



Polytechnic University of Puerto Rico

UNDERGRADUATE CATALOG

A c a d e m i c Y e a r s 2 0 1 1 - 1 2 t o 2 0 1 6 - 1 7

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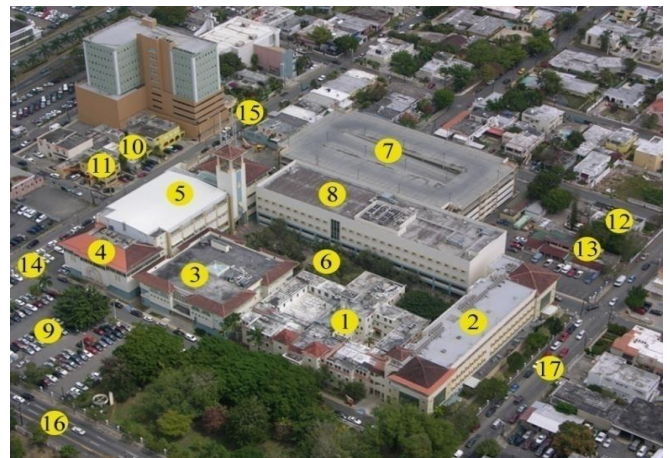
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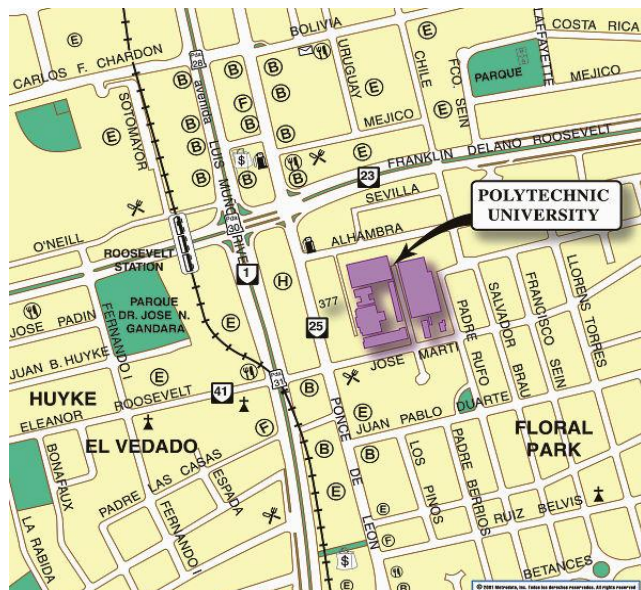
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I. CAMPUS MAP

- | | |
|---|--|
| 1. Main Building; University Adm. Offices | 6. Fifth Centennial Plaza |
| 2. Engineering Laboratories Building | 7. Student's Parking |
| 3. Library | 8. Pavilion Building: (School of Management and Entrepreneurship, Surveying and Geospatial Science Department) |
| 4. Amphitheater | 9. Parking for Faculty, Administration and Visitors |
| 5. Multi-Purpose Building: (School of Architecture, Graduate School of Landscape Architecture, School of Arts, Sciences and Education, Athletic Activities, Honors Program, Basketball Court, Security Office, Cafeteria) | 10. PUPR - Facility |
| | 11. Graduate School |
| | 12. Medical Services |
| | 13. General Services |
| | 14. Main University Entrance |
| | 15. Alhambra Street |
| | 16. Ponce de León Avenue |
| | 17. José Martí Street |

II. LOCATION MAP



III. ACADEMIC CALENDAR

Academic Years 2012 - 2019

FA/12	August 6, 2012	October 27, 2012
WI/12	November 12, 2012	February 16, 2013
SP/13	March 4, 2013	May 25, 2013
SU/13	June 10, 2013	July 20, 2013
FA/13	August 5, 2013	October 26, 2013
WI/13	November 18, 2013	February 22, 2014
SP/14	March 10, 2014	May 31, 2014
SU/14	June 9, 2014	July 19, 2014
WI/14	November, 2014	February, 2015
SP/15	March, 2015	May, 2015
SU/15	June, 2015	July, 2015
FA/15	August, 2015	October, 2015
WI/15	November, 2015	February, 2016
SP/16	March, 2016	May, 2016
SU/16	June, 2016	July, 2016
FA/16	August, 2016	October, 2016
WI/16	November, 2016	February, 2017
SP/17	March, 2017	May, 2017
SU/17	June, 2017	July, 2017
FA/17	August, 2017	October, 2017
WI/17	November, 2017	February, 2018
SP/18	March, 2018	May, 2018
SU/18	June, 2018	July, 2018
FA/18	August, 2018	October, 2018
WI/18	November, 2018	February, 2019
SP/19	March, 2019	May, 2019
SU/19	June, 2019	July, 2019

ACTIVITIES ON THE ACADEMIC CALENDAR

1) Admissions Deadline:

Third Saturday prior to the beginning of the term.

2) New and Transfer Students Orientation:

One week prior to the beginning of the term.

3) Registration Period:

New and Transfer Students - Monday before the beginning of classes. Regular Students- One week prior to the beginning of classes.

4) Beginning of the Term (Monday or Tuesday):

Classes begin on Monday or Tuesday after the week of registration. Three credit-hour courses meet twice a week (2 hours per session) for twelve-week period, equivalent to three semester credit-hours.

5) Deadline for Late Registration and Course Changes:

Friday of the first week of each term.

6) Deadline for Completing Pending Projects and to Remove Incomplete Grades:

Eleven (11) weeks after the end of the preceding term are allowed for this purpose (tenth week of the current term).

7) Deadline for the First Partial Examination:

The fourth week of each term (first third of the term).

8) Deadline for the Second Partial Examination:

The eighth week of each term (second third of the term).

9) Deadline for Partial or Total Withdrawal:

Students may withdraw totally or partially until the tenth week of the current term, and receive a grade of "W".

10) Period of Early Registration:

Eleventh week of the current term.

11) Deadlines for Final Examinations:

The last week of each term will be devoted to the total review of course content. Final examinations will comprise all material covered during a given term.

12) Regular Registration Period:

The registration period will be held in the recess period between terms. Active students will be notified in advance of their registration day.

IV. BOARD OF TRUSTEES

Ricardo Jaén Presno, MD, **Chairman**
 Luis Fullana, BS in Agronomy, **Vice Chairman**
 Francisco Martínez, BS in Civil Engineering, **Treasurer**
 Vanessa M. Mullet Sánchez, JD, **Secretary**
 Irving A. Jiménez Juarbe, JD, **Trustee**
 Luis E. González Cognet, MD, **Trustee**
 María M. Meléndez Ramos, DEd, **Trustee**
 Ricardo Leranc Morales, Arq, **Trustee**
 Ernesto Vázquez Barquet, MBA, **Ex Officio**

V. INFORMATION DIRECTORY

Mailing Address: P.O. Box 192017

San Juan, PR 00919-2017

Address: 377 Ponce de León Ave., San Juan, PR 00918

University Switchboard: (787) 754-8000 / (787) 622-8000

Internet Home Page: <http://www.pupr.edu>

Fax (787) 763-8919- Office of the President
 Fax (787) 753-4465- Accounting Office
 Fax (787) 764-8712- Admissions and Promotions Office
 Fax (787) 763-8275- Bursar's Office
 Fax (787) 294-1816- Continuing Education and Training
 Fax (787) 274-8562- Cooperative Education Program
 Fax (787) 625-0414- Distance Education Center
 Fax (787) 758-1334- Enrollment Management and Student Services Office
 Fax (787) 766-1163- Financial Aid Office
 Fax (787) 751-0545- General Services
 Fax (787) 758-7933- Graduate School
 Fax (787) 771-0012- Health, Safety and Environmental Compliance Office
 Fax (787) 753-6569- Human Resources Office
 Fax (787) 753-1675- Information Technology Office
 Fax (787) 758-3383- Integrated Student Services Center
 Fax (787) 758-3522- Institutional Development & Com.
 Fax (787) 763-3028- Library
 Fax (787) 766-4925- Medical Services
 Fax (787) 754-8268- Planning and Development Office
 Institutional Research Office
 Fax (787) 754-8821- Purchasing Office
 Fax (787) 764-1902- Registrar's Office
 Fax (787) 767-0607- School of Architecture
 Fax (787) 767-0607- Interior Design Program
 Fax (787) 767-0607- School of Landscape Architecture
 Fax (787) 754-5931- School of Arts, Sciences and Education
 Fax (787) 754-5931- Education
 Fax (787) 754-5931- Mathematics and Science
 Fax (787) 756-8647- Socio-Humanistic Studies
 Fax (787) 281-8342- School of Engineering, Surveying and Geospatial Science
 Fax (787) 771-0010- Chemical Engineering
 Fax (787) 773-0098- Civil & Environmental Engineering
 Fax (787) 281-8342- Electrical & Computer Engineering
 Fax (787) 771-0013- Land Surveying & Geospatial Science
 Fax (787) 765-9207- Industrial Engineering
 Fax (787) 771-0011- Mechanical Engineering
 Fax (787) 756-7274- School of Management and Entrepreneurship
 Fax (787) 763-6867- Security
 Fax (787) 767-2921- Sponsored Research Office
 Fax (787) 754-8520- Student Support Services Program
 Fax (787) 754-8450- Tutoring Services
 Fax (305) 418-4325- Miami Campus
 Fax (407) 677-5082- Orlando Campus

VI. ADMINISTRATIVE OFFICIALS

President

Ernesto Vázquez Barquet, BA, MBA

Executive Vice President

Ernesto Vázquez Martínez, BSIE, MBA

Vice President for Academic Affairs

Miguel A. Riestra, BA, MA, PhD

Vice President for Administration and Finance

Ernesto Vázquez Martínez, BSIE, MBA

Vice President for Enrollment Management and Student Services

Carlos Pérez, BA, MBA

Associate Vice President for Enrollment Management and Student Services

Elsa Zayas, BA, MA

Associate Vice President for Federal and State Grant Funds Administration

Olga C. de Torres, BBA

Dean of Graduate School

Miriam Pabón, BSIE, MEM, PhD, PE

Dean, School of Architecture

Carlos Betancourt Llambías, MArch

Associate Dean, School of Architecture

Diana Rivera Rivera, MArch

Assistant Dean, School of Architecture

Maribel Rijos Pérez, MA Ed

Head, School of Landscape Architecture

Marisabel Rodríguez, MLA, PLA

Head, Department of Interior Design

Smyrna Maurás Modesti, BA, MA, CODDI

Dean, School of Arts, Sciences and Education

Catalina Vicéns, BA, MA, PhD

Head, Department of Education

Carmen Lara Cotto, BA, MA, EdD

Head, Department of Mathematics and Science

Horacio García Correa, BSEE, MEM

Head, Department of Socio-Humanistic Studies

Virginia Dessús, BA, MA, PhD

Dean, School of Engineering, Surveying and Geospatial Science

Carlos González Miranda, BSIE, MSIE, PhD, PE

Associate Dean, School of Engineering, Surveying and Geospatial Science

Cuauhtémoc Godoy, BSIE, MSIE, EdD, PE

Head, Department of Chemical Engineering

Elba Herrera, BS, MS, CHE

Head, Department of Civil and Environmental Engineering

José Borrageros, BSCE, MSCE, PE

Associate Director, Department of Civil and Environmental Engineering

Amado Vélez, BSCE, MSCE, PE

Head, Department of Electrical and Computer Engineering, and Computer Science

Othoniel Rodríguez Jiménez, BSEE, PE, MSEE & CS, PhD

Head, Department of Surveying and Geospatial Science

Marisol Rodríguez, BS, MS, PhD (Candidate)

Head, Department of Industrial Engineering

Cuahtémoc Godoy, BSIE, MSIE, EdD, PE

Head, Department of Mechanical Engineering

Bernardo Restrepo Torres, BS, MS, PhD, PE

Dean, School of Management and Entrepreneurship

José Orlando Rivera; BSIE, MSEM, PhD (Candidate)

Head, Department of Business Administration

Edwin Dávila Aponte, BBA, MBA, PhD

Coordinator, Associate Degree Programs

José A. Morales, BS, MBA, PhD

Administrator, Financial Aid Office

Sergio Villoldo, BBA, MBA

Director, Admissions and Promotions Office

Teresa Cardona, BBA

Director, Cooperative Education Program

Angie Escalante, BASW, MBA

Director, Department of Athletic Activities

Roberto Medina Ortiz, BA

Director, Distance Education Center

Heyda Delgado, BA, MA Ed

Director, Guidance and Counseling Office

Claribel Díaz Díaz, BA, MC

Director, Honors Program

Wilfredo Torres, BSEE, MEM

Director, Human Resources Office

Ana E. Castellano, BBA, MBA

Director, Information Technology Office

Pedro Pérez, MIS

Supervisor, Integrated Student Services Center

William Peña, BBA, MBA

Director, Institutional Development and Communications Office

Lourdes Alcrudo, BBA

Director, Library

Mirta Colón Rodríguez, BA, MLS

Director, Planning and Development Office

Miguel A. Riestra, BA, MA, PhD

Director, Plasma Laboratory

Ángel González, BSEE, MSEE, PhD

Director, Sponsored Research Office

Ángel González, BSEE, MSEE, PhD

Director, Student Support Services Program

José Mojica, BA, MA

Legal Counselor

Irving A. Jiménez Juarbe, BA, MSW, JD

Outcomes and Student Learning Assessment Office

Blanca Tallaj Almanzar, BSCSE, MSIE

José A. Martínez, BSCE, MSCE, PE

María M. García Sandoval, BSIE, MEMSE, PhD

Registrar

Mayra López, BA, MA

VII. GENERAL INFORMATION**BRIEF HISTORY**

Polytechnic University of Puerto Rico (PUPR) is a private, non-profit, coeducational, nonsectarian institution of Higher Education founded in 1966. At present it is the largest private Engineering School and the only one in San Juan, capital of Puerto Rico. It is also the largest private Hispanic Serving Engineering School in the United States and its territories. PUPR offers the following licensed and accredited programs at the undergraduate level, listed in the order they were authorized.

- Associate Degree of Engineering in Software Development (2013)
- Associate Degree in Land Surveying (2013)
- Associate Degree of Engineering in Supply Chain and Logistics (2014)
- Associate Degree in Mechanical Engineering (2013)
- Bachelor of Science in Land Surveying and Mapping (1974)
- Bachelor of Science in Civil Engineering (1974)
- Bachelor of Science in Industrial Engineering (1980)
- Bachelor of Science in Electrical Engineering (1984)
- Bachelor of Science in Mechanical Engineering (1988)
- BBA in Industrial Management (1990) **postponed (2008)**
- Bachelor of Architecture (1995)
- BBA in Construction Management (1996)
- Bachelor of Science in Chemical Engineering (1997)
- Bachelor of Science in Environmental Engineering (1997)
- BBA in Accounting (1996)
- BBA in Management Information Systems (1996) **postponed (2008)**
- BBA General Management (1996)
- BBA in Marketing (1996)
- BBA in Finance (2002) **postponed (2005)**
- Bachelor of Science in Computer Sciences (2002)
- Bachelor of Science in Computer Engineering (2003)
- Bachelor of Science in Mechanical Engineering with Specialization in Aerospace Science (2009)
- Bachelor in Science in Secondary Education in Natural Sciences & Mathematics (2014)
- Bachelor of Interior Design (2014)

At the graduate level PUPR offers:

- Master in Engineering Management (1992)
- MBA in International Enterprises (1997)
- MBA in Management of Technology (1997) **postponed (2001)**
- MBA (General and Interdisciplinary) (1997)
- MBA in Computer Information Systems (E-Commerce & Data Base) (1997)

- Master in Environmental Management (1998)
- Master of Science in Manufacturing Engineering (1998)
- Master of Engineering in Manufacturing Engineering (1998)
- Master of Science in Manufacturing Competitiveness (1998)
- Master of Science in Civil Engineering (1998)
- Master in Manufacturing Competitiveness (1998)
- Master of Engineering in Civil Engineering (1998)
- Master of Science in Electrical Engineering (2002)
- Master of Engineering in Electrical Engineering (2002)
- Master of Science in Computer Engineering (2004)
- Master of Engineering in Computer Engineering (2004)
- Master of Science in Computer Science (2005)
- Master in Computer Science (2005)
- Master in Landscape Architecture (2006)
- MS in Civil Engineering with Specialization in Structures (Sept. 2009)
- MS in Civil Engineering with Specialization in Geotechnology (Sept. 2009)
- MS in Civil Engineering with Specialization in Water Resources (Sept. 2009)
- MS in Civil Engineering with Specialization in Water Treatment (Sept. 2009)
- Master of Engineering in Civil Engineering in Structures (Sept. 2009)
- Master of Engineering in Civil Engineering in Geotechnology (Sept. 2009)
- Master of Engineering in Civil Engineering in Water Resources (Sept. 2009)
- Master of Engineering in Civil Engineering in Water Treatment (Sept. 2009)
- MS in Computer Engineering with Specialization in Internet Engineering (Sept. 2009)
- MS in Computer Engineering with Specialization in Software Engineering (Sept. 2009)
- MS in Computer Engineering with Specialization Digital Signal Processing (Sept. 2009)
- Master of Engineering in Computer Engineering with Specialization in Software Engineering (Sept. 2009)
- Master of Engineering in Computer Engineering with Specialization in Internet Engineering (Sept. 2009)
- Master of Engineering in Computer Engineering with Specialization in Digital Signal Processing (Sept. 2009)
- MS in Computer Science with Specialization in IT Management and Information Assurance (Sept. 2009)
- MS in Computer Science with Specialization in Knowledge Discovery and Data Mining (Sept. 2009)
- MS in Computer Science with Specialization in Computer Graphics and Game Technology (Sept. 2009)
- Master in Computer Science with Specialization in IT Management and Information Assurance (Sept. 2009)
- Master in Computer Science with Specialization in Knowledge Discovery and Data Mining (Sept. 2009)
- Master in Computer Science with Specialization in Computer Graphics and Game Technology (Sept. 2009)
- MS in Electrical Engineering in Communication Systems (Sept. 2009)
- MS in Electrical Engineering in Digital Signal Processing (Sept. 2009)
- Master of Engineering in Electrical Engineering in Communication Systems (Sept. 2009)
- Master of Engineering in Electrical Engineering in Digital Signal Processing (Sept. 2009)
- MS in Manufacturing Engineering with Specialization in Industrial Automation (Sept. 2009)
- MS in Manufacturing Engineering with Specialization in Pharmaceutical Processes (Sept. 2009)
- MS in Manufacturing Engineering with Specialization in Quality Management (Sept. 2009)
- Master of Engineering in Manufacturing Engineering with Specialization in Industrial Automation (Sept. 2009)
- Master Engineering in Manufacturing Engineering with Specialization in Pharmaceutical Processes (Sept. 2009)
- Master of Engineering in Manufacturing Engineering with Specialization in Quality Management (Sept. 2009)
- Master in Manufacturing Competitiveness with Specialization in Pharmaceutical Processes (Sept. 2009)
- Master in Manufacturing Competitiveness with Specialization in Quality Management (Sept. 2009)
- Master of Engineering in Mechanical Engineering with Specialization in Aerospace (2009)
- Master in Geospatial Science and Technology (2012)
- Master in Science in Education in Mathematics and Natural Sciences (2014)
- Doctor of Philosophy in Engineering and Applied Sciences (2014)

ONLINE PROGRAMS

- Master of Engineering Management
- MS in Manufacturing Engineering
- MS in Manufacturing Competitiveness
- Master of Engineering in Manufacturing Engineering
- Master in Manufacturing Competitiveness
- MBA in Computer Information Systems

LICENSING AND ACCREDITATION**License****A. Puerto Rico Education Council (PREC)**

P.O. Box 19900; San Juan
Puerto Rico 00910-1900
Telephone: (787) 724-7100

Renewal date of the License was extended to cover the following programs:

ASSOCIATE DEGREE PROGRAMS Date of License Renewal

- Associate Degree of Engineering in Software Development Sept. 2014
- Associate Degree in Land Surveying Sept. 2014
- Associate Degree of Engineering in Supply Chain and Logistics Sept. 2014
- Associate Degree in Mechanical Engineering Sept. 2014

BACHELOR'S PROGRAMS Date of License Renewal

- Bachelor in Architecture Sept. 2014
- BBA Accounting Sept. 2014
- BBA Construction Management Sept. 2014
- BBA in Finance (**postponed**) Aug. 2005
- BBA General Management Sept. 2014
- BBA in Industrial Management (**postponed**) April, 2008
- BBA Management in Information Systems (**postponed**) April, 2008
- BBA Marketing Sept. 2014
- BS in Chemical Engineering Sept. 2014
- BS in Civil Engineering Sept. 2014
- BS in Computer Engineering Sept. 2014
- BS in Computer Science Sept. 2014
- BS in Electrical Engineering Sept. 2014
- BS in Environmental Engineering Sept. 2014
- BS in Industrial Engineering Sept. 2014
- BS in Land Surveying and Mapping Sept. 2014
- BS in Mechanical Engineering Sept. 2014
- BS in Mechanical Engineering with Specialization in Aerospace Sept. 2014
- Bachelor of Interior Design Sept. 2014

MASTER'S PROGRAMS Date of License Renewal

- MBA in Computer Information Systems (E-Commerce & Data Base) Sept. 2014
- MBA (General and Interdisciplinary) Sept. 2014
- MBA (International Enterprises) Sept. 2014
- MBA Management of Technology (**postponed**) Dec. 2001
- Master in Computer Sciences Sept. 2014
- Master in Engineering Management Sept. 2014

