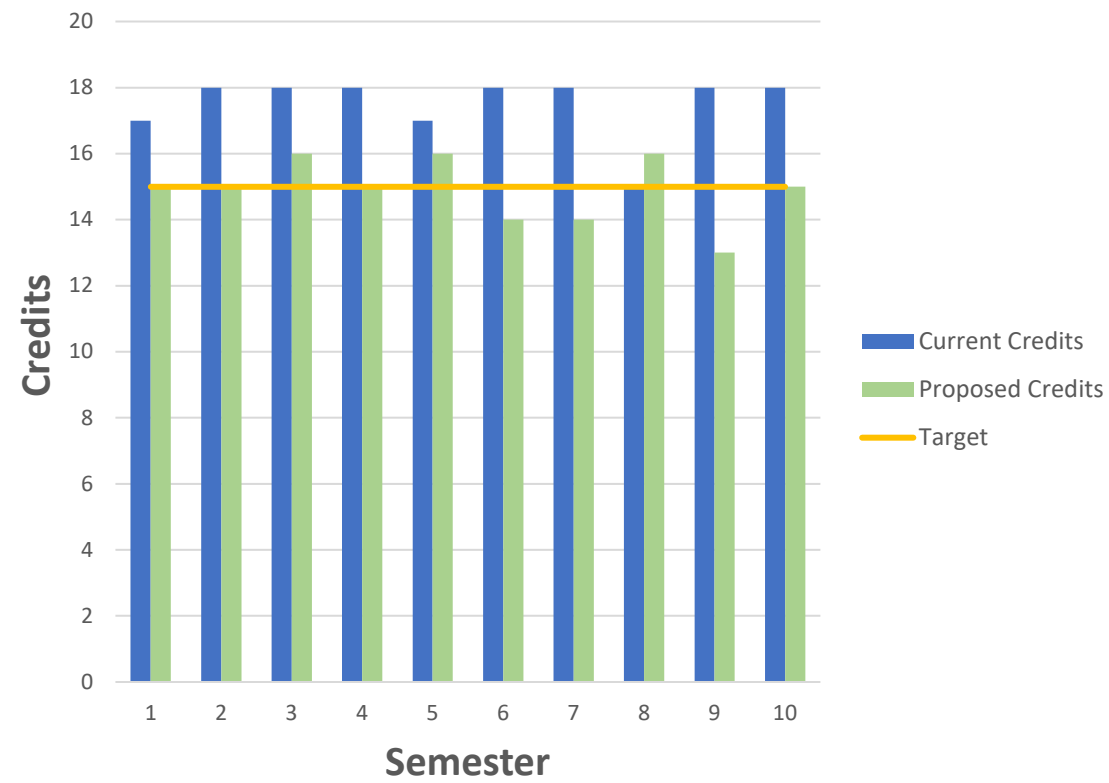
\*La lista de cursos se irá modificando según se actualice la lista de cursos electivos en ética para la Facultad de Ingeniería.