- Master in Environmental Management Sept. 2014
- Master in Landscape Architecture Sept. 2014
- Master in Manufacturing Competitiveness Sept. 2014
- Master of Engineering in Civil Engineering Sept. 2014
- Master on Engineering in Computer Engineering Sept. 2014
- Master of Engineering in Electrical Engineering Sept. 2014
- Master of Engineering in Manufacturing Engineering Sept. 2014
- MS in Civil Engineering Sept. 2014
- MS in Computer Engineering Sept. 2014
- MS in Computer Sciences Sept. 2014
- MS in Electrical Engineering Sept. 2014
- MS in Manufacturing Competitiveness Sept. 2014
- MS in Manufacturing Engineering Sept. 2014
- MS in Civil Engineering with Specialization in Structures Sept. 2014
- MS in Civil Engineering with Specialization in Geotechnology Sept. 2014
- MS in Civil Engineering with Specialization in Water Resources Sept. 2014
- MS in Civil Engineering with Specialization in Water Treatment Sept. 2014
- Master of Engineering in Civil Engineering in Structures Sept. 2014
- Master of Engineering in Civil Engineering in Geotechnology Sept. 2014
- Master of Engineering in Civil Engineering in Water Resources Sept. 2014
- Master of Engineering in Civil Engineering in Water Treatment Sept. 2014
- MS in Computer Engineering with Specialization in Internet Engineering Sept. 2014
- MS in Computer Engineering with Specialization in Software Engineering Sept. 2014
- MS in Computer Engineering with Specialization Digital Signal Processing Sept. 2014
- Master of Engineering in Computer Engineering with Specialization in Software Engineering Sept. 2014
- Master of Engineering in Computer Engineering with Specialization in Internet Engineering Sept. 2014
- Master of Engineering in Computer Engineering with Specialization in Digital Signal Processing Sept. 2014
- MS in Computer Science with Specialization in IT Management and Information Assurance Sept. 2014
- MS in Computer Science with Specialization in Knowledge Discovery and Data Mining Sept. 2014
- MS in Computer Science with Specialization in Computer Graphics and Game Technology Sept. 2014

- Master in Computer Science with Specialization in IT Management and Information Assurance Sept. 2014
- Master in Computer Science with Specialization in Knowledge Discovery and Data Mining Sept. 2014
- Master in Computer Science with Specialization in Computer Graphics and Game Technology Sept. 2014
- MS in Electrical Engineering in Communication Systems Sept. 2014
- MS in Electrical Engineering in Digital Signal Processing Sept. 2014
- Master of Engineering in Electrical Engineering in Communication Systems Sept. 2014
- Master of Engineering in Electrical Engineering in Digital Signal Processing Sept. 2014
- MS in Manufacturing Engineering with Specialization in Industrial Automation Sept. 2014
- MS in Manufacturing Engineering with Specialization in Pharmaceutical Processes Sept. 2014
- MS in Manufacturing Engineering with Specialization in Quality Management Sept. 2014
- Master of Engineering in Manufacturing Engineering with Specialization in Industrial Automation Sept. 2014
- Master Engineering in Manufacturing Engineering with Specialization in Pharmaceutical Processes Sept. 2014
- Master of Engineering in Manufacturing Engineering with Specialization in Quality Management Sept. 2014
- Master in Manufacturing Competitiveness with Specialization in Pharmaceutical Processes Sept. 2014
- Master in Manufacturing Competitiveness with Specialization in Quality Management Sept. 2014
- Master of Engineering in Mechanical Engineering with Specialization in Aerospace Sept. 2014
- Master in Geospatial Science and Technology Sept. 2014
- Master in Science in Education in Mathematics & Natural Sciences Sept. 2014

DOCTORAL PROGRAM

- Doctor of Philosophy in Engineering and Applied Sciences Sept. 2014

B. Middle States Commission on Higher Education (MSCHE)

3624 Market Street,
Philadelphia, PA 19104-2680
(215) 662-5606, Fax (215) 662-5501
Webpage: www.middlestates.org

In 2005, the Middle States Commission on Higher Education re-accredited the institution and in November 18, 2010 reaffirmed it. In 2010 PUPR submitted the Periodic Review Report and was commended for the evaluation results.

C. Accreditation Board for Engineering and Technology (ABET)

111 Market Place, Suite 1050
Baltimore, MD 21202- 4012.
Telephone: (410) 347-7700
Webpage: <http://www.abet.org>

The following Bachelor of Science programs are accredited by the Engineering Accreditation Commission of ABET:

- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Environmental Engineering
- Industrial Engineering
- Mechanical Engineering

The following program was accredited by the Applied Science Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202- 4012.

- Telephone: (410) 347-7700
- Land Surveying and Mapping

D. National Architectural Accrediting Board (NAAB)

1735 New York Avenue, NW,
Washington, DC 20006
(202) 783-2007
(202) 783-2822
Webpage: www.naab.org

In 2009, NAAB accredited the Bachelor of Architecture.

E. Landscape Architectural Accreditation Board (LAAB)

636 Eye Street, NW
Washington, DC 20001-3736
Tel: 202-898-2444
Fax: 202-898-1185
Webpage: www.asla.org

The Landscape Architectural Accreditation Board granted accreditation to the Master in Landscape Architecture (First Professional Degree) in 2011.

F. International Assembly for Collegiate Business Education (IACBE)

11374 Strang Line Road
Lenexa, KS 66215 USA
Tel: (913)631-3009
Fax: (913) 631-9154
Webpage: www.iacbe.org

Polytechnic University of Puerto Rico has received specialized accreditation for its business programs through the International Assembly for Collegiate Business Education (IACBE), located in Olathe, Kansas. The business programs in the following degrees are accredited by IACBE:

- Bachelor of Business Administration with concentration in: Accounting, Finance, Marketing, Construction Management, General Management, Industrial Management, and Management Information Systems, was accredited in 2006.
- Master of Business Administration, Master of Engineering Management and Master of Environmental Management was accredited in 2006.

MISSION, VISION AND GOALS

Polytechnic University of Puerto Rico fosters learning, scholarship, and service in the core area of liberal arts, and in the professional fields of architecture, business, education, land surveying and engineering. PUPR's character arises from its vision of teaching/learning, and service/outreach functions as independent, mutually supportive, and central to its mission and goals.

Preamble

Polytechnic University of Puerto Rico is a private, non-profit university providing access to education through its main campus in San Juan, PR, and branch campus in Miami and Orlando, FL. Also, PUPR works in partnership with the Instituto Tecnológico de Santo Domingo in the Dominican Republic.

Mission

“As an institution of higher education, the mission of the Polytechnic University of Puerto Rico is to provide opportunities to individuals from diverse backgrounds and in different locations, to cultivate their potential for leadership, productivity, competitiveness and critical thinking; through exposure to intellectual, scientific, humanistic and technological advancement, with the purpose of contributing to regional and global sustainability.”

Vision

“To be recognized as the leading Hispanic Serving Institution in multiple fields of study, meeting societal and industrial standards in general, in association with public and private enterprise; characterized by an emphatic relationship between faculty and students, and with a culture of client-oriented quality service, empowerment and teamwork. Polytechnic University of Puerto Rico reflects the meeting of the two pervasive cultures of the Americas, thus it is well positioned to serve as a catalyzer of a symbiotic relationship between the United States and the Latin American nations.”

Goals

The following goals guide Polytechnic University in meeting its mission:

- To contribute to regional and global socio-economic development, sustained by a capable and committed Faculty and through the formation of competitive professionals in the fields of architecture, applied sciences, business, engineering, math, and science education.
- To provide access to higher education through on-campus and at a distance programs of study in compliance with guidelines that comprise hallmarks of quality.
- To instill in PUPR graduates a genuine interest to search for solutions to the challenges associated with the needs and aspirations of society.
- To promote the dissemination of knowledge through the teaching-learning process and through publications, and to develop an interest in applied research.
- To adapt current and develop new programs of study that respond to the needs and realities of PUPR constituents and to society in general.
- To foster the linkage between PUPR and industry, government, commerce, professional associations, as well as with other universities.
- To promote teaching and learning best practices supported by “state of the art” technology.
- To achieve long-term sustainable growth in financial resources.
- To promote global and socio-cultural exposure of the PUPR community.
- To continuously seek innovative ways to increase student retention and graduation rates, and to reduce students’ time to degree attainment.

OUTCOMES AND STUDENT LEARNING ASSESSMENT

The Office of Outcomes and Student Learning Assessment is in charge of the institutional learning assessment program. The objective of this program is to: a) “improve” the performance of all academic programs and administrative offices; b) “prove” by providing evidence that the expected outcomes have been achieved and: c) “inform” or disclose the gathered data to guide the decision making process institution wide.

The assessment to “improve” is a short term cycle, and it is driven by the faculty members or key stakeholders. The development stage starts with the design and planning of the courses, the course components, and the curricula or project/program. During this stage several improvements should be incorporated while the program or project is

implemented. This formative mode of assessment leads to improvements on a continuous basis.

In contrast to the assessment to “improve”, the assessment to “prove” is a long term cycle. The development stage requires of statistical data and final results from already implemented models. The analysis of the data will generate inferences and implications. This summative assessment will provide evidence of outcomes, and will close the loop of the development stage of the project.

Following the assessment to “prove” the effectiveness of the program, it should identify important stakeholders. The data gathering and its analysis is used to guide the decision making process, increasing the likelihood of dissemination of information and the institutionalization of the changes made as a result of assessment of the outcomes.

The assessment of an academic program will be based on the accreditation criteria issued by the corresponding agencies and the institutional mission and academic objectives. The Office of Outcomes Assessment understands that assessment to “improve”, assessment to “prove” and the information disclosure are fundamental stages for the development of an effective outcomes assessment program.

The teaching and learning outcomes assessment process impacts directly upon the mission, vision, and goals of the institution. It is an extremely relevant tool to confirm these are met.

PROFESSIONAL AFFILIATIONS

Board of Examiners of Engineers, and Surveyors of Puerto Rico. Graduates of Civil Engineering, Industrial Engineering, Electrical Engineering, Mechanical Engineering, Environmental Engineering, Chemical Engineering, Computer Engineering, Architecture, Landscape Architecture, and Land Surveying and Mapping curricula qualify to take the examinations required for a professional license.

Board of Examiners of Architects, Landscaping Architects. Graduates of Architecture and Landscape Architecture curricula qualify to take the examinations required for a professional license.

Board of Examiners of Certified Public Accountants. Graduates of BBA in Accounting qualify for the Certified Public Accountant (CPA) examination.

Bureau of Immigration and Citizenship Services

Department of Education of Puerto Rico

Department of Social Services of Puerto Rico (Vocational Rehabilitation)

Veterans Administration

VIII. GENERAL SERVICES AND FACILITIES

PHYSICAL FACILITIES

The main campus of Polytechnic University of Puerto Rico is located in the Metropolitan Area of San Juan at 377 Ponce de León Avenue, nearby the financial and economic center of Puerto Rico. The campus consists of nine acres and six buildings housing classrooms, laboratories, academic offices, library, administrative offices, student center, medical services, athletic and other recreational facilities, and a parking building.

PUPR opened branch campuses at the following cities:

- a. Polytechnic University of Puerto Rico, Miami
8180 NW 36 St.; Suite 401,
Miami, Florida, USA 33166
- b. Polytechnic University of Puerto Rico, Orlando
550 North Econlockhatchee Trail
Orlando, Florida 32858
- c. Instituto Tecnológico de Santo Domingo (INTEC)
Ave. Los Próceres, Calle Gala,
Postal 342-9 y 249-2, Santo Domingo
- d. Universidad Latina de Panamá
Cede Central Panamá, Apartado 0823-00933
Panamá, República de Panamá

LIBRARY

The Library is an academic unit with a mission to offer the university community the information services needed to achieve academic excellence and develop leaders with the knowledge and skills that will help them become professional, responsible and successful citizens. This statement is consonant with the university's mission and all library services are directed towards achieving it.

The Library occupies over 40,000 square feet in a three-story building. The collection is specialized in Engineering, Geospatial Sciences, Architecture, Business Administration, and Landscape Architecture to support the academic programs. The collection also includes over 117,000 books and serial volumes which are catalogued and searchable through our online catalog. The print resources are

organized in open stacks according to the Library of Congress Classification System. In order to deliver the best possible combination of traditional and virtual library services, the library has subscribed to thousands of on-line resources including full text electronic books and periodicals. There are wireless access points throughout the library providing laptop access to electronic and online research resources. In addition, remote access is available through the library's website and blog.

Librarians and library staff offer specialized information assistance and services such as inter-library loans, information literacy, and bibliographic search, among others. There are also scanning, printing and photocopy services. Carrels and rooms for individual or group studying are distributed throughout the three levels of the building.

The library also has a presence in the Web 2.0 for direct communication with the students. A blog is kept-up-to date with information and recommended links.

Library hours include weekends and holidays totaling 90 hours weekly. During finals exams periods in the Fall, Winter and Spring trimesters, and library study areas open 24/7. In addition, the library sponsors cultural activities and expositions during the year.

LIBRARY FACILITIES

The first floor houses the administrative offices; the Circulation collection; exhibit space; reading and lounge areas; twelve group-study rooms; the Interlibrary Loans office and the Technology Assistance Center. The Engineering and Science Support area occupies a big space which offers access to engineering software in twenty computers available for student use with copying and printing facilities.

The second floor is a glass-enclosed area that invites to individual study and research. It contains the Reference, Cartography, Periodicals and Rare Books collections along with computers for online research and facilities for printing and scanning. There are carrels and rooms for individual or groups use.

The second floor contains the Department of Collection Development and Technical Services, the institution's Historical Archives, and the offices of the Information Literacy Coordinator, the Virtual Services Coordinator, and Reference Librarian.

The third floor has an open layout with tables, group-study rooms, and conference rooms for faculty, staff, or student's meetings. There is a large room with capacity for up to 150 people that can be turned into two smaller rooms with capacity for 75 persons. This space can be arranged with different settings for academic or social activities. It also contains the Information Systems Department and two

information literacy laboratories supervised and coordinated by staff members, equipped with video projectors, smart board, computer equipment and computer stations for students. The Distance Education Center and the Editorial and Translation Office are also located in this floor.

INFORMATION LITERACY PROGRAM

The purpose of the Information Literacy Program is to help students achieve the skills necessary to recognize when they need information, and to learn how to find, retrieve, analyze, and use the information in an effective and ethical way so they can become life-long learners. The program is based on the standards established by the Association of Academic and Research Libraries of the American Library Association.

The Program Coordinator is a librarian and works with faculty members and departmental directors. Together they create and integrate activities into courses for the development of the students' information literacy skills. Orientations and workshops include topics such as information literacy, library's resources and services, search and evaluation of information, anti-plagiarism strategies, and style manuals. The office of the coordinator is located in the second floor of the library.

DISTANCE EDUCATION CENTER

The Distance Education Center (DEC), known in Spanish as *Centro de Educación a Distancia (CEDUP)*; at Polytechnic University of Puerto Rico supports through its human and technological resources the online academic programs. This Center enables faculty and students to choose the way in which the teaching – learning process is offered, opening a new door of educational opportunities.

CEDUP is responsible for the management, design and development of projects arising from the academic offerings using distance education as its teaching and learning methodology. Its functions include offering workshops in the areas of instructional technology and distance education as part of professional development activities for the faculty offering online courses. It supports the main campus as well as Miami and Orlando campuses in Florida.

The professional profile of CEDUP staff meets the IBSTPI® competencies focused on four domains of skills: (1) professional foundations, (2) planning and analysis, (3) design and development, and (4) implementation and management. The Center has specialists in the use and management of the Blackboard™ platform, Instructional Systems Design, Graphic Design, Multimedia Integration, Instructional Technology, and Course Building. *CEDUP* was established in 2001. Its facilities are located in the 3rd floor of the Library Building. Blackboard (Bb) is the educational

platform in use. Courses developed through the educational platform have been incrementing. Today courses are taught in one of three ways: web enhanced, hybrid or totally online.

EDUCATIONAL TECHNOLOGY CENTER

The Educational Technology Center (ETC) constitutes the academic computing center. It offers the following services:

1. Computer support for student body and faculty, to assist them in the performance of their academic endeavors and projects.
2. Faculty and administrative personnel training on computer use.
3. Technological and computer support as requested by the different academic departments.

The ETC is organized in four areas:

1. Engineering Graphics Laboratory for computer assisted design.
2. AutoCAD Laboratory for multiple purposes and the use of the latest versions of AutoCAD.
3. Main Computer Area - Computers with all the latest engineering applications.
4. Computer Classrooms for the different institutional courses.

The Center provides the latest technology in the industry today.

CONTINUING EDUCATION

The Continuing Education is oriented towards serving the needs of all the Alumni, especially the professional engineers and surveyors. Given the reality of our industrialized society and rapid technological advances, this program provides the resources necessary for renewal of licenses for working professionals. It offers short term non-credit seminars, conferences, symposiums, workshops and courses of a technological nature.

IX. STUDENT INFORMATION AND SERVICES

The Vice Presidency for Enrollment Management and Student Services, established in 2004, is the administrative unit in charge of the development or academic life. This Vice Presidency serves as a link between the office of Admissions and Promotions, Financial Aid office, Guidance and Counseling Office, Athletic Activities, Cooperative Education Program, Alumni, Student Council, Student Organizations, and Social Activities.

The office has a vice president, associate vice president, assistant to the associate vice president and a secretary. It

is located at the Main Building, first floor, interior garden. Service hours are from Monday to Thursday, 8:00 am – 5:30 pm, and Friday from 8:00 am – 3:00 pm.

AOD PROGRAM

The Alcohol and Other Drugs Program (AOD Program) better known in Spanish as the *Programa de Calidad de Vida* is attached to the Vice Presidency of Enrollment Management and Student Services.

The AOD Program provides students the opportunity to develop positive attitudes toward life, discourages the use and abuse of alcohol or controlled substances, and works in the prevention of HIV/AIDS and violence. Prevention means helping the members of the academic community to develop personal strengths and values against those unhealthy habits.

This program offers information and many alternatives to improve the quality of life through promotions, workshops and educational activities, social or sporting events to create prevention awareness among the academic community in general. The program is managed by a coordinator and student volunteers.

The AOD Program works closely with all the units that offer services to students.

All students entering the AOD Program due to drug, alcohol, and/or violence situation receive the following services:

- Reasonable accommodation, if applicable.
- Care and emotional support at all times.
- Crisis intervention.
- Meetings with faculty and administrative personnel, when a conflict arises.
- Academic and personal counseling.
- Student's family intervention, and when needed, intervention with the appropriate authorities.
- Constant communication with behavioral health care professionals that provide therapy to students who give them therapy.
- Monitoring the student, in terms of behavior and academic progress.

COOPERATIVE EDUCATION PROGRAM

Cooperative Education Program is an academic program designed to provide students with opportunities to work off-campus as professional assistants related to their academic majors or career goals. It is a unique form of education that integrates classroom study with paid and supervised work experiences in the public and private sectors. It affords students the opportunity to acquire essential practical skills by being exposed to the reality of the world of work beyond

the boundaries of the campus, enhancing their self-confidence and career direction. The Program strives to create optimum learning through partnership involving the learner, the university and the work site. Employers and the Institution jointly provide students with meaningful high quality work experience through full-time employment. Participants should meet the following requirements:

QUALIFYING FOR COOP

- Filling out Coop information forms (application, student agreement).
- Attending group or individual orientation.
- Completing an individual interview with Coop professionals.
- Preparing a resume prior to any referral for job interviews.
- Signing the Cooperative Education Agreement.
- Be a third, fourth or fifth year student (needing at a minimum 20 credit-hours to graduate), or with at least 90 passed credit-hours.
- Have a cumulative academic general grade point average of 2.50/4.0 or higher.
- Be accepted in the organization as an assistant to engineer, a manager or an architect.
- Be enthusiastic and responsible.
- Registered in COOP 3010 three (3) credit-hours / free elective course (If required)

COURSE DESCRIPTION

COURSE CODE	COURSE TITLE	CREDIT-HOURS
Coop 3010, Section 39	Professional Practice	3

The Cooperative Education Program primary objective is to provide the student with career related experience in business, industry and government. Coop offers all qualified students regardless of major, and opportunity to enhance their academic preparation, acquire valuable work experience, mature personally and professionally, and explore career options.

All Coop jobs pay a salary. How much you can earn depends upon the particular profession, the demands of the position, your skill level, and the local economy.

PREREQUISITES

- Engineering and architecture students must complete the first three years of academic studies; students with other four -year majors must complete the first two years of academic studies.
- Minimum grade index of 2.50 / 4.00

EVALUATION

A performance report and an employer evaluation form are required for the work term, providing the student, the employer and the university with feedback in the student's accomplishment.

PLACEMENT OFFICE

The Placement Office has the mission to help our students to obtain professional experience (Temporary or Regular Contract) related to their academic area.

The participants should meet the following requirements:

- Active students of Polytechnic University of Puerto Rico (third, fourth or fifth year student) or Ex – Alumni.
- Fill the program Application Form
- Add the resume to the Application Form (English)
- Present US citizenship or Visa documentation.
- Participate in employer's interviews.

INTEGRATED STUDENT SERVICES CENTER

The Integrated Student Services Center (CESI, for its acronym in Spanish) was inaugurated on October 18, 1999. The main objective of CESI is to offer centralized finance, registration and student aid services. In addition, a Counselor's Office is provided at the Center. It provides students with a one-stop office in which to fulfill all transactions.

It is essential for students who look for a service, to come first to CESI. We have a referral system for students who need additional information regarding any of the different University Offices. For easy access, CESI is located next to the Fifth Centennial Plaza, just in front of the Classroom's Pavilion. Office hours are Mondays through Thursdays from 8:00 am to 8:00 pm, Fridays from 8:00 am to 12:00 noon and from 1:00 pm to 3:00 pm, and Saturdays from 8:00 am to 12:00 noon. These office hours satisfy the needs of our daytime, evening, and Saturday students.

DEPARTMENT OF ATHLETIC ACTIVITIES

The Department of Athletic Activities is responsible for planning and coordinating sport events, besides offering recreational activities to the student body.

The institution participates in the Inter University Athletic League (LAI, by its Spanish acronym). This organization has among its members the largest campuses of the different public and private universities in Puerto Rico and the Virgin Islands. PUPR participates in several sports such as volleyball, beach volleyball, basketball, tennis, university

relay race, cross country running, track and field, heptathlon and decathlon, judo, wrestling, and table tennis.

INSTITUTIONAL DEVELOPMENT AND COMMUNICATIONS OFFICE

The Institutional Development and Communications Office objectives are to coordinate, manage, develop and provide service in various areas: Communications, Public Relations and Advertising, Website and Graphic Design, Social Media, Alumni Association, Institutional Events and Fundraising management for donations and scholarships. It aims to strengthen the administrative, faculty, students, alumni, and academic community.

ALUMNI OFFICE

The Alumni Association was re-opened in mid-2012 to reinforce the link between alumni and the University. The Association is located at the Institutional Development and Communications Office. The Office is responsible for maintaining communication between alumni and Alma Mater.

CULTURAL ACTIVITIES OFFICE

The Cultural Activities Office of the Socio-Humanistic Studies Department was created in 2006 and has been entrusted to provide students, in close collaboration with faculty, the opportunity of getting acquainted with experiences that provide cultural and intellectual enrichment, and strengthen their commitment towards their education.

The office aims to coordinate, sponsor, inform, and organize cultural and educational activities for students, faculty, academic community and the general public. However, its primary emphasis is getting students in contact with their immediate reality, especially artistic manifestations, traditions and culture of their own country. It strives to promote student comprehension of cultural diversity so they can be proud of their heritage, traditions, music and folklore. It also aims to expose students to new formative experiences that will allow them a better perspective regarding artistic and cultural manifestations of their country, as well as of other nations.

EXTRACURRICULAR ACTIVITY

UNIVERSITY CHOIR

The University Choir is a vocal ensemble in which a student or employee can participate after being qualified by an audition. The Choir performs using four singing voices: Soprano, Alto, Tenor and Bass. The repertoire is mostly performed *a capella* (without accompaniment) and sometimes with instrumentation. Through the whole year

the Choir participates in cultural activities inside and outside the Institution, providing services to the community, local public schools and non-profit organizations. The Choir's repertoire highlights Puerto Rican and Latino American choral music. The student who requests and is admitted to the Choir receives exemptions in enrollment costs.

HONORS PROGRAM

The mission of the Honors Program at Polytechnic University of Puerto Rico is to provide a dynamic environment for all participating students by stimulating individual academic achievement and development.

The office coordinates the following student activities: technical and cultural tours, lectures, workshops, counseling, enrollment in honors courses, visits to museums and industries, scholarships and newsletters distribution.

To be eligible for the program, students must have a cumulative grade point average (GPA) of 3.25 or higher. Admittance is available for new first-year students up to their senior year at the university.

The Honors Program is affiliated with the *Asociación Universitaria de Programas de Honor de Puerto Rico* (AUPH) that is dedicated to developing events for students participating in honors programs within and outside of Puerto Rico .

PROGRAM BENEFITS

- Additional days to borrow books at the library.
- Express - window and/or advanced enrollment validation.
- Acceptance of up to 33% of the initial tuition deposit for students who do not have any financial aid or scholarships to cover the costs of the enrollment validation.
- Students with a GPA of 3.25 or higher may be eligible for the Honors Scholarship if they meet all eligibility and selection criteria.
- Honor courses
- Co-curricular and extra-curricular activities with students from other Honors Programs/institutions within and outside of Puerto Rico.

For more information, please visit the Honors Program office located on the second floor of the Multi-Purpose Building, or call 787-622-800 extensions 384 and 420.

RESERVE OFFICERS' TRAINING CORPS

Since 1985, the Polytechnic University of Puerto Rico has had formal arrangements with the University of Puerto Rico whereby students may register in the University of Puerto Rico's Reserve Officers' Training Corps (ROTC) program.

Arrangements for participation in this program should be made with the Department of Military Science Studies at the University of Puerto Rico in Río Piedras or Mayagüez.

PUPR will accept as elective credit-hours with grades for undergraduate degrees a maximum of twelve credit-hours in ROTC courses from the University of Puerto Rico under the aforementioned agreement.

SECURITY OFFICE

Pursuant to Public Law 101 – 542 “Student Right to Know and Campus Security Act of 1990”, PUPR created the Office of Security. This office is responsible for creating, promoting and maintaining academic and working conditions at campus that are free of criminal acts. Pacific coexistence among all the university components is essential for achieving a teaching/learning environment free from all forms of violence. Such atmosphere will benefit students, faculty members, visitors, suppliers and officials from diverse agencies who participate in our operations.

This environment will be monitored on a continuous basis, without interruption, by a closed circuit television network. Cameras are installed in all the common area corridors of all buildings, entrances, exits, computer rooms, library, laboratory rooms and campus entrances.

All students, faculty members and employees are provided with an identification card which is required to gain access to the campus and services.

The Security Office provides the following services:

- Installation and operation of a 24 hours a day, 7 days a week monitoring system.
- Implementation of the vehicle access control system at campus.
- Management of the identification card system of employees and students.
- Seminars about the campus security system for students, employees and visitors.
- Provision of security measures for diverse activities within the campus.
- Gathering of security information data and publication of the Annual Statistical Report.
- Assistance with malfunctioning vehicles.
- Distribution of a Security Handbook or manual.
- Escorts to students and employees, if required.

GUIDANCE AND COUNSELING OFFICE

The Guidance and Counseling Office offers assistance, career information and guidance in the personal, vocational and educational aspects that may hinder students from achieving a college education during their first two years of studies or 72 credit-hours. It aims at assisting students in

making appropriate educational, vocational and personal choices. The office also offers services for students with emotional, physical or learning limitations. The services coordinated for these students are: individual tutoring, note takers, sign language interpreters, books on tape, student/professor coordination and technology assistance.

COUNSELOR SERVICES

- Academic
- Personal
- Pre-Registration and New Students Registration
- Freshmen Orientation
- Students with Disabilities
- Occupational and Career Counseling
- Psychological Services
- Alcohol and Other Drugs Prevention Program (*Programa de Calidad de Vida*, in Spanish)
- Coordination of Services in the Technological Assistant Center
- Serve as instructors for the *Introduction to University Life* course required for all first term freshman students.

DEVELOPMENTAL STUDIES

The Mathematics and Sciences Department and the Socio-Humanistic Studies Department, under the School of Arts Sciences and Education, deliver a set of courses designed to help incoming students develop skills in Mathematics, Physics, Spanish and English languages; which are needed for entry-level and advanced university courses. Through these developmental courses, the students will be able not only to generate positive attitudes toward their studies, but also to adapt better to the university environment and the demands of an academic program.

The Developmental Program consists of the following courses:

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
SCIE 0110	Introduction to Physics	3
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3
Total		27

Students are enrolled in the corresponding developmental courses based upon their College Entrance Examination Board test results. Students can take up to 27 credit-hours

in developmental courses during the first year of study depending on the degree of deficiencies from high school. Developmental courses are required in addition to the minimum graduation requirements of any particular undergraduate degree program.

TUTORING SERVICES

The Tutoring Services division at campus (known as *Centro de Progreso Universitario* (CPU), in Spanish) was established in 2002 as part of the activities of the Title V project which ended in 2006. After this period, it became part of the institutional commitments to support students and was assigned to the School of Arts, Sciences and Education. Thanks to this effort, it continues to this day to offer students' academic support services during the first years of their college career (the first 72 credit-hours).

This division works closely with the School of Arts, Sciences and Education and the academic departments, as well as with the counselors and subject coordinators, who serve as links between the tutors and professors. The objective of the Tutoring Services is to reinforce the students' academic skills to help them to reach their careers and professional goals. Our tutorial team consists of professional tutors (some of them also professors), and an advanced student, who serves as Peer Tutor. Students who attend regularly will be evaluated using a method inspired by modern pedagogies, and also be awarded honor points that will be added to the course grade, according to the standards of each professor.

Diverse methodologies are used to offer tutoring services. The students receive the service in small groups in which, in addition to clearing their doubts, they learn how to develop or strengthen their teamwork skills, among other advantages. Tutoring is offered in the areas of Mathematics, English, Spanish, Chemistry, Physics and some engineering courses as Static, Computers, Programming, Probability and Statistics, among others, depending on the availability of tutors.

The Tutoring Services division is located on the 3rd floor of Building M (Main Building) Polytechnic University of Puerto Rico, San Juan Campus. Service hours are Monday through Thursday from 7:00 am to 8:30 pm, Friday 8:00 am to 3:00 pm. Office hours are Monday through Thursday from 7:00 am - 5:00 pm, and Friday 8:00 am - 3:00 pm. For more information, please call (787) 622-8000 ext. 274, 331; or visit the office M-305.

LANGUAGE LABORATORY

The language laboratory is designed so that students can practice skills transmitted in class and simultaneously keep in touch with technologies from the 21st century. There are

several educational programs focused on developing the four English language arts in addition to various platforms that integrate both the Internet and the institution's Blackboard Enterprise resources. Most of these resources can work remotely, always supervised by a tutor or technician, for the greater benefit of the student. The laboratory has a physical capacity of thirty (30) students. Each computer has a separate audio system, Internet access and the ability to record tasks through a microphone. We employ several platforms and educational programs. These include: Blackboard Enterprise, English Discoveries, English Central, Tell Me More, and YouTube. In addition, tutoring services make use of online resources, audiovisual facilities (projector, smart board) and traditional teaching methods.

Each student is supervised by the technician for the proper handling of equipment through "Robotel," a learning management program that also enables remote interaction, among other benefits.

STUDENT SUPPORT SERVICES PROGRAM

The Student Support Services Program is financed by federal funds from the US Department of Education. It provides tutorial services, counseling and cultural activities to two hundred and thirty (230) disadvantaged, low income, first generation with university level studies and/or physically handicapped students.

Its goal is to retain and graduate eligible project participants enrolled at PUPR. It is divided into three primary components: tutorial, counseling, and cultural activities. The students receive tutorial services related to the developmental courses in Mathematics, Physics, English and Spanish.

STUDENT COUNCIL

The Undergraduate Student Council is the representative body of the students. It aims to express student opinions and promote communication and cooperation among students, Faculty, and Administrative personnel or officers. The Student Council is constituted by an elected President, Vice President, Secretary, Treasurer, and representatives of the Departments of Civil and Environmental Engineering, Industrial Engineering, Electrical Engineering, Mechanical Engineering, Chemical Engineering, Surveying and Geospatial Science, Business Administration, and Architecture.

STUDENT ORGANIZATIONS

As an enhancement to student life and professional growth various student organizations exist at Polytechnic University

of Puerto Rico. The following organizations are actually certified as such:

- CGE (Consejo General de Estudiantes)
- AIAS (American Institute of Architecture Students)
- SWE (Society of Women Engineers)
- SHPE (Society of Hispanic Professional Engineers)
- ASCE (American Society of Civil Engineers)
- IEEE (Institute of Electrical and Electronics Engineers)
- CIAPR (Colegio de Ingenieros y Agrimensores de Puerto Rico)
- SAE (Society of Automotive Engineers)
- AIChE (American Institute of Chemical Engineers)
- ACI (American Concrete Institute)
- AEAE (Asociación Estudiantil de Administración de Empresas)
- IIQ (Institute Chemical Engineers)
- ISPE (International Society for Pharmaceutical)
- Capítulo Estudiantil de la Cámara de Comercio de la UPPR
- enactus (Entrepreneurial - Action - Us -)

PUPR encourages students to join student organizations.

STUDENT REGULATIONS

The Student Regulations document establishes the norms that rule student's behavior. Administrative personnel also use it as guide to offer students adequate counseling when situations arise. It establishes the rights, obligations and responsibilities of students in order to promote an academic environment of tolerance, respect and order with the support of the academic community.

Students Regulations Article VI establishes the acts that constitute an infringement of institutional norms that can result in disciplinary sanctions to the student.

STUDENT GRIEVANCE PROCEDURES

Polytechnic University of Puerto Rico, committed to academic excellence, establishes institutional policies that serve as guides for the well-being of the academic community. To promote these policies several procedures have been established in order to allow students to know where to file a claim through the appropriate institutional constituencies. Promotion of these policies is done through the following media: brochures, catalog, and PUPR web page. Among the policies are:

1. Declaration of Polytechnic University of Puerto Rico Institutional Policy
 - a. Sexual Harassment Policy at the Workplace and Academia
 - b. Grievance Procedures
 - c. Drugs and Alcohol Use and Abuse Prevention Policy

d. Institutional Policy regarding People with Disabilities

2. Student Grievance Procedures
3. General policy and procedures to evaluate student's requests to amend the academic records.
4. General policy and procedures to change from one degree program or specialization to another at the undergraduate level.

MEDICAL SERVICES

The University requires that all students be covered by some type of health insurance plan. Upon registration, the student must show that he/she is subscribed to a health plan. Students who cannot prove that they are subscribed to a health plan, must register in the health services plan sponsored by the institution. To register for and receive the services sponsored by the institution, the student must pay the corresponding fee for health services stipulated in the Tuition and Fees section of the Catalog.

The Health Services plan sponsored by the institution is an individually contracted service plan. The service is not a Health Insurance Plan and as such does not include radiology or laboratory services, or medicines. The health services sponsored by the institution are offered by a physician in his private office located at José Martí Street adjacent to the University campus. Medical services are rendered Monday through Thursday, 8:00 am to 9:00 pm.

X. ADMISSIONS

ADMISSIONS POLICY

Polytechnic University of Puerto Rico admissions policy provides an opportunity to: (a) high school graduates; (b) individuals who have passed a state high school equivalence examination, as well as (c) transfer students and (d) USA veterans and beneficiaries, to enroll in PUPR credit courses and programs. Students should avail themselves of the Student Regulations, copies of which are distributed by the Office of the Vice President of Enrollment Management and Student Services. The Institution reserves the right to admit, on a temporary status, or reject, any applicant who fails to meet fully a single criterion. An Admission Application and the corresponding fee are valid for two trimesters. A summary of said policies is presented herein.

FRESHMAN APPLICANTS

Students applying for admission to a higher education institution for the first time are classified as First Time Freshman Applicants. All students applying for admission to

the freshman class of Polytechnic University of Puerto Rico must meet the following requirements:

- File application for admission. The application for admission form asks for important information which the applicant is responsible to submit. Any false information given in the application form will be enough reason to reject said application, unless the applicant is able to prove to the Registrar or the Director of Admissions that such information was given without malice aforethought.
- Applicants to the PUPR Undergraduate Programs will be admitted according to the following table:

Discipline	Minimum Applicant General Indexes (IGS in Spanish)
Engineering	245
Architecture	250
Land Surveying	230
Business Administration	230
Computer Science	245

Placement Test				
Levels	Score	Courses	Credit-Courses	Enrollment
Level I	3	Mathematics	MATH 0102 MATH 0106	MATH 0110
Level I	4 or 5	Mathematics	MATH 0102 MATH 0106 MATH 0110	MATH 1330
Level II	3	Mathematics	MATH 0102 MATH 0106 MATH 0110	MATH 1330
Level II	4 or 5	Mathematics	MATH 0102 MATH 0106 MATH 0110 MATH 1330	MATH 1340
Advanced Level	3, 4, 5	Spanish	SPAN 0100 SPAN 0110 SPAN 1010	SPAN 2010 or SPAN 2020*
Advanced Level	3, 4, 5	English	ENGL 0100 ENGL 0110 ENGL 1010	ENGL 2010 or ENGL 2020*

The High School General Point Average [GPA_{HS}] and the results of the College Board verbal and mathematics Aptitude Tests [V.A.T. + M.A.T.] are needed to calculate the Admission Index as follows:

$$AI = \frac{200 \times GPA_{HS} + V.A.T. + M.A.T.}{6}$$

Applicants who do not meet the stated high school grade point average of 2.00 and/or the PUPR Admissions Index can request, in writing, special consideration by the Director of Admissions due to extenuating circumstances. Applicants who have been denied admission may request reconsideration by the Admissions Committee.

- Submit an official academic transcript from a high school certifying graduation or the results of the high school equivalency examination.
- Submit an official copy of the College Entrance Examination Board Achievement Test scores. Prospective applicants for admission to the freshman class must take the Scholastic Aptitude Test administered by the College Entrance Examination Board, either in English or Spanish. Application forms for the examination may be obtained at the high schools or from the College Entrance Examination Board by writing directly to P.O. Box 71101 San Juan, Puerto Rico 00936-8001. Applicants 25 years of age or older are exempt from this requirement.
- Pay a thirty dollar (\$30.00) non-refundable application fee. The application fee will not be applicable towards the student's registration charges.
- Submit an Immunization Certificate (for applicants under 21 years of age)
- Aliens must submit a copy of immigration status.
- Recent Birth Certificate

In considering an application, the Director of Admissions of Polytechnic University of Puerto Rico will take into account the scholastic record to determine qualification for admission. The university reserves the right to require further information from any applicant. This table is used to locate students by results:

Achievement Test Scores

College Board	
Mathematics	
MATH 0102	200-549
MATH 0106	550-649
MATH 0110	650-699
MATH 1330	700-800
Spanish	
SPAN 0100	200-549
SPAN 0110	550-749
SPAN 1010	750-800
English	
ENGL 0100	200-599
ENGL 0110	600-749
ENGL 1010	750-800

This table is used, if the student has taken the Advanced Placement Test (CEEB).

*SPAN 2020 and ENGL 2020 are for Business Administration Students

TRANSFER APPLICANTS

An applicant who has studied at a recognized institution of higher education may apply for admission as a transfer student. Transfer applicants must have passed no fewer than nine transferable college credit-hours. They will be favorably considered for all academic work completed with a C or higher grade at each prior institution given that every

course under consideration is required by the chosen program. Transfer credit-hours are limited to work satisfactorily completed at an accredited institution of higher education within a five year period immediately preceding application for admission.

A transfer applicant will not be considered for admission if he or she is on academic probation, suspension, or dismissal from the previous institution given that every course under consideration is required by the chosen program. If he or she would be on academic probation upon return to the previous institution; or if on disciplinary probation during or following the last term at the previous institution; or within one year after dismissal.

All students who have passed nine transferable credit-hours at an accredited institution of higher education prior to applying for admission to Polytechnic University of Puerto Rico must submit:

1. An application for admission will not be considered unless received on or before the application deadline indicated in the academic calendar. PUPR reserves the right to refuse applications for admission once enrollment limits are reached.
2. An official transcript from each institution of higher education previously attended. The transcript should be mailed directly by the institution(s) of origin to the Admissions Office. The transcript(s) must furnish a statement of good standing. Student copies of official transcripts are not acceptable. The applicant who is actively enrolled in another institution at the time of application should request a current official transcript to be forwarded immediately. An official transcript, including the final grades of the last quarter or semester of attendance, must be requested and sent to the Admissions Office.
3. A copy of the latest edition of the undergraduate catalog from each institution of higher education previously attended.
4. Payment of a thirty dollar (\$30.00) application fee with the completed application form. The application fee is not refundable and will not be applicable toward the student's registration charges.
5. All transfer students must submit a letter of recommendation signed by the Dean of Student Affairs of the previous institution.
6. An Immunization Certificate (applies only to applicants under 21 years of age).
7. Aliens must submit a copy of immigration status.
8. Recent Birth Certificate

Candidates from institutions of higher education who would have met the admission requirements of high school applicants prior to their university experience will be taken into consideration for transfer admission.

SPECIAL STUDENTS

Applicants who have studied at an institution of higher education and have been authorized to take courses at Polytechnic University of Puerto Rico to complete requirements from their institution, are classified as special students. Also, those applicants who are not interested in obtaining an academic degree from PUPR or a grade except for use as professional development course work, are classified as special students. An applicant desiring to enroll as a special student must submit:

1. A complete application form for admission.
2. Payment of thirty dollars (\$30.00) non-refundable application fee with the completed application form.
3. Submit an authorization as Special Student.
4. Recent Birth Certificate

If the person wants to change this classification to a Regular Student, he or she will have to fulfill all the requirements of the Admissions Office, take the prerequisites and obtain a grade of **C** or higher in everyone. A Special Student does not qualify for financial aid until the classification to Regular Student has been made.

AUDIT STUDENTS

Audit Students are required to submit an admission application and pay a \$30.00 non-refundable admission fee. These students are not interested in earning credit-hours toward a degree, diploma, or certificate. They may attend classes as auditors after paying the tuition fees, with authorization of the Faculty Dean and Registrar, but will not receive grades or credit for work done in any subject.

INTERNATIONAL STUDENTS

Polytechnic University of Puerto Rico (San Juan, Miami and Orlando campuses) is authorized by the Immigration and Naturalization Services (INS) to issue a *Certificate of Eligibility for Nonimmigrant Student Status* (Form I-20) for qualified international students who are not citizens of the United States of America or permanent residents.