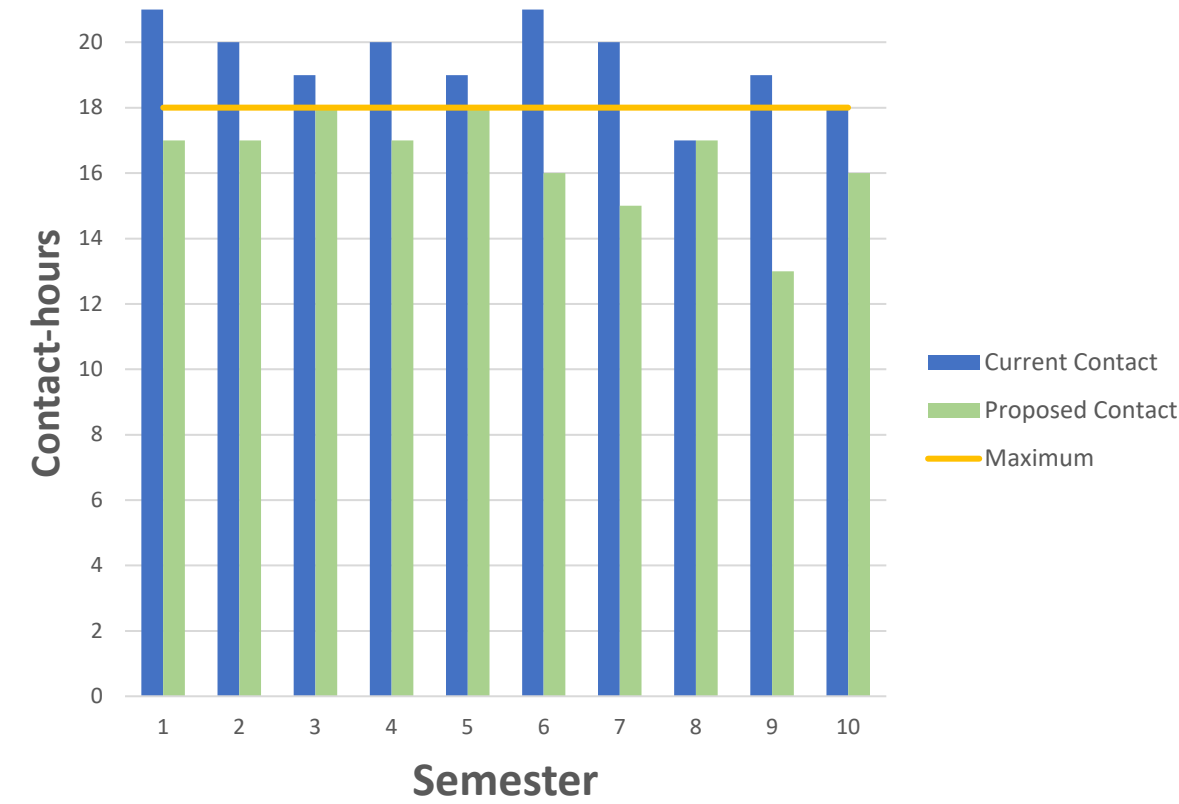
# Curriculum Restrictions Used in the Design- Verification