Following admission acceptance, the applicant must submit all documentation required by the INS, and established in the Applicant's Checklist. Afterward, the Admissions Office issues and delivers the Form I-20 to admitted students. The admitted students then deliver the completed Form I-20 to the Bureau of Immigration and Citizenship Services (BICS) of their country of origin in petition of a Student Visa Number. Subsequent to the BICS authorization of a Student Visa Number, admitted students return this Form I-20 to the Admissions Office. Applicants are classified as international students only after receipt of all required documentation and paid registration fees for the first academic term of full-time enrollment.

CHECKLIST INTERNATIONAL UNDERGRADUATE APPLICANTS

An applicant desiring to enroll as an international student must fulfill the following documentation:

- ◆ Complete the Application for Admission.
- ◆ Pay a \$50.00 non-refundable Admission Fee.

Resident Applicant

- ◆ Copy of Resident Card

Non-Resident Applicants/Student Visa:

In order to process the I-20, all applicants must demonstrate financial capacity to complete the required educational program.

- ◆ Submit a sworn statement by the person that will cover the applicant's educational costs and living expenses, indicating the annual amount assigned for this purpose.

All secondary school graduates interested in applying to PUPR's Puerto Rico campus must:

- ◆ Submit an official transcript of all secondary education validated by the Department of Education of Puerto Rico if applying for admission to PUPR's Puerto Rico campus.

All secondary school graduates interested in applying to PUPR's Orlando and Miami campuses must:

- ◆ Submit an official transcript of all secondary education validated by the Florida Department of Education

TRANSFER APPLICANTS

- ◆ Submit an official transcript of the applicant's home country and certified by one of the following agencies: **Educational Credential Evaluators, Inc., World Education Service, Academic Credentials Evaluation, Josef Silny, Inc.**

HOME SCHOOLING

Polytechnic University of Puerto Rico established a system of academic credential evaluation for each homeschooler applying for admission into an academic program. The purpose is to determine whether the applicant complies with all the criteria for eligibility. These criteria are the following:

1. File an Application for Admission with the following attached documents:
 - a. Non reimbursable \$30.00 fee
 - b. College Entrance Examination Board test results
 - c. Immunization Certificate (Original) (Only for students under 21 years of age.)
 - d. Recent Birth Certificate

- e. Home Schooling - Educated Student Certificate (PUPR will provide the form) (Document must be notarized)

Transfer Student with Form I-20

1. An application for admission.
2. Payment of fifty dollars (\$50.00) non-refundable application fee.
3. An immunization certificate under 21 years of age.
4. All transfer students must submit a letter of recommendation signed by the Dean of Student Affairs of the previous institution.
5. An official transcript from each institution of higher education previously attended. The transcript should be sent directly from the institution of origin to the Admissions Office. Translations should be made and validated by a representative of the Department of State of the country of origin or its consulate in Puerto Rico.
6. Evidence of the ability to defray all expenses while studying in Puerto Rico.
7. Recent Birth Certificate

ADMISSIONS PROCEDURE

Candidate students (i.e., First time freshman, transfer, special audit and foreign) may apply for admission to any of the three academic terms and summer session available each academic year. Applications for full-time and part-time studies are processed throughout the year. Although applications may be made at any time, candidates for admission to the First Time Freshman class should submit their applications during the final year of high school.

Upon proper completion of all admission requirements as stated in the previous section of the Catalog, the applicant will then be admitted, and eligible to register. When registration is complete, and all fees are paid, the student will be officially enrolled at the University. The dates for registration are stated in the Academic Calendar. Counselors are available to help the registrants for program planning and scheduling of classes during the registration period.

SPECIAL PROGRAM FOR HIGH SCHOOL STUDENTS

The Special Program for High School Students (SPHS) provides high-achieving students the opportunity to take college-level courses while pursuing their 10th, 11th and 12th grade. Students with grade point averages (GPA) of 3.25 or more that comply with all the admission requirements are accepted into the program. Participants can enroll in up to two college-level courses per term provided these are taken after school hours. Credit-hours completed through SPHS can be validated after successful completion of course requirements. Financial aid is available for those who qualify.

XI. FINANCIAL INFORMATION AND SERVICES

TUITION AND FEES SCHEDULE FOR UNDERGRADUATE PROGRAMS

The following schedule of tuition and fees applies to all undergraduate students at Polytechnic University of Puerto Rico. Academic year consists of three consecutive academic periods called terms from August to July of the following year.

TUITIONS PER CREDIT-HOUR		
TOT CODES	DESCRIPTION	FISCAL YEAR 2013-2014
TEN	TUITION ENGINEERING	\$190.00
TBA	TUITION BUSINESS ADM.	\$175.00
TGN	TUITION GENERAL COURSE	\$175.00
TAR	TUITION ARCHITECTURE	\$200.00

**Tuition and fees are subject to change without notice.
Revised October 10, 2011**

GENERAL FEES (Per Trimester-12 weeks)	DESCRIPTION UNDERGRADUATE FEES	FISCAL YEAR 2013-2014
ATL	ATHLETIC FEE	\$30.00
CTI	TECHNOLOGY FEE	\$80.00
LIB	LIBRARY	\$65.00
REG	REGISTRATION	\$35.00
SRM	STUDENT HEALTH SERVICES	\$20.00
STA-UG	STUDENT ACTIVITIES	\$30.00

TOT CODES	OTHER FEES	FISCAL YEAR 2013-2014
ADB	APPLICATION FOR ADMISSION	\$30.00
ADF	APPLICATION FOR ADMISSION INTERNATIONAL STUDENTS	\$50.00
REA	READMISSION	\$25.00
TRA	TRANSCRIPTS	\$8.00
CER	CERTIFICATIONS	\$5.00
RRC	COPY OF REGISTRATION REPORT	\$3.00
ADC	DROP COURSE FEE (per course)	\$15.00
DPC	DEFERRED PAYMENT CHARGE	\$40.00
DGS	ARCHITECTURE DESIGN	\$240.00
ACE	ACADEMIC EVALUATION FEE (first one is free)	\$10.00
DID	DUPLICATE ID CARD	\$16.00
IDC	CAMPUS CARD	\$15.00
LAB	LABORATORIES	\$225.00
LRE	LATE REGISTRATION FEES	\$60.00
PAK	PARKING ACCESS	\$60.00
DDI	DUPLICATE DIPLOMA	\$65.00
ADC	PARTIAL / TOTAL WITHDRAWAL (per course)	\$15.00
GRA	GRADUATION FEE*	\$145.00
CMP	CHANGE FOR ACADEMIC CONCENTRATION OR PROGRAMS	\$15.00

* Graduation candidates will pay the graduation fee in effect at the moment of the graduation ceremony. Graduation fee paid after the dates specified in Academic Calendar will have additional charges.

PAYMENT OF TUITION AND FEES

Every student must pay the total cost of tuition and fees during the registration process. They are responsible for the total cost of tuition, even if they do not attend classes, their scholarship and/or sponsorship is cancelled, or if a withdrawal is requested.

The university grants the privilege to defer 50% of the total cost to students who choose not to pay in full. Deferred payments are due thirty (30) days after the beginning of the term and involve an additional cost. The validation process of registration is not completed until the student has paid the total cost of tuition or signs a deferred payment agreement. The student is responsible for verifying and keeping track of enrollment, add/drops and defer payments dates, and taking the necessary steps to comply with them.

Students who have requested financial and or veteran benefits must consult either with the financial aid office or the Institution's veterans Representative located in the

Registrar's office prior to the completion of the registration process.

Students receiving sponsor's benefits should contact the Bursar's Office and submit relevant evidence to determine the corresponding registration cost according to the benefits received.

Payments of fees can be made in cash, money order, manager's checks, certified or personal checks; checks should be made payable to: Polytechnic University of Puerto Rico or PUPR (returned checks will incur in additional charges and the student lose the privilege of using this payment method). In addition, Visa, MasterCard, or American Express credit cards, and debit cards are accepted. Students can also make payments on outstanding balances through Telepago Popular of Banco Popular. Through Polytechnic University's portal: mypoly.pupr.edu (online service) students can make payments through Banco Popular ATH, Visa, MasterCard and personal checks for previous balance and new term.

Polytechnic University of Puerto Rico does not issue credit and/or debit card refunds. If the student pays with a credit/debit card and for some reason a reimbursement is required, the institution will issue a check under the student's name.

Polytechnic University of Puerto Rico reserves the right to revise policies, tuition fees and other costs.

FINANCIAL AID GENERAL ELIGIBILITY REQUIREMENTS

The University participates in the following student financial aid programs: Federal Pell Grant, Federal Supplemental Educational Opportunity Grant (FSEOG), Federal Work Study Program (FWSP), Institutional Work Study Program (IWSP), Federal Direct Loan program, State Grants and Scholarships, Institutional Scholarships, High School Special Program (PES), Science, Technology, Engineering and Mathematics (STEM).

To be eligible to receive financial aid, a student must meet the following requirements:

- Is enrolled as a regular student in an eligible program.
- Is a U.S. citizen or eligible alien.
- Has a high school diploma or its equivalent.
- Has a valid social security number.
- Is registered with selective Service, if required.
- Is not in default.
- Makes satisfactory academic progress.
-

APPLICATION PROCEDURES

Students that require financial aid must complete the free Federal Student Aid Application form from the U. S. Department of Education. The Student Aid Report (SAR) or Institutional Student Information Record (ISIR) received will contain the information the students gave on their Application plus their Expected Family Contribution number which determines their eligibility for Pell Grant and other programs.

The student must submit all required documents to the Financial Aid Office. The student must complete promptly each step in the process, so as not to miss any deadlines. Noncompliance with the deadline may result in the denial of the requested financial aid.

To determine eligibility, the Financial Aid Office considers the student's financial need, and academic status. For the specific requirements of each program and additional information about financial aid, see the Student Financial Aid Manual in the Financial Aid Office.

FINANCIAL DELINQUENCY

If a student does not meet its financial obligations within the stipulated dates, the Collection Policy of Polytechnic University of Puerto Rico states that:

1. Tuition and fees from previous terms of study must be paid in full, prior to the student registering for the current trimester.
2. After the defer date (30 days after the beginning of the term,) any outstanding balance will be subject to 1.5% monthly interest.
3. After 180 days, outstanding balances will be subject to an additional collection fee if the university refers these to legal divisions or collection agencies.
4. If PUPR is obliged to take legal action for the collection of this debt, the student will be responsible for costs, disbursements and other fees incurred in the collection, as determined by the corresponding Court. Debtors will be subject may be excluded from graduation ceremonies. The university may also withhold grades, issuance of transcripts, degrees, diplomas, and certificates of good standing to any student whose account is in arrears.

Inactive students may be granted a Payment Plan to pay-off their outstanding balances. This agreement with Polytechnic University of Puerto Rico is held in association with United Credit Bureau. If students referred to a legal division or collection agency, will be charged additional fees.

Sponsored Students are also governed by the policies mentioned above, even if the outstanding balance belongs to the Sponsor.

FINANCIAL SERVICES: REFUND POLICIES

The Bursar's Office is responsible for complying with the refund policy established by the institution. The student must request a withdrawal in writing, and in accordance with the Academic Calendar, for the refund to be applied.

INSTITUTIONAL REFUND POLICY For any partial or total withdrawal requested by a student:

	Percentage of Refund
During regular registration process	100%
During the first week of classes in each term	100%*
During the second week of classes in each term	33% Tuition and Laboratory Fess**
During the third week of classes through the withdraw deadline of each term	0.00%

*Registration fee is non-refundable.

**Registration, Library, Athletic Activities, Technology and Activities Fees are nonrefundable.

RETURN OF FEDERAL FUNDS (TITLE IV)

When a student ceases to attend classes, a statutory schedule is used to determine the amount of federal funds the student is entitled to receive. This schedule is based on calendar days; and has no relationship with the refund policy of the institution.

Up through 60% of the calendar days of the academic terms in each enrollment period, pro rata schedule is used to determine the amount of federal funds the student has earned at the time of withdrawal. Withdrawal after the 60% level of the academic term is reached, a student has earned the right to 100% of federal funds. The student is responsible for any pending balance due to the return of federal funds.

Students who do not officially withdraw (unofficial total withdrawal) only earn 50% of the federal funds received. The student would be responsible for any pending balances due to the return of title IV funds.

XII. ACADEMIC INFORMATION AND SERVICES

The student should familiarize thoroughly with: (1) this section of the catalog, (2) the section containing the academic requirements for the degree he/she plans to earn, (3) the offerings of his/her major program of study, and

(4) any changes published after the publication of this Catalog. A degree will be awarded only to a student who has satisfied all the academic and administrative requirements of Polytechnic University of Puerto Rico.

PROGRAM CURRICULUM SEQUENCE CONTINUITY

Polytechnic University of Puerto Rico provides students with the program curriculum sequence aligned with the academic time length and course prerequisites. The student is responsible for following the curriculum sequence to accomplish the graduation requirements within the corresponding time schedule. If the student is not able to follow the curriculum sequence, he/she must coordinate and develop the most effective program sequence with his/her mentor to comply with the graduation time-frame. The department is in charge of providing courses based on the program curriculum sequence. If the course has low enrollment, the department will develop course alternatives for students that are in compliance with the program curriculum sequence.

ACADEMIC PROGRAM CONTINUITY

Polytechnic University of Puerto Rico will reserve the right to close or postpone an academic program based on low student enrollment. To insure that the student is not affected by this decision, the institution will provide the necessary course alternatives to allow program completion.

ACADEMIC SCHEDULE

Registration for all students is held prior to the beginning of each trimester on designated days as specified in the Academic Calendar. Completion of registration for each trimester is a prerequisite of class attendance. The academic year consists of three terms, and three summer sessions. Fall, Winter, and Spring classes are scheduled from 8:00 am to 10:30 pm, Monday through Thursday, and from 8:00 am to 5:00 pm Friday and Saturday. Depending on the term selected, students may be required to make up class contact hours lost due to days observed as holidays.

CHANGES IN CLASS SCHEDULE

During the first week of classes a student may add, or drop courses online using the student portal or in person at the Integrated Student Services Center (CESI).

Add Policy: A student may add a course during the official Add/Drop period; a class which has been dropped will not appear in his/her permanent record. Approval of the student's Director is necessary before any course change is made. For withdrawal after the Add/Drop period, consult the Withdrawal Policy.

ACADEMIC LOAD

The minimum full time load per term is twelve (12) credit hours. To register for sixteen (16) credit-hours or above, the student must seek the approval of the Department Director and Dean. Credit-hours will not be awarded for courses in which the student is not properly registered.

PARTIAL WITHDRAWAL FROM COURSES

Polytechnic University of Puerto Rico does not encourage withdrawal from courses. Nonetheless, should a student consider withdrawing from a course, consultation with counselors or mentors is recommended to discuss possible options other than withdrawal. The partial withdrawal must be completed online through the student portal until the date specified in the academic calendar.

TOTAL WITHDRAWAL

Students needing to withdraw from the university for personal reasons, must secure a Withdrawal Form from the Office of the Registrar. This type of withdrawal must be signed by the institution's Counselor, Librarian, Financial Aid Officer, and the offices of the Registrar and Finance. The application shall be submitted to the Office of the Registrar by the stated deadline.

ABANDONING A COURSE

Whenever a student leaves the course and does not request an official withdrawal will receive a **WF** grade to allow the institution to differentiate between a student who failed to complete its academic responsibilities, and a student who failed as a result of course abandonment.

GRADING SYSTEM: GRADES WITH HONOR POINTS

Polytechnic University of Puerto Rico utilizes an alphanumeric grading system. The grades that must appear in the mid-term and final reports are as follows:

- A Excellent (4 honor points per credit-hour)
- B Good (3 honor points per credit-hour)
- C Satisfactory (2 honor points per credit-hour)
- D Deficient (1 honor point per credit-hour)
- F Failure (0 honor points per credit-hour)
- WF Student abandoned course without Authorization
 - I Incomplete (With a grade)

(Honor points are the equivalences assigned arbitrarily to a letter grade)

GRADE POINT AVERAGE

A student's Grade Point Average is the measure of academic achievement. It is computed as follows:

- a. The total number of credit-hours corresponding to all courses taken, counted once, and having a grade of A,B,C,D, F or WF, is obtained (T).
- b. The credit-hours of each course is multiplied by 4,3,2,1 or 0 according to grades of A,B,C,D, F or WF, respectively.
- c. These products are added (S); and identified as honor point .
- d. S is divided by T to obtain the grade-point average.

A student may be allowed to repeat a course passed with a "D", before taking the next course in the sequence, if the corresponding Department Head considers that the case has sufficient merit to receive authorization. In computing the grade-index, the highest grade obtained in a repeated course will be used whenever it is higher than the original grade. If the grade obtained in the repeated course is lower than the original grade, the original grade will prevail.

GRADES WITH NO CORRESPONDING HONOR POINTS

- AU** Audit (class audited only)
- R** Repeated course
- W** (Withdrawal) Indicates that the student, after obtaining proper authorization from PUPR's officers, receives permission to withdraw from a course without penalty.
- WM** Military Withdrawal.
- P** Pass, only for specified courses.
- NP** Not passed, only for specified courses.

GENERAL POLICY AND PROCEDURES TO EVALUATE STUDENT ACADEMIC ACHIEVEMENT

The policy and procedures for student retention, probationary status, suspension, and permanent dismissal are established mechanisms that allow for the evaluation of a student's academic achievement.

Polytechnic University of Puerto Rico requires every student to demonstrate academic progress in the number of academic credit-hours completed and the grade point average the student maintains.

DEFINITIONS

Credit-Hour

A credit hour for Federal programs, including the Federal student financial assistance programs, is defined as follows: (34CFR 600.2 of final regulations)

An amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than:

1. One hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of time; or
2. At least an equivalent amount of work as required in paragraph (1) of this definition for other academic activities as established by the institution, including laboratory work, internships, practice, studio work, and other academic work leading to the award of credit hours.

PUPR's Adopted Definition of Credit-Hour

One credit-hour corresponds to 15 contact hours per term for a lecture course, and thirty (30) to forty five (45) contact hours per term for a laboratory or practicum course. Additionally, includes a minimum of 2.5 hours of out-of-class student work each week for the twelve week term. The exception is each one of the Architecture (ARCH) courses which requires twelve (12) contact hours per week.

Attempted Credit-Hours

Credit-hours the student has registered at PUPR, and in which he/she has obtained I (With a grade), A, B, C, D, F, WF or W, including all repetitions.

Transferred Credit-Hours

Credit-hours taken at other accredited institutions, which the student has passed with A, B, or C grades, and that are accepted by the Department Director or the corresponding Dean, in accordance with PUPR policy.

Passed Credit-hours

Attempted credit-hours taken at PUPR in which A, B, C, or D grades are obtained, except in those specific cases defined by the departments.

Grade Point Average

The measure of academic merit achieved by the student; it is calculated by dividing the total accumulated honor points

by the number of credit-hours in which the student has received final grades, including outstanding F's.

Dismissal for Academic Deficiency

A student who systematically fails to satisfy the achievement index may be permanently dismissed from PUPR for academic deficiency.

Academic Progress

The measure that shows whether the student passes 66% of the attempted credit-hours with a grade point average equal to, or higher than, the retention index. See Table A or Table B, whichever applies.

Repeated Courses

Undergraduate courses in which a student has been enrolled two or more times because he/she has obtained a grade of D, F, WF or W. For the purpose of determining the Grade Point Average only the highest grade obtained will be used.

Academic Year and Term

Academic year consists of three consecutive academic periods called terms from August 1 to July 31 of the following year. The Summer academic period is optional and the grades will be added to the previous academic period of study. Academic Term refers to the 12 week period running from the first day at classes to the last day of final tests as defined in Page 4. During the summer session the period is reduced to six weeks doubling the daily contact hours per week.

Doted Courses

All courses will become extinct, expired or doted seven (7) years after being passed. This rule applies equally to courses passed at PUPR or to transfer courses. The respective Department Head and Dean may validate some after judging each one of them. The student must repeat all those confirmed doted by the Dean, or in its place may be authorized by the Department Head and the Dean to take advanced equivalent courses instead.

Retention Index

PUPR adopts the required retention index as seen in Table A, in accordance with the number of completed credit-hours and transferred credit-hours. (Students are required to obtain a minimum grade point average of 2.00/4.00 in concentration courses for graduation purposes.) This constitutes the Institutional Policy, administered by the Registrar's office.

Retention Index (Qualitative Element)

The institutional policy applicable to students without

Federal Financial Aid is shown in the following table:

Table A- Retention Index (Qualitative Element)

Transferred Credit-Hours (1)	Passed Credit-Hours at PUPR (2)	Total Accumulated Credit-Hours Range (1+2)	Minimum Grade Point Average (MGPA)
		0-36	1.50/4.00
		37-72	1.65/4.00
		73-108	1.80/4.00
		109 and more	2.00/4.00

Transferred credit-hours will not be used to compute the grade point average, but they will be counted to determine the level or year to which the student belongs.

Maximum Time Allowed to Complete an Academic Degree while Receiving Federal Financial Aid: (Quantitative Element)

Students must complete graduation requirements within a maximum time equivalent to 150% of the credit-hours required by the academic degree program in which enrolled. Above 150% the student will be responsible for paying the total registration charges.

Veterans receiving benefits must complete graduation requirements within the program's schedule time of completion (100%). Veteran's educational benefits will finish at the program's schedule time of completion of the 150% of the credit-hours required. In the event that the veteran does not complete the graduation requirements within the 150% limit; the student will not be able to continue receiving the veterans' or any other Federal financial aid. However, the student may receive any other financial aid available.

The academic records of the veterans are always kept under the custody of the Registrar within the premises of the Registrar's Office.

Probationary and Suspension Status

Students whose academic progress does not satisfy the qualitative elements will begin a probationary period that will not exceed two consecutive academic years before being suspended for one year. After suspension is effective, the student may return under a probationary status for a maximum period of one (1) additional academic year, at the end of which he/she may be suspended for a period of three academic years. A student may be admitted once again under a probationary status for one academic year. In the event he (she) does not succeed, he (she) will be permanently dismissed.

Incomplete (I) Grade

A professor may deem necessary to give the student an incomplete (I) or provisional grade when for justifiable

reasons the student was impeded to satisfy all the course requirements. The grade is calculated by assigning a grade of "O" for the part of the work not finished. When a student completes the course requirements by the date indicated in the academic calendar, the instructor changes the provisional grade to the final grade and reports this change to the registrar. If the Instructor does not report any change within the required period, the provisional grade becomes final. In no event, the final grade will be less than the provisional one.

Academic Progress Review Procedures by Registrar

The academic progress of the students will be measured using the qualitative element which will be verified during the summer of each academic year.

The retention index (qualitative element) will be determined according to Table A. The GPA will be computed only with credit-hours taken at PUPR. Probation, suspension, or dismissal will be determined, employing the following procedure:

1. When the accumulated index is lower than the established index as given in Table A, an academic probation period (P1) will be granted for one academic year. The Registrar's Office will notify the student of the academic status in a certified letter. At the same time, the Counseling Office will be notified to ensure the required follow-up.
2. During the probation period (P1), the student must raise the grade point average to a value equal to or higher than the corresponding index in Table A.
3. If after this probation period the student does not comply with the established condition in Item 2 and does not remediate his/her academic deficiencies, he/she will be granted a second one academic year probation (P2). Whenever a student fails to succeed the probation (P2), the student will be suspended for one academic year. The Registrar's Office will notify the suspended student via certified letter.

After the one (1) year suspension, the student may be readmitted in probation (P 3) for one academic year.

In the event a student fails to raise the GPA above the retention index after the third probationary period (P 3), the student will be suspended for a period of three (3) academic years; afterwards, the student may request readmission. A student may be admitted again under a probationary status for one academic year. In the event he/she does not succeed, he/she will be permanently dismissed.

ACADEMIC DISHONESTY AND PLAGIARISM

The University seeks to foster a spirit of honesty and integrity. Any work submitted by a student must represent an original work produced by that student. Any source used

by a student is to be documented through normal scholarly references and citations, and the extent to which any sources have been used must be apparent to the reader. The University, further, considers a dishonesty the resubmission for a subsequent course, partially or entirely of work already submitted and graded for a previous course. It is the student's responsibility to seek clarification from the course instructor about how much help may be received in completing an assignment or exam or project or what sources may be used. Students found guilty of academic dishonesty or plagiarism shall be liable for sanctions up to and including dismissal from the University.

RIGHT TO APPEAL

The student may appeal this decision under the following conditions:

- a. Any student who considers that a mistake has been made in the application of these policies and procedures used to evaluate academic progress may send a written request for reconsideration to the Academic Achievement Committee within ten (10) working days after notification of the decision.
- b. The request for reconsideration should state clearly the mistake he/she understands has been made, give a brief statement of facts, state and justify the basis for the requested change or restitution.
- c. Each request for reconsideration must be submitted to the Registrar's Office.
- d. Presentations before the Academic Achievement Committee by persons who are not members of the Committee will be permitted in special cases. The Committee's decision will be final.

ACADEMIC PROGRESS REVIEW PROCEDURES FOR STUDENTS WITH FINANCIAL AID

The academic achievement of all students who qualify and receive federal financial aid will be evaluated employing two indices, as follows:

- a. Retention Index (Qualitative Element) This index is defined as shown in Table A.
- b. Retention Index (Quantitative Element) The minimum percentage of passed credit-hours required from each student receiving financial aid is not less than 66% of credit-hours attempted every academic year. This is to say that the student must complete all the graduation requirements within the time frame of 150% of the total credit-hours of program chosen. The calculation of the 150% takes into consideration the student's academic history. The student is not qualified to receive any further financial aid after reaching the 150% limit.

The student academic progress is measured annually by the Financial Aid Office during the summer term. If it is the first time in which the student doesn't meet the Academic Progress Policy, the student will be placed on a limited probationary period (one year) and will continue to receive financial aid (Pell Grant Program); if not, the student will not be eligible for financial aid. The Financial Aid Office will inform the students in writing.

EXAMINATIONS

Final examinations are regularly scheduled and administered at the end of each term. Dates of final examination schedules will be published and placed on the bulletin boards of the Institution. It is the responsibility of the instructor to give two or more summative examinations in each term in compliance with the syllabus, as well as a comprehensive final examination, which is compulsory for all students in a class. Besides these, the instructor may administer several other formative tests as deemed necessary in compliance to Outcomes Assessment Plan.

DEAN'S LIST

Announcement is made at the beginning of each term of those students who, in the previous term, completed a minimum of twelve (12) credit hours and accumulated a general grade point average of 3.25 or higher and who are eligible for inclusion in the National Dean's List.

READMISSION POLICY

Students who are not active during two or more consecutive terms, or who are under suspension for disciplinary or academic reasons, and wish to continue their studies, must apply for readmission to the institution. Regular students who have discontinued their studies for one year or more will be readmitted under the procedure in effect. The applicable curriculum will be the one outlined in the Catalog in effect at the time of readmission. Each applicant will be evaluated by the Director of the Department to which the student is seeking readmission.

Readmission applications must be submitted at least a month prior to the next registration period. If a student does not register during the period requested, the application will remain active for one (1) additional term.

PROCEDURE FOR READMISSION

1. The student will complete and submit the readmission application to the Registrar's Office.
2. The student will pay a nonrefundable readmission fee.

3. Upon payment of the readmission fee, the Finance Office will notify the student of any outstanding debt with the institution.
4. If a student is indebted to the institution, the process of readmission is held up until the student pays the debt and receives clearance from the Finance Office.
5. The Registrar's Office will apply the following criteria to evaluate the readmission application:
 - a. Study any evidence of disciplinary measures taken or non-compliance with University regulations and any stipulations made.
 - b. Verify that the student complies with the minimum G.P.A. according to Table A (Retention Index)
 - c. Confirm that the student complies with the required suspension time limit.
6. A student whose readmission application has been denied may appeal to the Readmissions Committee through the Registrar's Office. The student will receive instructions regarding the procedure to follow in order to request reconsideration by the committee.
7. If a student has a lower grade point average than required, or if required suspension time limit has not expired and the Committee rules in favor of the student, readmission will be granted on a probationary basis.
8. The conditions of the probation period will be:
 - a. The student must pass all courses, for which he/she is registered, with a grade of "C" or higher.
 - b. The academic load will be limited to a maximum of twelve (12) credit-hours per term.
 - c. The G.P.A should be increased or improved according to what has been established.
9. Students who have voluntarily interrupted their studies at PUPR, and during this inactive period have attended another institution (or other institutions) without prior permission from the Department Director, will have no right to request the transfer of credit-hours taken at other institutions.
10. The decision of the Readmissions Committee will be sent in writing to the student through the Registrar's Office. The decision is firm and final.

APPLICATION FOR GRADUATION

Candidates for a Baccalaureate degree who have completed 80% or more of the credit-hours required must apply for graduation. The application must be completed and a graduation fee paid no later than the date specified in the academic calendar. Applications are obtained at the Registrar's Office. The application should be returned to the Registrar's Office after clearance by Library, Financial Aid and Finance Offices confirming nonexistence of debts and

payment of the non-refundable graduation fee. Any alleged error in the analysis of academic record should be reported to the Registrar within a week after it has been received by the student.

GRADUATION REQUIREMENTS

Polytechnic University of Puerto Rico reserves the right to make changes in the curricula and degree requirements whenever, in its judgment, the same are considered beneficial both for the Institution and the students. As a rule, a student is entitled to graduate under the curriculum requirements in force at the time of admission to the Institution. However, students who fail to fulfill the graduation requirements within the regular period assigned to their corresponding curricula, and students who re-enroll after a period of one year or more of absence are governed by the requirements applicable to the class in which they will graduate.

To receive a graduation diploma from Polytechnic University of Puerto Rico, candidates must meet the following conditions or requirements:

1. Apply for graduation after passing 80% of the program credit-hours required by filing an application form at the Registrar's Office on the day specified in the academic calendar.
2. Pay the graduation fee and satisfy all other financial obligations to the University not later than the date specified in the academic calendar.
3. Students completing requirements in the Spring Term are required to attend the Commencement Exercises, unless excused by the Dean of the corresponding Faculty or the Vice President for Enrollment. Students completing requirements during the Summer, next year Fall and Winter Terms are invited to participate in next year summer commencement exercises.
4. Students should have taken the final credit-hours for the degree at PUPR with the understanding that these credit-hours correspond to at least the total credit-hours of the last year of the program as specified and described in the Catalog.
5. The student must attain a minimum cumulative grade point average of 2.00/4.00 in the student's major department courses (for engineering, major courses include both general engineering and concentration courses), as well as a minimum cumulative grade point average of 2.00/4.00. It is highly recommended that students repeat if possible; all concentration courses passed with D in order to improve their GPA and assure a better dominion of the subjects.
6. For graduation with honors, the student must satisfy all of the following additional criteria:
 - a. Must have completed at PUPR not less than 65%

- of the program credit-hours required for graduation.
- b. Must have earned at PUPR (including all attempted credit hours) an overall grade point average of 3.250 - 3.499 Cum Laude; 3.500 - 3.899 Magna Cum Laude; 3.900- 4.000 Summa Cum Laude
 - c. Must be recommended by the Honors and Academic Distinctions Committee, composed of the President of the University and four members of the Academic Council appointed by the President.
7. The University celebrates Commencement Exercises once every academic year during the Summer term, at which time all degrees and certificates are awarded.

CURRICULAR CHANGES

When the curriculum of any one program is revised, the Registrar will automatically initiate the transfer process of every student, enrolled in said program to the revised curriculum. The student will be moved horizontally and will be required to take all the necessary courses of a level higher than that at which he/she actually is until he/she completes the number of credit-hours specified in the old curriculum. Under no circumstances will the student be asked to go and take any new courses of lower codification added to the revised curriculum. By the same token, the Department Director and the Registrar will do everything within their power to help the student transfer smoothly without the penalty of taking an excessive number of new courses.

CERTIFICATIONS AND TRANSCRIPTS

Whenever a student files an application with the Registrar's Office for a certification of his program of study, transcripts or any other official statement, the same will usually be issued by the Registrar within two weeks after the filing of the request. However, when a request is made at the beginning or the end of a term, a longer period of time for issuance may be required.

To transfer credit-hours to other colleges and universities and to supply information to certifying agencies and prospective employers, official transcripts are issued in a confidential manner. These are mailed directly to the addresses designated by the students and are never given to the student or any other individual. Students may also obtain an official copy of the transcript of credits marked Student Copy. Any alleged errors in the transcript should be reported to the Registrar within ten days of receiving it. A transcript and certification fee is charged for each transcript. All services are denied to debtor students.

DIPLOMAS

Diplomas must be claimed by graduates at the Registrar's office no earlier than three weeks following the graduation ceremony.

CHANGE OF ADDRESS

When a student submits an application for admission, he/she is required to submit a mailing address. After admission, changes of address should be reported immediately to the Office of Admissions. If change of the address is not indicated, the University will not be responsible for correspondence it sends which is not received by the student. Any notice, official or otherwise, mailed to a student's address as it appears on the records shall be deemed sufficient notice.

CLASS ATTENDANCE

The fact that classes are scheduled is evidence that attendance is important. Students should maintain regular attendance if they are to attain maximum success in the pursuit of their studies. Students who have not attended any classes during the first two weeks of the academic term, are automatically disqualified to charge tuition fees to federal funds and are responsible for their payment. The instructor, via email to rosters@pupr.edu, will submit the names of all such students to the Office of the Registrar.

It is recognized that the record of class attendance may vary according to the student, the instructor, or the course. On occasions, it may be necessary for the student to be absent from scheduled classes or laboratories for health reasons. The student is responsible for contacting the instructor and for all work, completed or assigned. Instructors in charge of courses in all programs of study are required to include in their midterm and final grade reports the total number of absences of all students. The Registrar will not accept reports if this condition is not met by the instructor.

XIII. PROGRAMS OF STUDY

SCHOOL OF ARTS, SCIENCES AND EDUCATION

MATHEMATICS AND SCIENCE DEPARTMENT
SOCIO-HUMANISTIC STUDIES DEPARTMENT
EDUCATION DEPARTMENT

BACHELOR IN SCIENCE IN
SECONDARY EDUCATION
IN NATURAL SCIENCES & MATHEMATICS

SCHOOL OF ARCHITECTURE

BACHELOR OF ARCHITECTURE
BACHELOR OF INTERIOR DESIGN

SCHOOL OF ENGINEERING, SURVEYING AND GEOSPATIAL SCIENCE

BACHELOR OF SCIENCE IN:

CHEMICAL ENGINEERING
CIVIL ENGINEERING
COMPUTER ENGINEERING
COMPUTER SCIENCE
ELECTRICAL ENGINEERING
ENVIRONMENTAL ENGINEERING
INDUSTRIAL ENGINEERING
LAND SURVEYING AND MAPPING
MECHANICAL ENGINEERING

SCHOOL OF MANAGEMENT AND ENTREPRENEURSHIP

BACHELOR OF BUSINESS ADMINISTRATION IN

ACCOUNTING
CONSTRUCTION MANAGEMENT
FINANCE (POSTPONED)
GENERAL MANAGEMENT
INDUSTRIAL MANAGEMENT (POSTPONED)
MANAGEMENT OF INFORMATION SYSTEMS
(POSTPONED)
MARKETING
ENTREPRENEURSHIP

**COMBINED BACHELOR'S & MASTER'S
DEGREE PROGRAM**

SCHOOL OF ARTS, SCIENCES AND EDUCATION

The School of Arts, Sciences and Education consists of the following units:

- Mathematics and Science Department
- Socio-Humanistic Studies Department
- Education Department
- Tutoring Services
- Student Support Services

The School provides all PUPR students with the undergraduate academic background and knowledge of the general culture, mathematics, science, education, the humanities, the social sciences and languages, as well as the required knowledge of physics, chemistry and biology to help them meet the challenges presented by the degree granting units of Engineering, Architecture, Surveying and Geospatial Science, and Business Administration. The School also equips learners with a strong educational foundation in the Education Program while providing intervention services for students at-risk.

VISION

The faculty of the School of Arts, Sciences and Education develops in our student body social awareness, sensitivity to existing societal differences, tolerance and acceptance through the guided exposure to the collective, historical, cultural and artistic realities of the world. The academic support personnel and faculty members facilitate the acquisition and enhancement of learning experiences and student retention.

MISSION

The faculty of the School of Arts, Sciences and Education are dedicated to the development of core learning experiences that serve as the basis for advanced education and training in engineering, architecture, business administration, geomatic sciences and geospatial sciences. The School also serves society by preparing educators with the mastery needed in their professional fields. Students are provided with the knowledge of sciences, humanities, and literature that transforms them into well-versed, socially responsible, and appropriately critical, interactive learners. The faculty and academic support personnel collaborate to facilitate student academic advancement through the use of the classroom, technology, tutoring, laboratory experiences, and retention services.

OBJECTIVES

The School of Arts, Sciences and Education will:

- Provide students with experiences in the humanities, social sciences, language, literature and the general culture.
- Develop ethical values and social consciousness in the learners through a variety of activities and events.
- Provide students with the opportunities to develop the mathematical and scientific knowledge and the skills needed to effectively analyze and manage problems within the fields of engineering, architecture, business administration, geomatic sciences, geospatial sciences, and education.
- Develop a strong academic basis in mathematics and sciences within our student body during their first two years of study.
- Develop strategies that facilitate student retention through academic support services and activities.
- Encourage and assist learners with diverse backgrounds and limitations due to family, economic, academic or other problems to enter and complete one of our career programs.
- Prepare professional educators committed to new educational paradigms.

GOALS

- Facilitate the development of basic academic skills in the learners to help them grow in the discipline and knowledge required within any professional career in engineering, architecture, business administration, and education.
- Offer courses in the fields of humanities and the social sciences to complement the study of engineering, architecture, business administration, geomatic science, geospatial sciences, and education with a profound sense of social responsibility.
- Provide a coordinated strategy for student retention that integrates the resources of faculty, academic support personnel, retention staff, administration, software and technology specialists.
- Create tutorial services and events directed towards research and the implementation of individualized assistance alternatives that satisfy the students' changing academic needs.
- Facilitate academic and administrative services.

Mathematics and Science Department

The Department continually reassesses its standards, encouraging excellence in instruction, academic performance, and service to the following programs: engineering, surveying and geospatial science, business administration, architecture, and education. A strong foundation in mathematics and sciences is essential for the study of science, engineering, management, and education. The specific requirements for each major program are given in the sections devoted to the departments. Science and mathematics requirements should be completed to the fullest extent possible during the freshman and sophomore years. Skills and competencies developed in these courses are applicable in the courses to be taken in each program. High school algebra, geometry and trigonometry or the equivalent and a satisfactory score on the mathematics placement test are prerequisites to all credit-hour courses in the department. Superior students in mathematics, regardless of their major preference, are encouraged to consult with the department before registration concerning the possibility of advanced placement. To meet the special needs of the students, the department offers classes from 8:00 a.m. to 10:30 p.m.

DEPARTMENT MISSION

To provide academic background in mathematics and sciences essential for the study of surveying, business administration, architecture, engineering, and education. Mathematics courses provide students with the logical reasoning and reflective thought, and promote the use of tools and techniques to solving problems. Science courses, through the promotion of knowledge allow the employment of fundamental principles and the use of the scientific method to explain physical or natural phenomena.

ACADEMIC OBJECTIVES

The Department of Mathematics and Science will enable the students to acquire the skills and competencies needed toward the completion of their respective academic programs. The students will be able to:

1. Apply the fundamental principles and concepts of mathematics and science required by the program chosen.
2. Identify, formulate, and solve problems using mathematical tools and fundamental principles of science required by the program chosen.
3. Communicate effectively with others orally and written, specifically in scientific and mathematical terms.

4. Engage appropriately in a teamwork environment using cooperative and collaborative approach toward the solution of a problem.
5. Understand and be aware of the importance of the mathematics and science in a global, economic, environmental, and societal context.
6. Recognize the basics elements of the Scientific Method necessary to develop scientific research.

DEPARTMENT EXPECTED OUTCOMES

The Department of Mathematics and Science must demonstrate that its students attain:

1. Ability to apply knowledge of mathematics and science.
2. Ability to conduct experiments, as well as to analyze data and draw conclusions from this data.
3. Ability to function in multi-disciplinary teams.
4. Ability to identify, formulates, and solves problems.
5. Ability to communicate effectively in scientific and mathematical terms.
6. Ability to engage in life-long learning.
7. Ability to recognize the importance of related contemporary issues.
8. Ability to understanding and to be aware of the importance of the mathematics and science in global, economic, environmental, and societal context.
9. Ability to recognize the basics elements of the Scientific Method.

LABORATORIES

Laboratory facilities are available for chemistry, physics, mathematics, Biology Microbiology science, and education courses. The facilities include equipment and materials necessary to develop skills by hands-on laboratory experiences.

DEVELOPMENTAL STUDIES COMPONENT

The Mathematics and Science Department offers the following developmental courses.

DEVELOPMENTAL COURSES

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
SCIE 0110	Introduction to Physics	3
MATH 1330	Pre-calculus I	3
MATH 1340	Pre-calculus II	3

COURSES OFFERINGS MATHEMATICS AND SCIENCE

COURSE	TITLE	CREDIT-HOURS
MATH 1310	Applied Mathematics for Business I	3
MATH 1320	Applied Mathematics for Business II	3
MATH 1352	Calculus I-A	2
MATH 1354	Calculus I-B	2
MATH 1350	Calculus I	4
MATH 1355	Probability and Statistics I	3
MATH 1356	Probability and Statistics II	
MATH 1357	Math Statistics and Probability	
MATH 1360	Calculus II	4
MATH 1370	Calculus III	4
MATH 1371	Seminar in Applied Math	1
MATH 2350	Differential Equations	3
MATH 2360	Linear Algebra	3
MATH 3019	College Geometry I	3

COURSE	TITLE	CREDIT-HOURS
MATH 3040	Number Theory	3
MATH 4020	History of Mathematics	3
MATH 4035	Discrete Mathematics I	3
MATH 4060	Modern Algebra for Teachers	3
MATH 4390	Special Topics in Mathematics	3
MATH 5310	Partial Differential Equations	3
MATH 6310	Advanced Engineering Mathematics I	3
MATH 6320	Advanced Engineering Mathematics II	3
SCIE 1110	General Biology	4
SCIE 1111	General Biology Laboratory	0
SCIE 1120	Botany	3
SCIE 1210	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory	0
SCIE 1214	General Chemistry I	4
SCIE 1215	General Chemistry I Laboratory	0
SCIE 1220	General Chemistry II	4
SCIE 1221	General Chemistry II Laboratory	0
SCIE 2110	Environmental Microbiology	4
SCIE 2111	Environmental Microbiology Laboratory	0
SCIE 2240	Environmental Chemistry	3
SCIE 1230	Organic Chemistry	4
SCIE 1231	Organic Chemistry Laboratory	0
SCIE 1410	General Physics I	3
SCIE 1420	General Physics II	3
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
SCIE 1433	Introduction to Astronomy	3
SCIE 1434	Energy and the Environment	3
SCIE 1435	Scientific Methods & Research	3

SCIE	1450	Thermodynamics and Statistical Mechanics	3
SCIE	1460	Electrodynamics	3
SCIE	1470	Optics	3
SCIE	1480	Nuclear Physics	3
SCIE	1490	Quantum Mechanics	3
SCIE	1491	Seminar in Physics	2
SCIE	1440	Physics II	4
SCIE	1441	Physics II Laboratory	1
SCIE	2204	Analytical Chemistry	4
SCIE	2205	Analytical Chemistry Laboratory	0
SCIE	2240	Environmental Chemistry	3
SCIE	2281	Seminar in Chemistry	2
SCIE	2250	Physical Chemistry I	4
SCIE	2251	Physical Chemistry I Laboratory	0

COURSE	TITLE	CREDIT-HOURS	
SCIE	2260	Physical Chemistry II	4
SCIE	2261	Physical Chemistry II Laboratory	0
SCIE	2270	Inorganic Chemistry	4
SCIE	2271	Inorganic Chemistry Lab.	0
SCIE	2460	Electromagnetic Oscillations and Topics of Modern Physics	3
SCIE	2461	Modern Physics Lab.	1
SCIE	2470	Principles of Material Science	3
SCIE	3240	Analysis and Instrumentation	4
SCIE	3241	Instrumentation Laboratory	0
SCIE	4490	Special Topics in Physics	3

COURSE DESCRIPTIONS

MATH 0102- PREPARATORY MATHEMATICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: Placement by Admissions Office.