Credits per Semester



Contact-Hours per Semester



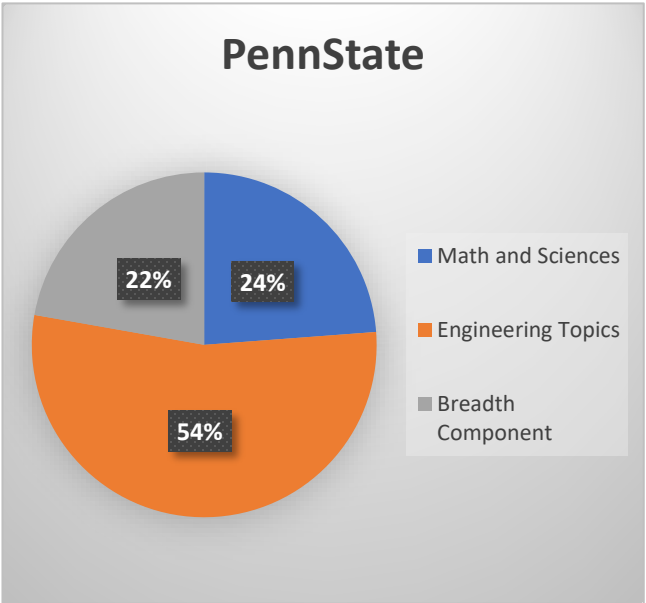
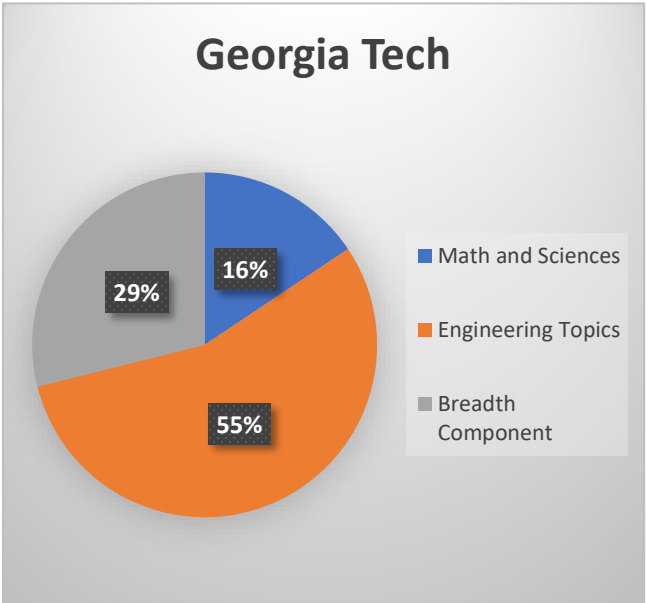
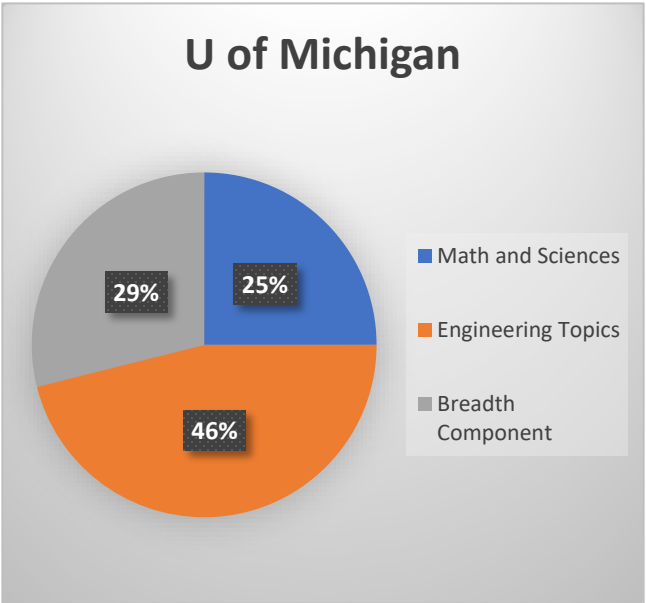
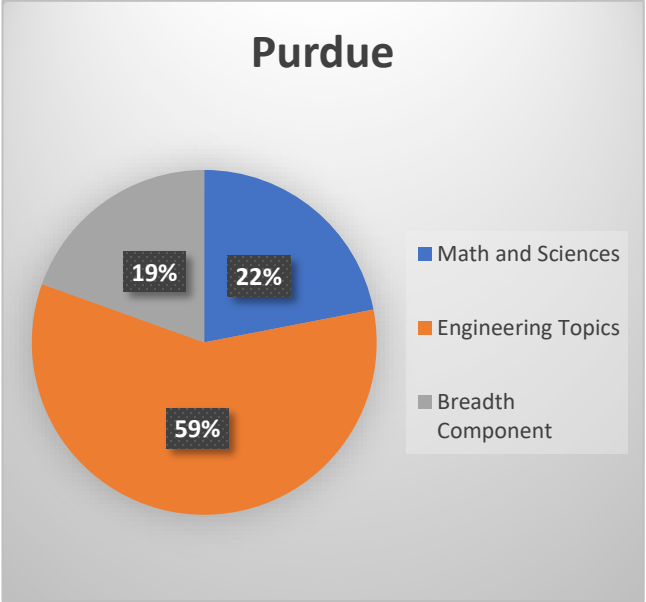
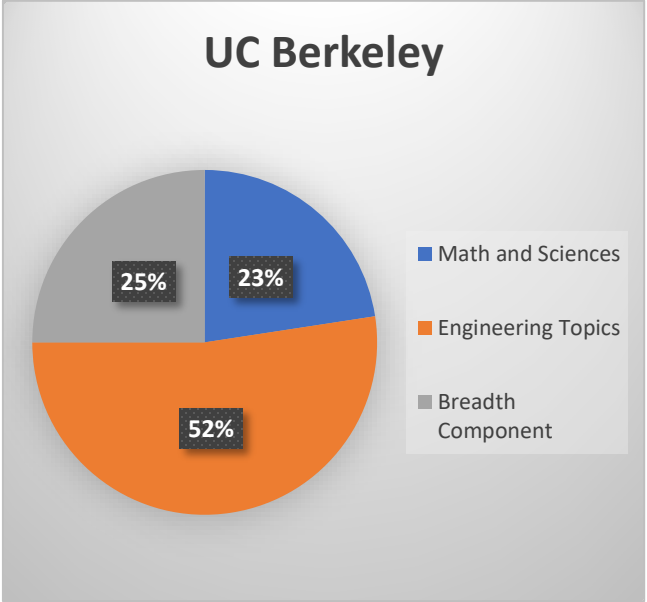
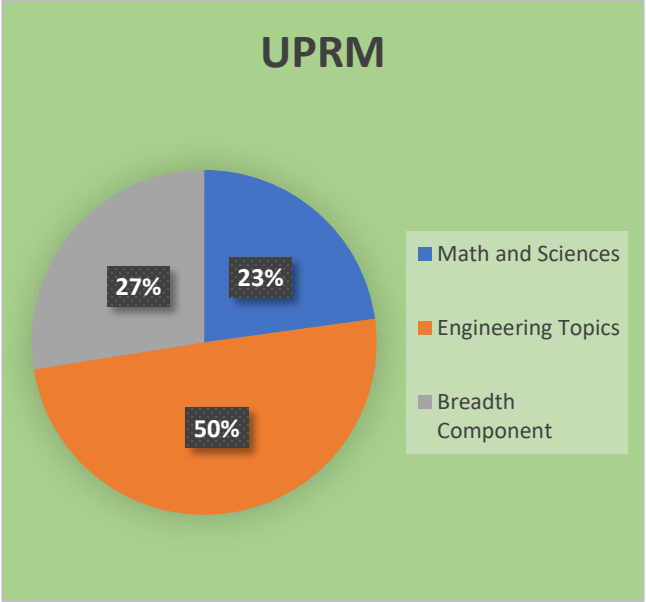
# Benchmark