Study of basic operations on natural, whole integers, rational, irrational numbers. Includes also fundamental properties of arithmetic, percent, ratio and proportion, elements of algebra and basic operations. A grade of "C" or better must be earned for placement in the next course.

MATH 0106- ELEMENTARY ALGEBRA

Three credit-hours. Two two- hour lecture periods per week. Prerequisites: MATH 0102 or equivalent; placement by Admissions Office and at least 80% in the departmental placement test.

Study of elements of algebra; polynomial-basic operations; algebraic fractions; exponents and radicals and applications. Introduces properties of real numbers; fundamental operations and elements of algebra; factoring, fractions, exponents; roots and radicals. A grade of "C" or better must be earned for placement in the next course.

MATH 0110- ALGEBRA

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 0106 or equivalent; Placement by Admissions Office and at least 80% in the departmental placement test.

This course includes the study of linear and nonlinear inequalities in one variable; inequalities and equations with absolute value; linear and quadratic equations, functions with applications, and relations and functions with its graphs. Includes also the study of algebra of functions, special functions, operations with functions, and inverse functions. A grade of "C" or better must be earned for placement in the next course.

MATH 1310- APPLIED MATHEMATICS FOR BUSINESS I

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: Placement by Admissions Office or MATH 0110

This course is designed for students enrolled in Business Administration options. It includes the study of linear, exponential and logarithmic functions, and its applications to areas related to business and economics such as cost, revenue and profit functions, break even analysis, market equilibrium, linear depreciation, average rate of change, marginal cost, simple and compound interest, investments and others. Also it includes systems of linear equations and matrices, Gauss- Jordan method, linear programming and the simplex method.

MATH 1320- APPLIED MATHEMATICS FOR BUSINESS II

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: Placement by Admissions Office or MATH 1310.

This course includes the study of those topics related to the principles of accounting, basic probability theory, permutations and combinations, introduction to differential and integral calculus, and its applications to continuous interest, marginal analysis, curve sketching, optimization functions of cost, revenue and profit, areas under curves.

MATH 1330- PRECALCULUS I

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: Placement by Admissions Office or MATH 0110

Relations and functions; linear and quadratic functions; curve sketching, rational functions, polynomial functions, synthetic division, remainder and factor theorems; zeros of polynomials; graphs; trigonometric functions and graphs; sine and cosine laws, solutions of right and oblique triangles, identities and trigonometric equations; and inverse functions. A grade of "D" or better must be earned for placement in the next course.

MATH 1340- PRECALCULUS II

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: Placement by Admissions Office or MATH 1330.

This course includes the study of trigonometry and its applications, complex numbers operations and De Moivre's Theorem, matrix and linear algebra, study of systems of linear equations, determinants and Cramer's Rule; vectors; analytic geometry and the conic sections, exponential and logarithmic functions and their applications. A grade of "D" or better must be earned for placement in the next course.

MATH 1352- CALCULUS I-A

Two credit - hours. Two two - hour lecture periods per week. Prerequisite: MATH 1340.

This course will acquaint the student with the concepts of limits and their properties, the derivative and its applications; finding derivatives by means of rules; chain rule, higher order derivatives; maxima and minima; related rates of changes, and curve sketching using derivatives.

MATH 1354- CALCULUS I-B

Two credit - hours. Two two - hour lecture periods per week. Prerequisite: MATH 1352.

This course will acquaint the student with the concepts of definite and indefinite integral; area under a curve, differentiation and integration of logarithmic, exponential and other transcendental functions; Inverse trigonometric functions, hyperbolic functions: differentiation and integration; area between curves, volumes of solids of revolutions; arc length, surfaces of revolution; moments, centers of mass and centroids.

MATH 1355 - PROBABILITY AND STATISTICS I

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: MATH 1340.

This course is an introduction to descriptive and inferential statistics. Topics include collection of data, numerical and graphical descriptive methods, linear correlation and regression, probability concepts and distributions, confidence intervals, and hypothesis testing for means and proportions.

MATH 1356 - PROBABILITY AND STATISTICS II

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: MATH 1355.

This course is a continuation of Statistics I. Topics include hypothesis testing, regression, correlation, statistical decision theory, analysis of variance and nonparametric methods.

MATH 1357 - MATH STATISTICS AND PROBABILITY

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: MATH 1356.

A calculus-based introduction to statistical methods dealing with basic probability, distribution theory, confidence intervals, hypothesis tests and sampling.

MATH 1350- CALCULUS I

Four credit-hours. Two two and a half - hour lecture periods per week. Prerequisite: MATH 1340.

This course will acquaint the student with the concepts of limits and their properties, the derivative and its applications; finding derivatives by means of rules; chain rule, higher order derivatives; maxima and minima; related rates of changes; curve sketching using derivatives, definite and indefinite integral; area under a curve, differentiation and integration of logarithmic, exponential and other transcendental functions; Inverse trigonometric functions, hyperbolic functions: differentiation and integration; area between curves, volumes of solids of revolutions; arc length, surfaces of revolution; moments, centers of mass and centroids.

MATH 1360- CALCULUS II

Four credit-hours. Two two and a half - hour lecture periods per week. Prerequisite: MATH 1350.

This course will acquaint the student with the concepts of: integration techniques, indeterminate forms and L'Hopital's Rule; improper integrals. Includes the study of infinite sequences and infinite series; Taylor and Maclaurin polynomials, power series; conics; parametric equations: area, length of a curve and, surface area; polar coordinates and polar graphs, area and length in polar coordinates; vectors in the plane, space coordinates and vectors in space, dot and cross product; lines, planes, surfaces in space, cylindrical and spherical coordinates.

MATH 1370- CALCULUS III

Four credit-hours. Two two and a half - hour lecture periods per week. Prerequisite: MATH 1360.

This course will acquaint the student with the concepts of: vectors-valued functions: differentiation and integration, velocity and acceleration, tangent and normal vectors, arc length and curvature. Includes the study of function of several variables: limit, continuity, partial derivatives and their applications, lagrange multipliers; multiple integrals and their applications, change of variables: polar coordinates, cylindrical and spherical coordinates, vector fields, line integrals, conservative vector fields, Stokes's, Green's and Gauss's Theorems.

MATH 1371 – SEMINAR IN APPLIED MATH

One credit-hour. One one and half hour lecture period per week. Prerequisite: MATH 1370

Topics are limited to those which are not part of content of regular courses offered by the department. Credit-hours earned can fulfill the requirement for mathematics component credit-hours and which would serve to stimulate further advanced studies in Mathematics or Engineering.

MATH 2350 - DIFFERENTIAL EQUATIONS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 1360, SCIE 1430.

Includes the solution and applications of first-order differential equations, linear differential equations of higher order and applications, differential equations with variable coefficients, Laplace transforms, and its applications.

MATH 2360 - LINEAR ALGEBRA

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1360

Includes topics such as systems of linear equations, Gauss elimination method, matrix notation, multiplication and inverse of a matrix; vector spaces of ordered n-tuples and functions, linear dependence, basis, linear transformations and their matrix representation; null, range space and rank of a matrix; change of basis, similar matrices. Inner products, orthogonal basis, eigenvalues of symmetric matrix, positive definite matrices and applications. This course stresses techniques which are useful in applications of linear algebra.

MATH 3019 - COLLEGE GEOMETRY I

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: NONE.

Topics from plane and solid Euclidean geometry will be covered, including the properties of parallels, perpendiculars, triangles, and circles along with perimeter and formulas for area of plane regions and for the surface area and volume of solids.

MATH 3040 - NUMBER THEORY

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: NONE.

The goal of this course is to provide a modern treatment of number theory. The student learns more about integers and their properties, important number-theoretical ideas and their applications. The course emphasizes reading and writing proofs.

MATH 4020- HISTORY OF MATHEMATICS

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: NONE.

The goals of this course are to develop knowledge of the contributions made by mathematicians and the influence these contributions have made to the development of human thought and culture over time. The course provides a chronological tracing of mathematics from the ancient Chinese into modern times, with an emphasis on problems and the individuals who formulated and solved them.

MATH 4035 - DISCRETE MATHEMATICS I

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: NONE.

This course provides a foundation in formal mathematics and theorem-proving. Topics include functions, relations, sets, simple proof techniques, Boolean Algebra, propositional logic, elementary number theory, the fundamentals of counting, recursion, and an introduction to languages (finite state machines).

MATH 4060 - MODERN ALGEBRA FOR TEACHERS

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: NONE.

Introduction to algebraic systems, their motivation, definitions and basic properties. Primary emphasis is on group theory (permutation and cyclic groups, subgroups, homomorphism, quotient groups) and is followed by a brief survey of rings, integral domains and fields

MATH 4390- SPECIAL TOPICS IN MATHEMATICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 3310 or MATH 2350, and Consent of the Director of the Department of Mathematics and Science

Topics are limited to those which are not part of content of regular courses offered by the department. Credit-hours earned can fulfill the requirement for mathematics component credit-hours and which would serve to stimulate further advanced studies in Mathematics or Engineering.

MATH 5310 – PARTIAL DIFFERENTIAL EQUATIONS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 3310 or MATH 2350

This course emphasizes in the study of partial differential equations as applied in sciences and engineering in solving problems. Topics include partial differential equations of first order and applications; orthogonal functions and Fourier series; partial differential equations of second order such as: heat equation, wave equation, Schrödinger equation, Laplace equation, and Laplace transforms, Fourier integral and Fourier transforms in the solution of initial-boundary value problems.

MATH 6310- ADVANCED ENGINEERING MATHEMATICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 3310 or MATH 2350

The course will acquaint the students with the tools and techniques of applied mathematics as they are used today in various disciplines of engineering and science. Topics covered include: matrix theory and linear algebra; vector analysis, curvilinear coordinates and tensor differential operators; mathematical applications; Fourier analysis; partial differential equations and boundary- value problems with applications; calculus of variations; complex analysis for mathematics and engineering; special functions (Bessel, Legendre, Hermite, Laguerre) and application of Green's functions to electrostatic boundary problems.

MATH 6320- ADVANCED ENGINEERING MATHEMATICS II Three credit-hours. Two two-hour lecture periods per week. Pre-requisite: MATH 6310

The course is designed to provide an introduction to a variety of tools and techniques found useful by engineers in the area of probability and to provide the necessary background in principles and applications of statistical and

probabilistic methods; graphs and combinatorial optimization; algorithms for solving linear programming problems as well as techniques for their analysis; probabilistic models of decision making and numerical methods. Computer programming will be necessary to utilize existing scientific subroutine for case studies.

SCIE 0110- INTRODUCTION TO PHYSICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: Placement by Admissions Office or MATH 0110

Introduction to Physical sciences with classroom demonstrations. Includes the following: general guidelines about the history and development of scientific thought and method, measurements and conversion of units and some useful fundamental mathematics for physics, basic concepts in mechanics; motion description in one and two dimensions, Newton's Law. A grade of "C" or better must be earned for placement in the next course.

SCIE 1110- GENERAL BIOLOGY

Four credit-hours. Two two-hour lecture periods per week. Prerequisites: None. Co-requisite: SCIE 1111

Introduction to biological concepts as a vital tool for understanding our world and for meeting many of the personal and global challenges that student confront today. It includes topics such as: heredity and evolution; the study of living beings with a particular emphasis on human biology; eco-systems and their characteristics.

SCIE 1111- GENERAL BIOLOGY- LABORATORY

Zero credit-hour. Two two-hour laboratory periods per week. Prerequisites: None. Co-requisite: SCIE 1110

This laboratory course complements the biological concepts being studied in class. Laboratory exercises involving the basic principles of biology, in particular, to how they relate everyday life, health and the environment.

SCIE 1120 – BOTANY

Three credit-hours. Two two-hour lecture periods per week. Pre-requisite: SCIE 1110, SCIE 1111

This course immerses students into the specifics of plant biology, their taxonomy, and to the relationship between the physical environment, plant development and growth. This course intends to offer students an awareness of the different kinds of plants that exist and how they are related to each other. It focuses on the similarities and differences among plants, with regard to structures and their functions at an intermediate level.

SCIE 1210- PRINCIPLES OF CHEMISTRY

Four credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 1340 Co-requisite: SCIE 1211

Introduction to the fundamental principles of chemistry, with emphasis in the principles of matter and its properties. atomic structures, molecular structure, Principles of

Stoichiometry, Laws of Gases, chemical bonding, chemical reactions, chemical composition of compounds, solutions, gases, solutions, acids and bases.

SCIE 1211- PRINCIPLES OF CHEMISTRY - LABORATORY

Zero credit-hour. One four-hour laboratory period per week Prerequisite: MATH 1340 Co-requisite: SCIE 1210

This Laboratory course complements the concepts being studied in class. It includes hands on experience experiments such as: 1. Safety in the Lab, 2. Mass, Volume and Density, 3. Molecular Structure and Covalent Bonding, 4. Colligative Properties and 5. Acids, Bases and Titration.

SCIE 1214- GENERAL CHEMISTRY I

Four credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 1340 Co-requisite: SCIE 1215

This course emphasizes in: Principles of chemistry, principles of stoichiometry, solutions, thermochemistry, atomic and molecular structure, and gases.

SCIE 1215- GENERAL CHEMISTRY I LABORATORY

Zero credit-hour. One four-hour laboratory period per week Prerequisite: MATH 1340 Co-requisite: SCIE 1215

This Laboratory course complements the concepts being studied in class. It includes hands on experience experiments such as matter and measurement, density, molecular structure and covalent bonding, titrations, gas laws, colligative properties and calorimetry.

SCIE 1220- GENERAL CHEMISTRY II

Four credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1214 SCIE 1215, MATH 1350 Corequisite: SCIE 1221

This course emphasizes the following topics: equilibrium, solutions, oxidation and reduction reactions, acids and bases; electrochemistry, thermodynamics, kinetics and Organic principles.

SCIE 1221- GENERAL CHEMISTRY II- LABORATORY

Zero credit-hour. One four-hour laboratory period per week. Prerequisites: SCIE 1214-1215, MATH 1350 Co-requisite: SCIE 1220

It includes experiments in chemical equilibrium, solutions, Aspirin synthesis, oxidation and reduction reactions, acids and bases, electrochemistry, thermodynamics and kinetics.

SCIE 1230- ORGANIC CHEMISTRY

Four credit-hours. Two two-hour lecture period per week. Prerequisite: SCIE 1220- 1221, MATH 1340 Co-requisite: SCIE 1231, MATH 1350

This course emphasizes in the study of the conformation, structure, properties, nomenclature, reactions and method of synthesis of different families of organic compounds.

SCIE 1231- ORGANIC CHEMISTRY - LABORATORY

Zero credit-hour. One four-hour laboratory period per week. Prerequisite: SCIE 1220- 1221, MATH 1340 Co-requisite: SCIE 1230, MATH 1350

Introduction to laboratory techniques important in the study of organic compounds. Includes extraction and synthesis of these materials as well as chemical and physical study of their properties.

SCIE 1410- GENERAL PHYSICS I

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1340

Introduction to mechanics: Newton's Laws, motion and equilibrium, work and energy, physical properties of solids, fluids and heat. Laboratory demonstrations are used in class to provide further explanation of topics. Course designed for Surveying and Architecture students only.

SCIE 1420- GENERAL PHYSICS II

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1410 and MATH 1350

Includes principles of electricity and magnetism; properties and principles describing light and sound are studied. Wave nature of light: interference, diffraction, and polarization: geo-metrical optics; mirrors and lenses; optical instruments. Laboratory demonstrations are used in class to provide further explanation of topics. For surveying students only.

SCIE 1430- PHYSICS I

Four credit-hours. Two two and a half - hour lecture periods per week. Prerequisite: MATH 1350 Corequisite: SCIE 1431

A calculus-based course emphasizing the principles and applications of mechanics. Includes motion in one, two and three dimensions, Newton's laws, work and energy, rotation, static equilibrium of a rigid body, particles and conservation of momentum.

SCIE 1431- PHYSICS I- LABORATORY

One credit-hour. One three-hour laboratory period per week. Prerequisite: MATH 1350 Corequisite: SCIE 1430

The first of a sequence of two laboratory courses, the experiences in this laboratory are designed to complement the Physics I course.

SCIE 1433 – INTRODUCTION TO ASTRONOMY.

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: SCIE 0110

The course is designed to provide a general knowledge of astronomy. It explores concepts of physics at a phenomenological level covering topics as historical and Modern Astronomy, the sky and coordinates systems, instrumentation in astronomy, the nature of light, the Solar System, evolution stars, galaxies, and Cosmology.

SCIE 1434 – ENERGY AND THE ENVIRONMENT

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: SCIE 1430

This course explores the physical, environmental, social impact of energy in a modern industrial society. The concept of energy will be worked from the thermodynamics point of view. The course will address the issues of energy consumption, energy extraction, conservation, consumption, and energy Policy considering scientific, technological, socioeconomic, political ,and environmental factors.

SCIE 1435 – SCIENTIFIC METHODS AND RESEARCH

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: SCIE 1440, SCIE 1441

This course explores the elements of implementing a student research program in the secondary school. The primary target audience is secondary school teachers particularly in the areas of mathematics, science and technology. Include the study of scientific research and methods from a comprehensive perspective; techniques and concepts of scientific research; writing in the American Psychological Association (APA) format; ethical standards governing scientific research; experiences in the use of internal and external critique methods; experiences accessing and using archival and web-based data sources; evaluation of descriptive, true-experimental and quasi-experimental research designs; identification and use of appropriate statistical analyses; conducting primary and secondary source literature reviews; and demonstration of research designing.

SCIE 1450 – THERMODYNAMICS AND STATISTICAL MECHANIC

Three-credit-hours. Two two- hour lecture periods per week. Prerequisite: SCIE 1440, SCIE 1441

This is an introductory course in Thermodynamics and the Principle of Statistic Mechanics. It emphasis on: The Zeroth law of Thermodynamics and the concept of temperature; The First law and the Conservation of Energy; The Second law and the direction of natural process; Carnot's Engine; Concept of Entropy. Absolute Scale of Temperature; The Third Law and simple applications. The principle of Statistical Mechanics emphasis on: Thermodynamic Weight, Statistical Mechanical ideas of Entropy and the connection with Thermodynamics; the Maxwell-Boltzmann, the Bose-Einstein, and the Fermi-Dirac distributions.

SCIE 1460 – ELECTRODYNAMICS

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: SCIE 1440, SCIE 1441

This course will develop content knowledge about Electromagnetism. It explore principles of electrodynamics dealing mainly with Time-varying fields, Maxwell's equations, Electromagnetic Waves, and Electromagnetic Spectrum. Also include Electromagnetic Oscillations and

Alternate Current which examine oscillations in a simple circuit consisting of inductance and capacitance.

SCIE 1470 – OPTICS

Three-credit-hours. Two two- hour lecture periods per week. Prerequisite: SCIE 1440, SCIE 1441

This is an introductory course in Optics. It emphasis on: Wave theory and applications, Interference and diffraction phenomena, Optics of solids, Lens, Laser, Holography, Non-linear optics and other topics of modern optics. The application of those principles to the development and understanding of modern optical devices will be discuss in class.

SCIE 1480 – NUCLEAR PHYSICS

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: SCIE 1440, SCIE 1441

This is an introductory course in Nuclear Physic. It emphasis on: General description of the atomic nucleus. Radioactivity, Nuclear Reactions, Nuclear forces, Nuclear Structure Models, Layer model. Scattering Elementary Theory, Reactors, High Energy Physics and Elementary Particles and Symmetry. The Health, Safety, and application related to nuclear energy will be discussed during the class.

SCIE 1490 – QUANTUM MECHANICS

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: SCIE 1440, SCIE 1441

This introductory course in Quantum Mechanics emphasis on the Schrodinger theory of Quantum Mechanics. Topics include Born's interpretation of the wave function, stationary solutions, properties of Eigen functions and energy quantization. Solutions to simple time-independent problems such as: the step potential, the square well, the infinite well and the harmonic oscillator. Applications to hydrogen-like atoms, including the concepts of angular momentum and spin.