Requisitos	Propues to UPRM	UC Berkeley	Purdue	Georgia Tech	U of Michigan	Penn State
<b>Matemática de Nivel Universitario y Ciencias Básicas</b>						
Math	20	16	18	12	16	15
Física	10	8	6	8	8	8
Química	4	4	3	0	8	4
Otra	0	0	0	0	0	3
Sub-Total	34	28	27	20	32	30
<b>Temas de Ingeniería</b>						
Temas de Ingenieria Fundamentales	25	20	32	26	18	29
Temas de Concentracion en Ingenieria Industrial	45	41	36	41	37	36
Capstone	4	4	4	4	4	3
Sub-Total	74	65	72	71	59	68
<b>Componente Educacional Amplio</b>						
Libres	12	12	0	11	0	0
Profesionales fuera de concentración	0	0	0	0	13	1
Kinesiologia	2	0	0	2	0	3
Sociohumanisticas (incluyendo lenguaje)	27	19	24	24	24	27
Sub-Total	41	31	24	37	37	31
<b>Total</b>	<b>149</b>	<b>124</b>	<b>123</b>	<b>128</b>	<b>128</b>	<b>129</b>

Credits Allocation

# Benchmark

Percentage  
distribution  
per area



## *FE Industrial and Systems Exam knowledge areas covered by required coursework, NCEES*

Knowledge	No. of Questions	Covered in the required coursework	
		Current Curriculum	Proposed Curriculum
<b>1. Mathematics</b>	6-9		
A. Analytic geometry (e.g., areas, volumes)		Fully	Fully
B. Calculus (e.g., derivatives, integrals, progressions, series)		Fully	Fully
C. Linear algebra (e.g., matrix operations, vector analysis)		Fully	Fully
<b>2. Engineering Sciences</b>	4-6		
A. Thermodynamics and fluid mechanics		Not covered	Not covered
B. Statics, dynamics, and materials		Fully	Partially
C. Electricity and electrical circuits		Fully	Fully
<b>3. Ethics and Professional Practice</b>	4-6		
A. Codes of ethics and licensure		Partially	Fully
B. Agreements and contracts		Not covered	Not covered
C. Professional, ethical, and legal responsibility		Partially	Fully
D. Public protection and regulatory issues		Partially	Partially

## *FE Industrial and Systems Exam knowledge areas covered by required coursework, NCEES*

		Covered in the required coursework	
Knowledge	No. of Questions		
		Current Curriculum	Proposed Curriculum
<b>4. Engineering Economics</b>	<b>9-14</b>		
A. Discounted cash flows (e.g., nonannual compounding, time value of money)		Fully	Fully
B. Evaluation of alternatives (e.g., PW, EAC, FW, IRR, benefit-cost)		Fully	Fully
C. Cost analyses (e.g., fixed/variable, break-even, estimating, overhead, inflation, incremental, sunk, replacement)		Fully	Fully
D. Depreciation and taxes (e.g., MACRS, straight line, after-tax cash flow, recapture)		Fully	Fully
<b>5. Probability and Statistics</b>	<b>10-15</b>		
A. Probabilities (e.g., permutations and combinations, sets, laws of probability)		Fully	Fully
B. Probability distributions and functions (e.g., types, statistics, central limit theorem, expected value, linear combinations)		Fully	Fully
C. Estimation, confidence intervals, and hypothesis testing (e.g., normal, t, chi-square, types of error, sample size)		Fully	Fully
D. Linear regression (e.g., parameter estimation, residual analysis, correlation)		Fully	Fully
E. Design of experiments (e.g., ANOVA, factorial designs)		Fully	Fully