SCIE 1491 – SEMINAR IN PHYSICS

Two-credit-hours. One – two and half hour lecture periods per week. Pre-requisite: SCIE 1440, SCIE 1441, Requires permission of the department's Director.

The topics in this course are limited to those which are not part of the content of regular course offering by the department. Credit-hours can fulfill the requirement for Physics component credit-hours and which would serve to stimulate further advanced studies in the area of interest. Requires permission of the department's director.

SCIE 1440

Four credit-hours. Two two and a half-hour lecture periods per week. Prerequisites: SCIE 1430- 1431, MATH 1360. Corequisite: SCIE 1441

Includes topics such as: gravity, mechanics of solids and fluids, oscillations and waves, sound, thermodynamics, electricity and magnetism; electric field, electric potential, capacitance, dielectrics and electrostatic energy,

electric current, direct-current circuits, magnetic field Gauss' Law and sources, and magnetic induction.

SCIE 1441- PHYSICS II- LABORATORY

One credit-hour. One three-hour laboratory period per week. Prerequisites: SCIE 1430-1431, MATH 1360 Co-requisite: SCIE 1440

A continuation of Physics Laboratory Experiments on the fundamental laws of physics and complement the Physics II course.

SCIE 2204 – ANALYTICAL CHEMISTRY

Four credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1220- 1221, MATH 1360 Co-requisites: SCIE 2205, Math 1370, ENGI 2210

This course emphasizes principles that are important to analytical analysis. Principles of sampling, sample preparation, calibration, standardization, data analysis using statistical methods, chemical equilibrium systems, classical gravimetric and volumetric analysis are discussed in this course.

SCIE 2205- ANALYTICAL CHEMISTRY LABORATORY

Zero credit-hour. One four-hour laboratory period per week. Prerequisites: SCIE 1220- 1221, MATH 1360 Co-requisites: SCIE 2204, Math 1370, ENGI 2210

This laboratory focuses on the experimental techniques and statistical analysis linked to titrimetric, gravimetric and electrochemical analysis.

SCIE 2110- ENVIRONMENTAL MICROBIOLOGY

Four credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1214-1215 Co-requisite: SCIE 2111

Course designed to introduce the basic concepts and principles of microbiology, roles microorganisms play in such fields as food production, engineering; microbiology and public health; how microorganisms contribute to the quality of life and the industrial processes; how certain microorganisms respond to environmental stimuli.

SCIE 2111- ENVIRONMENTAL MICROBIOLOGY LABORATORY

Zero credit-hour. One four-hour laboratory period per week. Prerequisites: SCIE 1214- 1215, Co-requisite: SCIE 2110

Laboratory experiments involving the basic principles of microbiology as they affect engineering problems encountered in connection with water supplies, sewage systems and the overall environment.

SCIE 2240- ENVIRONMENTAL CHEMISTRY

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1214- 1215, MATH 1350

This course includes a general introduction to environmental chemistry, basic principles of aquatic chemistry, water pollution and treatment, atmospheric chemistry, the

geosphere and hazardous substances, soil chemistry, and the nature and sources of hazardous wastes, the study of sources, reactions, transport, effects, and fates of chemical species in water, soil, air, and living environments and the effects of technology thereon.

SCIE 2281 – SEMINAR IN CHEMISTRY

Two - credit-hours. One – Two and a half hours meeting per week Pre-requisite: SCIE 1220, SCIE 1221 Requires permission of the Department's Director.

The topics in this course are limited to those which are not part of the content of regular course offering by the department. Credit-hours can fulfill the requirement for chemistry component credit-hours and which would serve to stimulate further advanced studies in the area of interest. Requires permission of the Department's Director.

SCIE 2250- PHYSICAL CHEMISTRY I

Four credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1440- 1441, SCIE 2204- 2205, MATH 1370 Co-requisites: MATH 2350, SCIE 2251

The course emphasizes the principles and laws of classical thermodynamics applied to ideal and real gases, phase equilibrium, chemical equilibrium, heterogeneous equilibrium of binary systems, and solutions.

SCIE 2251- PHYSICAL CHEMISTRY I- LABORATORY

Zero credit-hour. One four-hour laboratory period per week. Prerequisites: SCIE 1440- 1441, SCIE 2204- 2205, MATH 1370 Co-requisites: MATH 2350, SCIE 2250

This laboratory focuses on the principles and concepts of equilibrium thermodynamics. The laboratory work emphasizes in the determination of equilibrium constants for several chemical processes.

SCIE 2260- PHYSICAL CHEMISTRY II

Four credit-hours. Two two-hour lecture periods per week. Prerequisite: SCIE 2250- 2251 Co-requisite: SCIE 2261

This course is to introduce the different atomic concepts of matter and energy. Physical chemistry is the applications of the methods of physical to chemical problems. It can be organized into thermodynamics, kinetics theory, electrochemistry, quantum mechanics, chemical kinetics, and statistical thermodynamics.

SCIE 2261- PHYSICAL CHEMISTRY II- LABORATORY

Zero credit-hour. One four-hour laboratory period per week. Prerequisites: SCIE 2250- 2251. Corequisite: SCIE 2260

This is a continuation laboratory of Physical Chemistry I. Electrochemistry, atomic concepts of matter and energy; thermochemistry, nature of the gaseous, liquid and solid, states of matter; direction of chemical changes; solutions; homogeneous equilibrium; electrochemistry and colloids.

SCIE 2270 – INORGANIC CHEMISTRY

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: SCIE 2260, SCIE 2261 Corequisite: SCIE 2271

Introduction to the fundamental principles of Inorganic Chemistry, emphasizing the structure of solids, complexes and further analysis and applications of material already discussed in Physical Chemistry (such as electronic spectra).

SCIE 2271 – INORGANIC CHEMISTRY LABORATORY

Zero- credit-hours. One 4 hours meeting per week Prerequisite: SCIE 2260, SCIE 2261 Corequisite: SCIE 2270

This Laboratory course complements the concepts being studied in class. The students will learn about the properties of inorganic compounds, and how to synthesize and characterize them. Introduction to the fundamental principles of Inorganic Chemistry, emphasizing n the structure of solids, complexes and further analysis and applications of material already discussed in Physical Chemistry (such as electronic spectra).

SCIE 2460 - ELECTROMAGNETIC OSCILLATIONS AND TOPICS OF MODERN PHYSICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1440- 1441. Corequisite: SCIE 2461

This is an advanced course in Physics focused on a modern approach in the main topics covered. In general the course coverage includes: Magnetism, Alternate Current, Maxwell's Equations, Electromagnetic Waves and Light, Optics, and Modern Physics topics.

SCIE 2461 - MODERN PHYSICS LABORATORY

One credit-hour. One three-hour laboratory period per week. Prerequisites: SCIE 1440-1441, Corequisite: SCIE 2460

The experiences of this laboratory are designed to complement the course dealing with: Magnetism, Alternate Current, Maxwell's Equations, Electromagnetic Waves and Light, Optics, and Modern Physics topics.

SCIE 2470- PRINCIPLES OF MATERIALS SCIENCE

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1214- 1215, SCIE 1440, SCIE 1441

This course includes the relation between the structure and properties of materials, factors which control the internal structure of solids, and processes for altering the structure and properties of solids. It brings together the developments in physical metallurgy, ceramics, and the physics and chemistry of solids.

SCIE 3240- ANALYSIS AND INSTRUMENTATION

Four credit-hours. Two-two hour lecture periods per week. Prerequisites: SCIE 2204, SCIE 2205. Corequisite: SCIE 3241

This course is to introduce the different instrumental methods of analysis. Instrumental analysis and analytical chemistry deals with methods for determining the chemical composition of samples of matter. A qualitative method yields information about the atomic or molecular species or the functional groups that exist in the sample; a quantitative method, in contrast, provides numerical information as to relative amount of one or more of these components.

SCIE 3241- INSTRUMENTATION LABORATORY

Zero credit-hour. One four-hour laboratory period per week. Prerequisites: SCIE 2204 , SCIE 2205 Corequisite: SCIE 3240

Laboratory work involving the basic concepts in the practice of the instrumental methods.

SCIE 4490- SPECIAL TOPICS IN PHYSICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 1370, SCIE 1440 - 1441 , and Consent of the Director of the Department

Topics are limited to those which are not part of the content of regular course offering by the department. Credit-hours can fulfill the requirement for physics component credit-hours and which would serve to stimulate further advanced studies in Physics or Engineering.

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Socio-Humanistic Studies Department

The Socio Humanistic Studies Department at PUPR is the first academic college unit in Puerto Rico which integrates the study of the Social Sciences and Humanities in a single two basic courses.

Our courses academic contents are suitable, rigorous and broad in contemporary issues to support Engineering, Surveying and Geospatial Science, Architecture, Management and Education programs. In addition, our program outcomes head toward college-level proficiency in global culture and literature, oral and written communication skills, critical thinking, ethics and information literacy.

PROGRAM MISSION

To contribute, as a supportive academic department, in developing a well-rounded education in the fields of Engineering, Land Surveying, Architecture, Management Entrepreneurship, and Education by providing a comprehensive and meaningful Socio-Humanistic knowledge toward the development of a socially responsible professional.

PROGRAM EDUCATIONAL OBJECTIVES

Educate the students in such a manner that they:

1. Develop a significant learning of general culture.
2. Develop reflective and critical thinking.
3. Develop basic language skills both in Spanish and English.
4. Recognize the importance of world literature.
5. Practice a foreign language.
6. Recognize the usefulness of literacy information.
7. Evaluate the importance of social, legal, ethics of contemporary issues.

PROGRAM EXPECTED OUTCOMES

The students will be able to:

1. Demonstrate their ability and knowledge about global culture.
2. Demonstrate ability to understand their social and ethical responsibility.
3. Develop and apply critical thinking skills.
4. Demonstrate oral, listening, written and reading competencies.
5. Develop and practice foreign language communication skills.
6. Develop lifelong learning abilities.
7. Recognize and analyze the influence of contemporary issues.
8. Judge the ethical components of contemporary issues.

DEVELOPMENTAL STUDIES COMPONENT

The Socio-Humanistic Studies Department offers the following developmental courses.

Developmental Courses

COURSE	TITLE	CREDIT-HOURS
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

SOCIO-HUMANISTIC COURSES LEVEL I

21 CREDIT-HOURS (Required)

SOCIO-HUMANISTIC

COURSE	TITLE	CREDIT-HOURS
S O H U 2010	Socio-humanistic Studies	3
S O H U 2020	Socio-humanistic Studies II (For Architects and Business Administration Students)	3
S O H U 2040	Ethics, Global, and Contemporary Issues	3

LANGUAGES

COURSE	TITLE	CREDIT-HOURS
S P A N 1010	Linguistic Analysis of Literary Genres	3
S P A N 2020	Business Spanish	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English and Communication	3

PHILOSOPHY

COURSE	TITLE	CREDIT-HOURS
PHIL 3000	Business Ethics (For Business Administration Students)	3

LEVEL II 3 CREDIT-HOURS (Electives)

Complete a minimum of three (3) additional credit-hours by selecting three credit-hours from one component. Any other elective chosen shall be from the same component or as specified by the Degree Granting Department:

ECONOMICS

(Prerequisite: NONE):

COURSE	TITLE	CREDIT-HOURS
ECON 3010	Micro Economics	3
ECON 3020	Macro Economics	3
ECON 3030	Economy of Puerto Rico	3
ECON 3040	International Economics	3
ECON 3050	Special Topics in Economic Studies	3

POLITICS

(Prerequisite: NONE):

COURSE	TITLE	CREDIT-HOURS
POSC 3010	Government and Politics of Puerto Rico	3
POSC 3020	Government and Politics of the United States	3
POSC 3030	Comparative Politics	3
POSC 3040	International Politics	3
POSC 3050	Special Topics in Political Science Studies	3

PSYCHOLOGY

(Prerequisite: NONE)

COURSE	TITLE	CREDIT-HOURS
PSYC 3010	Industrial Psychology	3
PSYC 3020	Human Development	3
PSYC 3030	Social Psychology	3
PSYC 3040	Abnormal Psychology	3
PSYC 3050	Theories of Personality	3
PSYC 3060	Special Topics in Psychological Studies	3

PHILOSOPHY

(Prerequisite: NONE)

COURSE	TITLE	CREDIT-HOURS
PHIL 3000	Business Ethics	3
PHIL 3010	Logic	3
PHIL 3030	The Philosophy of Eugenio María de Hostos	3
PHIL 3040	Ethics in Engineering	3
PHIL 3050	Comparative Philosophical Movements	3
PHIL 3051	Cosmology and Meta –Cosmology	3
PHIL 3060	Special Topics in Philosophical Studies	3

HISTORY

(Prerequisite: NONE*)

(Prerequisite: SOHU-2010**)

COURSE	TITLE	CREDIT-HOURS
HIST 2010	History of Puerto Rico in the Caribbean Context**	3
HIST 3010	History of Puerto Rico*	3
HIST 3010 (A)	History of Puerto Rico (For Architects Only)	3
HIST 3020	History of the United States*	3
HIST 3030	History of Surveying**	3
HIST 3040	History of Engineering*	3
HIST 3050	History and Art Appreciation*	3
HIST 3070	Movie History*	3
HIST 3090	Special Topics in Historical Studies*	3
HIST 4030	Historiography (For Architects Only)**	3

LITERATURE

(Prerequisite: NONE)

COURSE	TITLE	CREDIT-HOURS
LITE 3010	Puerto Rican Literature	3
LITE 3020	Hispanic-American Literature	3
LITE 3030	American Literature	3

LITE 3040	Writing About Architecture	3
LITE 3050	Comparative Literature	3
LITE 3060	Special Topics in Literature Studies	3

LANGUAGES

(Prerequisite: NONE)

COURSE	TITLE	CREDIT-HOURS
LANG 3010	Introduction to the Italian Language	3
LANG 3020	Intermediate Italian Language	3
LANG 3030	Introduction to French Language	3
LANG 3040	Intermediate French Language	3
LANG 3050	Introduction to German Language	3
ENGL 2010	Analysis of World Literature	3
SPAN 2010	Hispanic Literature	3
SPAN 240 (A)	Business Language and Communication	3

SOCIO-HUMANISTIC STUDIES

(Prerequisite: NONE)

COURSE	TITLE	CREDIT-HOURS
SOHU 3010	Post Modernism Studies	3
SOHU 3020	Contemporary Social Problems in Engineering	3
SOHU 3030	Archaeology for Architects	3
SOHU 3060	Special Topics in Socio-humanistic Studies	3

ENGINEERING RELATED SOCIO-HUMANISTIC TOPICS

(Prerequisite: NONE)

COURSE	TITLE	CREDIT-HOURS
ECON 3010	Micro Economics	3
PSYC 3010	Industrial Psychology	3
HIST 3040	History of Engineering	3
PHIL 3040	Ethics in Engineering	3
SOHU 3020	Contemporary Social Problems in engineering	3

PUERTO RICAN STUDIES

(Prerequisite: NONE)

COURSE	TITLE	CREDIT-HOURS
HIST 3010	History of Puerto Rico	3
POSC 3010	Government and Politics of Puerto Rico	3
LITE 3010	Puerto Rican Literature	3
ECON 3030	Economy of Puerto Rico	3
PHIL 3030	The Philosophy of Eugenio Maria de Hostos	3

SOCIO-HUMANISTIC REQUIREMENTS

Level I -18 credit-hours

Level II -3 credit-hours

Total 21 credit-hours

COURSE DESCRIPTIONS

SOCIO-HUMANISTIC STUDIES

SOHU 2010- SOCIO-HUMANISTIC STUDIES

Three credit-hours. Two-hour lecture periods per week. Prerequisite: NONE

Analysis of fundamental concepts and problems common to the humanities and the social sciences from a historical perspective. The following topics are analyzed: conceptual framework of the humanities and the social sciences, human organization in society, the human-being and his environment, science of human behavior, methods of study and analysis of personality.

SOHU 2020- SOCIO-HUMANISTIC STUDIES II

Three credit-hours. Two two-hour lecture periods per week, Prerequisite: SOHU 2010.

Analysis of the following topics: the problem of knowledge and its artistic expression. Man and his political organization, contemporary economic systems, revolution and culture in the Twentieth Century.

SOHU 2040- ETHICS, GLOBAL, AND CONTEMPORARY ISSUES

Three credit-hours. Two two-hour lecture periods per week, Prerequisite: SOHU 2010.

Study of the generally accepted ethical principles that govern social behavior, with special emphasis in the practice of Engineering. Analysis of the man; his political organization, contemporary economic system in a global context.

SOHU 3010- POSTMODERNISM STUDIES

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Critical study of the most relevant modern philosophical thought up to post-modernism. It includes critical thinking to post-modern topics such as globalization, sub cultural crisis and ecological conscience.

SOHU 3020- CONTEMPORARY SOCIAL PROBLEMS IN ENGINEERING

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study and analysis of contemporary social problems that affect the engineering profession: e.g. ethical issue, conservation of the environment, restriction of financial resources, etc, and possible solutions to these problems.

SOHU 3030- ARCHEOLOGY FOR ARCHITECTS

Three credit-hours. Two two-hour lecture periods per week, Prerequisite: NONE

The basic principles governing the fields of Anthropology and Archeology are examined as they relate to human

perception and utilization of space, providing contemporary tools evaluate cultural values of space in times.

SOHU 3060- SPECIAL TOPICS IN SOCIO-HUMANISTIC STUDIES

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Intensive analysis of special topics related to the field of humanities and/or social sciences.

SPANISH

SPAN 0100- PREPARATORY SPANISH

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: Placement by Admissions Office.

This course is designed to develop all five basic language skills: listening, speaking, reading, comprehension and writing. The course also includes the study of the basic rules of grammar, morphology, syntax, and orthography. The course gives special attention to the development of basic skills in reading and writing of paragraphs.

SPAN 0110- SPANISH GRAMMAR

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: Placement by Admissions Office or SPAN 0100.

This course is designed to teach students the different linguistic concepts used by the speaker. It discusses structural grammar which serves as basis for student's participation in paragraph and composition workshops. It also provides practice in oral expression by encouraging students to express their opinion regarding topics discussed in class.

SPAN 1010- LINGUISTIC ANALYSIS OF LITERARY GENRES

Three credit hours. Two two-hour lecture periods per week. Prerequisite: SPAN 0110.

The purpose of this language and literature course is to have the student attain the greatest possible mastery of written expression and the analysis of literary texts according to their genre, theme, structure, and socio-humanistic context.

SPAN 2010- HISPANIC LITERATURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: SPAN 1010.

Study of Hispanic literary texts according to their genre, structure and socio-humanistic context. The literary genres covered in this course are the novel and drama. A historical background of the origins and development of these literary genres is offered.

SPAN 2020- BUSINESS SPANISH

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: SPAN 1010.

Focus on business letters, types of letters and writing techniques, emphasizing vocabulary, punctuation and grammar. Business communication is extensively practiced. Business procedures and policies are presented.

SPAN 240 (A) - BUSINESS LANGUAGE AND COMMUNICATION

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: SPAN 1010.

An exploration with practical experience on the language of business communication, skills and techniques. Diverse types of documents are examined and prepared, focusing on business letters, reports, and computer usage both for writing and presentation.

ENGLISH

ENGL 0100- PREPARATORY ENGLISH

Three credit-hour. Two two-hour lecture periods per week. Prerequisite: Placement by Admissions Office.

The course is designed to develop basic written and oral skills. It promotes oral communication and personal expression, giving special emphasis to the development of vocabulary. By performing language functions, students acquire the basic skills of the English language.

ENGL 0110- ENGLISH GRAMMAR

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: Placement by Admissions Office or ENGL 0100.

Fundamental course in language designed to provide students with grammar skills in English for listening and writing, with emphasis in increasing student's capability of developing logical thinking both in speaking and writing.

ENGL 1010- THE STUDY OF THE ESSAY AS A LITERARY GENRE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGL 0110.

A course designed to develop reading and thinking skills necessary to comprehend a reading text in a meaningful way. It focuses on oral and written answers of discussion questions and summaries of selections discussed in class.

ENGL 2010- ANALYSIS OF WORLD LITERATURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGL 1010.

A comprehensive study of fiction, poetry, and drama to help Students achieve a global understanding and Comprehension of literary works.

ENGL 2020- BUSINESS ENGLISH AND COMMUNICATION

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGL1010.

This course is designed to provide students with the principles governing effective communication in business.

Students are trained in the use of business vocabulary and idioms and analysis is done of the psychological approach to business situations. It provides the necessary training to help students develop proficiency and competence in using the language in the business environment.

ECONOMICS

ECON 3010- MICRO ECONOMICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE Study of the theories and basic principles of marketing operations in capitalist, socialist, and liberal societies, emphasizing concepts of micro economics.

ECON 3020- MACRO ECONOMICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ECON 3010.

Study of monetary indicators of economics activity. Analysis of the theories of investment, savings, production and cost. Analysis of the objectives of the economic policy and its fiscal and credit tools.

ECON 3030- ECONOMY OF PUERTO RICO

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of the economic development of Puerto Rico during the twentieth century. Analysis of the main economic problems of Puerto Rico and their possible solutions.

ECON 3040- INTERNATIONAL ECONOMICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of international economics and the problems of economic development and growth. Discussion of the equilibrium of economic markets and costs operations as the tool to adjust and manage the international economic activity.

ECON 3050- SPECIAL TOPICS IN ECONOMICS STUDIES

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Intensive analysis of special topics related to Economics.