## *FE Industrial and Systems Exam knowledge areas covered by required coursework, NCEES*

Knowledge	No. of Questions	Covered in the required coursework	
		Current Curriculum	Proposed Curriculum
6. Modeling and Quantitative Analysis	9-14		
A. Data, logic development, and analytics (e.g., databases, flowcharts, algorithms, data science techniques)		Fully	Fully
B. Linear programming and optimization (e.g., formulation, solution, interpretation)		Fully	Fully
C. Stochastic models and simulation (e.g., queuing, Markov processes, inverse probability functions)		Fully	Fully
7. Engineering Management	8-12		
A. Principles and tools (e.g., planning, organizing, motivational theory, organizational structure)		Partially	Partially
B. Project management (e.g., WBS, scheduling, PERT, CPM, earned value, agile)		Partially	Partially
C. Performance measurement (e.g., KPIs, productivity, wage scales, balance scorecard, customer satisfaction)		Partially	Partially
D. Decision making and risk (e.g., uncertainty, utility, decision trees, financial risk)		Not covered	Not covered



## *FE Industrial and Systems Exam knowledge areas covered by required coursework, NCEES*

Knowledge	No. of Questions	Covered in the required coursework	
		Current Curriculum	Proposed Curriculum
<b>8. Manufacturing, Service, and Other Production Systems</b>	<b>9-14</b>		
<b>A. Manufacturing processes (e.g., machining, casting, welding, forming, dimensioning, new technologies)</b>		Fully	Not covered
<b>B. Manufacturing and service systems (e.g., throughput, measurement, automation, line balancing, energy management)</b>		Fully	Fully
<b>C. Forecasting (e.g., moving average, exponential smoothing, tracking signals)</b>		Fully	Fully
<b>9. Facilities and Supply Chain</b>	<b>9-14</b>		
<b>A. Flow, layout, and location analysis (e.g., from/to charts, layout types, distance metrics)</b>		Fully	Fully
<b>B. Capacity analysis (e.g., number of machines and people, trade-offs, material handling)</b>		Fully	Fully
<b>C. Supply chain management and design (e.g., pooling, transportation, network design, single-level/multilevel distribution models)</b>		Fully	Fully

## *FE Industrial and Systems Exam knowledge areas covered by required coursework, NCEES*

Knowledge	No. of Questions	Covered in the required coursework	
		Current Curriculum	Proposed Curriculum
10. Human Factors, Ergonomics, and Safety	8-12		
A. Human factors (e.g., displays, controls, usability, cognitive engineering)		Partially	Fully
B. Safety and industrial hygiene (e.g., workplace hazards, safety programs, regulations, environmental hazards)		Not covered	Not covered
C. Ergonomics (e.g., biomechanics, cumulative trauma disorders, anthropometry, workplace design, macroergonomics)		Fully	Fully
11. Work Design	7-11		
A. Methods analysis (e.g., charting, workstation design, motion economy)		Fully	Fully
B. Work measurement (e.g., time study, predetermined time systems, work sampling, standards)		Fully	Fully
C. Learning curves		Fully	Fully
12. Quality	9-14		
A. Quality management, planning, assurance, and systems (e.g., Six Sigma, QFD, TQM, house of quality, fishbone, Taguchi loss function)		Fully	Fully
B. Quality control (e.g., control charts, process capability, sampling plans, OC curves, DOE)		Fully	Fully

## *FE Industrial and Systems Exam knowledge areas covered by required coursework, NCEES*

		Covered in the required coursework	
Knowledge	No. of Questions	Current Curriculum	Proposed Curriculum
13. Systems Engineering, Analysis, and Design	8-12		
A. Requirements analysis and system design		Fully	Fully
B. Functional analysis and configuration management		Partially	Partially
C. Risk management (e.g., FMEA, fault trees, uncertainty)		Not covered	Not covered
D. Life-cycle engineering		Not covered	Not covered
E. Reliability engineering (e.g., MTTF, MTBR, availability, parallel and series failure)		Partially	Partially