POLITICAL SCIENCE

3010- GOVERNMENT AND POLITICS OF PUERTO RICO

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of government and the political system of Puerto Rico. Analysis of the Constitution, the governmental structure and functions, and its political relations with the United States.

POSC 3020- GOVERNMENT AND POLITICS OF THE UNITED STATES

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of the main political structures and functions in the United States, focusing on the executive, legislative, and

judicial branches. Analysis of the Constitution and the foreign policy of the nation with emphasis on its relations with Latin American countries.

POSC 3030- COMPARATIVE POLITICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Comparative analysis of current main political systems: United States, Great Britain, France, Russia, China and Japan.

POSC 3040- INTERNATIONAL RELATIONS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Comprehensive study of international relations and their nature. Structure and functions of main international organizations such as UNO, OAE, etc.

POSC 3050- SPECIAL TOPICS IN POLITICAL SCIENCE STUDIES

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Intensive analysis of special topics related to political science.

PSYCHOLOGY

ATUL 0100- ADJUSTMENT TO UNIVERSITY LIFE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: To be taken by freshmen during the first year of residency.

The principal objective of this course is to offer the students basic skills to achieve an effective adjustment to university life. This course is designed for freshman students. The professor discusses University regulations, effective use of library resources, study habits, professional ethics, and offers audiovisual information about the diversity of careers in the engineering, surveying and business administration fields.

PSYC 3010- INDUSTRIAL PSYCHOLOGY

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Analysis and discussion of the historical development of industrial psychology, as a discipline, as well as its theoretical and methodological bases. Study of human behavior in the work place.

PSYC 3020- HUMAN DEVELOPMENT

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of the different stages of human development from childhood to adulthood, interweaving the physical, psychological, and social factors in the dynamics of human behavior.

PSYC 3030- SOCIAL PSYCHOLOGY

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of the historical roots of social psychology and its perspectives for the twenty-first century. Analysis of individual processes such as socialization, attitudes, social perception, interpersonal relationships, and group influence upon the individual behavior.

PSYC 3040- ABNORMAL PSYCHOLOGY

Three credit-hours. Two-hour lecture periods per week. Prerequisite: NONE

The main objective of this course is the study of mental disorders and abnormal behavior of human beings.

PSYC 3050- THEORIES OF PERSONALITY

Three credit hours. Two two-hour lecture periods per week. Prerequisite: NONE

Analysis of the different theories of personality such as Psychodynamic, Behavioral, Humanist, and Existential Theory, and how these theories explain different aspects of human behavior.

PSYC 3060- SPECIAL TOPICS IN PSYCHOLOGICAL STUDIES

Three credit hours. Two two-hour lecture period per week. Prerequisite: NONE

Intensive analysis of special topics related to psychology

PHILOSOPHY

PHIL 3000 Business Ethics

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of the philosophical and legal aspects of ethics and their application to the professional responsibility in the field of Business Administration.

PHIL 3010- LOGIC

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of subjects aimed toward the development of logic and thinking skills, especially those necessary for the solution of scientific and mathematical problems.

PHIL 3030- THE PHILOSOPHY OF EUGENIO MARIA DE HOSTOS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Analysis of the main work of Puerto Rican philosopher Eugenio Maria de Hostos, based on selected topics: vision of woman, education, science, technology, etc.

PHIL 3040- ETHICS IN ENGINEERING

Three credit-hours. Two two-hour lecture periods per

week. Prerequisite: NONE

Study of the philosophical and legal aspects of ethics and their application to the professional responsibility in the field of engineering.

PHIL3050- COMPARATIVE PHILOSOPHICAL MOVEMENTS

Three credit hours. Two two-hour lecture periods per week. Prerequisite: NONE

Comparative analysis of main philosophical movements: existentialism, idealism, realism, pragmatism, and others.

PHIL 3051 – COSMOLOGY AND METACOSMOLOGY

Three credit hours. Two two-hours lecture periods per Week- Prerequisite: NONE

Basic foundations of astro-physics and the creation of the Physical universe.

PHIL3060-SPECIAL TOPICS IN PHILOSOPHICAL STUDIES

Three credit hours. Two two-hour lecture periods per week. Prerequisite: NONE

Intensive analysis of special topics related to Philosophy.

HISTORY

HIST 3010- HISTORY OF PUERTO RICO

Three credit hours. Two two-hour lecture periods per week. Prerequisite: NONE

A comprehensive study of the history of Puerto Rico from its discovery and the Spanish colonization to the present.

LITE 3020- HISPANIC AMERICAN LITERATURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of Spanish American literature since its beginning to the present. Analysis of several authors and representative literary works of each time period.

HIST 3010- (A)- HISTORY OF PUERTO RICO (for architects only)

Three credit hours. Two two-hour lecture periods per week. Prerequisite: NONE

A comprehensive study of the history of Puerto Rico from its discovery and the Spanish colonization to the present.

HIST 3020- HISTORY OF THE UNITED STATES

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

A comprehensive study of the history of the United States of America from the English colonization to the present.

HIST 3030- HISTORY OF SURVEYING

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

History of Surveying from its inception and origin, up to the laws which have regulated this profession in Puerto Rico, both in the 19th and 20th Century.

HIST 3040 - HISTORY OF ENGINEERING

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of the history of engineering from its beginning (8,000-BC- 3,000 BC) to present times, emphasizing its main characteristics throughout different times.

HIST 3050 - HISTORY AND ART APPRECIATION

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE.

Brief history of art since the prehistoric era to present. Appraisal of works of art through the study of the principles of art appreciation and visual analysis.

HIST 4030- HISTORIOGRAPHY (for architects only)

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SOHU 2010, ARCH 3030, ARHH 3010.

Understanding the history of history, history as a science, and the history of Architecture as text, to grow familiar with the discipline's attributes and limitations. History interpretation and manipulation are focused upon.

HIST 3070- MOVIE HISTORY

Three credit-hours. Two two-hour lecture period per Week Prerequisite: NONE

The course presents the history of filmography, showing examples of classic and contemporary films.

HIST 3090- SPECIAL TOPICS IN HISTORICAL STUDIES

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Intensive analysis of special topics related to history.

HIST 2010- HISTORY OF PUERTO RICO IN THE CARIBBEAN CONTEXT

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARCT 1010, ARCT 1011, ARCH 1030, SPAN 0110, MATH 0110.

The course examines Puerto Rico's past within the context of the Caribbean region. It employs diverse intellectual backgrounds, such as cultural and postcolonial studies, critical theory and post-structuralism approaches in order to promote an interdisciplinary understanding of Puerto Rican culture and its geopolitical surroundings. A comparative methodology will be used in order to emphasize the development of ideas instead of building a lineal chronology of events. Finally globalization will be addressed as part of the historical processes that shaped the region both in its present as well as its past.

LITERATURE

LITE 3010- PUERTO RICAN LITERATURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of Puerto Rican literature from its beginning to the present. Analysis of several selected Puerto Rican authors and their most important literary works.

LITE 3020- HISPANIC AMERICAN LITERATURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Study of Spanish American literature since its beginning to the present. Analysis of several authors and representative literary works of each time period.

LITE 3030- AMERICAN LITERATURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Prose fiction analysis of various literary works representative of modern American fiction.

LITE 3040- WRITING ABOUT ARCHITECTURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

The course focuses on reading and writing skills needed to articulate architectural essays. Grammar and vocabulary exercises are combined with the analysis of organizational diagrams and narrative styles in order to develop the student's capacity to express ideas coherently.

LITE 3050- COMPARATIVE LITERATURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

An in depth analysis of recurring themes in literature as they appear in selected writing of America, Europe, Asia, Australia and Africa.

LITE 3060- SPECIAL TOPICS IN LITERATURE STUDIES

Three credit hours. Two two-hour lecture periods per week. Prerequisite: NONE

Intensive analysis of special topics related to literature.

LANGUAGES

LANG 3010- INTRODUCTION TO ITALIAN LANGUAGE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Comprehensive study of the Italian language through the use of dialogs, grammar exercises, vocabulary and audiovisual methods. Develop the five basic skills of the language: listening, reading, comprehension, speaking and writing.

LANG 3020- INTERMEDIATE ITALIAN LANGUAGE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: LANG 3010

Intensive study of the Italian language emphasizing the correct use of the grammar and language skills. These skills will be developed through: dialogs, audiovisual methods and written exercises.

LANG 3030- INTRODUCTION TO FRENCH LANGUAGE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Comprehensive study of the French language through the use of dialogs, grammar exercises, vocabulary and audiovisual methods. Develop the five basic skills of the language: listening, reading, comprehension, speaking and writing.

LANG 3040- INTERMEDIATE FRENCH LANGUAGE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: LANG 3030

Intensive study of the French language emphasizing the correct use the grammar and language skills. These skills will be developed through: dialogs, audiovisual methods and written exercises.

LANG 3050- INTRODUCTION TO GERMAN LANGUAGE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Comprehensive study of the German language through the use of dialogs, grammar exercises, vocabulary and audiovisual methods. Develop the five basic skills of the language: listening, reading, comprehension, speaking and writing.

LANG 3060- INTERMEDIATE GERMAN LANGUAGE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: LANG 3050

Intensive study of the German language emphasizing the correct use of the grammar and language skills. These skills will be developed through: dialogs, audiovisual methods and written exercises.

DEPARTMENTAL FACULTY

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Education Department

EDUCATION PROGRAM

The Education Department will provide a strong emphasis on mathematics/science content and the role of mathematical ways of thinking in the teaching and learning of math and science. A candidate in this program will develop and demonstrate the research-based knowledge, skills, and attitudes necessary for effective classroom, building leadership in curriculum and instruction. The program is designed particularly, but not exclusively, for candidates interested in teaching improvement initiatives supported by current theory. Candidates in this program will focus upon research in content knowledge, content pedagogical knowledge, curriculum design, instructional models and assessment strategies targeted toward increasing student achievement. PUPR innovative math and science preparation provide student-teachers with a strong educational foundation, pedagogies for effective teaching and specialized subject knowledge in at least one academic discipline.

Program Mission

The mission of the Education program is to serve society by preparing professional educators committed to the new educational paradigms, leaders in education with an inquisitive attitude, creative and critical thinkers, with a mastery of pedagogical and conceptual content in their discipline

Program Educational Objectives

The Education program seeks to foster that candidates develop cognitive, affective, research, technological and communication skills. The intention is that candidates become lifelong learner in order to be competent and to be an effective teacher. In order to fulfill this objectives the Education program will:

1. Prepare educational professionals recognized for the quality and significance of their teaching, research, scholarship, service, outreach, and leadership.
2. Provide widely recognized leadership in the improvement of teaching, learning, and the assessment of educational outcomes across the life span through research, scholarship, and technology.
3. Enhance the commitment of faculty, staff, and students to the centrality of diversity, social justice, and democratic citizenship.
4. Provide leadership in the development of collaborative, professional relationships with schools, communities, and workplace settings.

5. Sustain a caring, supportive climate.
6. Enhance the effective and efficient management.

Program Expected Outcomes

The graduate of the Education Program will:

1. Apply content expertise in the subject matter.
2. Understand concepts, theories, and research about effective teaching and learning and the interaction of subject matter and pedagogy; uses multiple strategies to help students learn subject matter.
3. Understand the context of schools, education, and learning; designs and delivers assessment-driven standards-based curriculum, instruction, training, or administrative practices.
4. Use data, especially about learners, to plan instructional, administrative, counseling, or consultative strategies and activities.
5. Use information technology effectively to improve learning, productivity, and professional practice.
6. Apply the knowledge, skills, and dispositions (i.e., competencies) to work successfully with diverse learners, their families, and other professionals.
7. As a practitioner-scholar, apply current theory, research, and best practice to improve one's professional practice as a teacher administrator, counselor, or school psychologist.
8. Write and speak clearly; communicate effectively with learners, their families, and other professionals in ways appropriate to purpose and content.
9. Engage in critical thinking, analysis, and problem solving that reflect scholarly intellectual standards and incorporate sound reasoning.
10. Engage in reflective practice that leads to continuous professional growth and improvement.
11. Collaborate successfully with families, other professionals, and community members to mobilize resources for both learners and one's own professional growth.
12. Have professional attitudes, values, and beliefs that support student learning and development. Seven Specific Professional Dispositions.
13. Demonstrate the vision and skills necessary to lead and manage classrooms and schools as complex, adaptive systems in a changing world.

Degree Offered: The Education Department offers undergraduate instruction leading to the degree of Bachelor in Science in Secondary Education in Natural Sciences & Mathematics (BS Ed).

MINIMUM GRADUATION REQUIREMENTS

To obtain the degree the student must complete the following minimum requirements:

Credits - Hours	Components
42	Mathematics and Sciences
27	Socio-Humanistic Studies
36	Education
15	Secondary Mathematics or Physics or Chemistry according to the student's area of interest
120	Total Credits

*Students must attain a minimum cumulative grade point average of 3.00/4.00 as graduation requirement.

LABORATORIES

Physics, Chemistry, Microbiology, Mathematics Laboratory, and The Learning Resource Center: Laboratory facilities are available for chemistry, physics, mathematics, microbiology science courses. The facilities include equipment and materials necessary to develop skills by hands-on laboratory experiences.

DEVELOPMENTAL STUDIES

All students that request admission and are admitted to the Education Program must show evidence that they have acquired the academic abilities and skills necessary to progress through this program of studies. Those not demonstrating the complete acquisition of these abilities will be required to take developmental courses. Abilities and skills are demonstrated through the results of the College Entrance Examination Board Test, results of PUPR's Placement Test, previous university experience, other test or criteria. The courses are designed to help students overcome deficiencies in Spanish, English, Mathematics, and Science. These developmental courses are in addition to the 120 credits-hours of the Education Program

DEVELOPMENTAL STUDIES COMPONENT

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
SCIE 0110	Introduction to Physics	3
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

COURSE DESCRIPTIONS

BACHELOR IN SCIENCE IN SECONDARY EDUCATION IN NATURAL SCIENCE & MATHEMATICS EDUCATION COMPONENT

EDUC 2010 - FOUNDATION OF EDUCATION I: LEARNING THEORIES

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: NONE

The study of major learning theories including those proposed by Skinner, Vigostky, Pavlov, Bandura, Piaget, Bruner, Sternberg, and others. Current and historical research into the application of theoretical knowledge in education systems is addressed. This course is designed to not only look in-depth at the major theories of learning and how they relate to instruction, but to help you determine your own theory of learning. We'll discuss the traditional theories of behaviorism, motivation, resilience, information processing, development, and instruction, and will take an in-depth look at the newer field of brain-based learning. Includes a 15-hour field experience.

EDUC 2020 - FOUNDATION OF EDUCATION II: SOCIOLOGICAL AND PHILOSOPHICAL

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

The study of the legal and ethical issues in education from the contexts of historical, philosophical, social and administrative foundations of the discipline.

EDUC 2030 - ETHICS AND EDUCATION

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

The course will involve readings and discussion about concepts, frameworks and processes that may be useful in addressing ethical issues facing educators and human service professionals. Topics covered will include: ethical frameworks; policy concepts; ethical self- analysis; ethical concepts; ethical implications; critical thinking skills; ethical communication; and, the nexus of ethics and the law. The course is designed to instill ethical decision-making consciousness, dialogical competence and confidence, commitment to predetermined professional principles; and, ethical courage in leadership through the development of personally and professionally appropriate ethical frameworks. Educational ethics invites educators to think about what role they play in achieving and maintaining a more democratic and ethical society through education. Investigations into controversial ethical issues and dilemmas prepare educators to critically think through potential situations that may arise with students, parents, administrators, and peers.

EDUC 2040 - EXCEPTIONAL CHILD

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

The study of teaching children with exceptionalities. Students study the effects of exceptionality on children's cognitive, affective and psychomotor behaviors. The course will examine the laws that govern the education system for children with special needs, as well as how those laws are interpreted and applied by educational institutions. In addition, the course will examine best practices, the links between home and school, and the advantages of aligning schools to communities to better serve children with diverse needs.

EDUC 3010 - TEACHING AND LEARNING WITH TECHNOLOGY

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

The study of instructional media and its use in the classroom. Traditional media and the latest technology are investigated. Provided are opportunities to work with the various mediums, produce materials, and integrate mediated experiences into instruction.

EDUC 3020 - THE INTEGRATION OF LANGUAGE THROUGH THE CURRICULUM

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

The study of the theoretical framework for directed language used in all content areas, with emphasis on establishing a consistent set of language standards, practices and uses. Applications in various contents, curricula and with various ability levels are developed. Includes a 15 hour field experience.

EDUC 4010 - STANDARDS-BASED CURRICULUM, INSTRUCTION AND ASSESSMENT

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: NONE

The course examines the impact of state learning and performance standards on the planning of curriculum, assessment, and instruction. In this course, students will design instruction using research-based curriculum planning and instructional models. Emphasis.

EDUC 4020 - TEACHING AND METHODOLOGY: SECONDARY MATH

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

This course is designed not only to encourage pre-service teachers to explore aspects of teaching mathematics, but also to enhance pre-service teachers' content knowledge of "school" mathematics. Considerable emphasis is placed on exploring multiple ways to make mathematics comprehensible to all of their future students. In addition, issues pertaining to lesson planning and implementation, assessment, integration of appropriate models, mathematics

connections, and the use of technology are explored. Includes field experience of 35 hours.

EDUC 4022 - TEACHING AND METHODOLOGY: SECONDARY SCIENCE

Three-credit-hours. Two two - hour lecture periods per week. Prerequisite: NONE

This course is designed not only to encourage pre-service teachers to explore aspects of teaching science, but also to enhance pre-service teachers' content knowledge of "school" science. Considerable emphasis is placed on exploring multiple ways to make science comprehensible to all of their future students. In addition, issues pertaining to lesson planning and implementation, assessment, integration of appropriate models, science connections, and the use of technology are explored. Includes field experience of 35 hours.

EDUC 4030 - PRACTICUM

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: EDUC 4020

Corequisite: EDUC 4031

A field based experience in which students apply the concepts being studied within a particular class to a real situation under the direction and supervision of a master teacher and a faculty member. The practicum is a focused experience that must be developed and approved prior to enrollment.

EDUC 4031 - SERVICE LEARNING PROJECT

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: EDUC 4020

Corequisite: EDUC 4030

Service-learning aims to foster values such as care, respect for diversity, a collaborative team spirit, professional commitment and dedication. PUPR Education Program aims to provide a holistic educational experience for our student teachers so that they can develop into the 21st Century teaching professional ready to bring about enhanced learning outcomes for students in the 21st century classroom. Service-Learning is a teaching and learning strategy that integrates meaningful community service with instruction and reflection to enrich the learning experience, teach civic responsibility, and strengthen communities. As a consequence of this immediacy of experience, service-learning is more likely to be personally meaningful to participants and to generate emotional consequences, to challenge values as well as ideas, and hence to support social, emotional and cognitive learning and development.

EDUC 3020 – LEARNING EVALUATION

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1355

The study of methods used to develop educational measurements, and the procedures used to globally assess student achievement. Included in the program of study are the development and use of standardized assessments,

structured and constructed assessments, observational methods, performance assessment, portfolio assessment, affective measures, and special needs measures. Included also are the historical study of psychometrics, the concepts of validity and reliability, referencing methods, and evaluation and reporting methods. This course focuses on the major concepts classroom teachers need to understand about assessment. We will compare and contrast traditional and authentic methods of assessment, define and apply the concepts of validity and reliability of instruments used for measurement and assessment, define and evaluate portfolios and performance assessments and their uses, and identify social skills and areas of the affective domain that can be assessed by classroom teachers. The course will address the No Child Left Behind Law, motivation and testing, different forms of assessment, (traditional paper pencil assessments, alternative methods of assessments, teacher-made tests, standardized tests), appropriate grading techniques, and assessing special need students.

EDUC 4210 - CONTEMPORARY ISSUES IN EDUCATION

Three-credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE

Offers a critical exploration of specific topics related to issues confronting educators today. While touching directly on policy/practice issues related to reading and special education, assigned readings will also address the philosophical underpinnings of teaching and learning in an age of performance-based accountability. Students assume a leadership role in generating relevant questions, facilitating class discussion and implementing and writing up an action or traditional research study. Students will develop an understanding of selected philosophical, historical, social, cultural, political, and economic questions and influences on the development of educational policies and practices. Importantly, students will develop an understanding of the ways the humanities and social sciences can be used to question, interpret, analyze, and criticize educational thought and teaching practices.

EDUCATION CURRICULUM

MATHEMATICS AND SCIENCES COMPONENT 42 CREDIT-HOURS

COURSE	TITLE	CREDIT-HOURS
MATH 1330	Pre-calculus I	3
MATH 1340	Pre-calculus II	3
MATH 1350	Calculus I	4
MATH 1360	Calculus II	4
MATH 1355	Probability and Statistics I	3
SCIE 1110	General Biology I	4

SCIE	1111	General Biology Lab	0
SCIE	1214	General Chemistry I	4
SCIE	1215	General Chemistry LAB. I	0
SCIE	1220	General Chemistry II	4
SCIE	1221	General Chemistry LAB. II	0
SCIE	1430	Physics I	4
SCIE	1431	Physics I Laboratory	1
SCIE	1435	Scientific Methods & Research	3
SCIE	1440	Physics II	4
SCIE	1441	Physics II Laboratory	1

**SOCIO-HUMANISTICS STUDIES
AND LANGUAGES COMPONENTS
27 CREDIT-HOURS**

COURSE	TITLE	CREDIT-HOURS	
SPAN	1010	Linguistic Analysis of Literary Genres	3
SPAN	2020	Business Spanish	3
ENGL	1010	The Study of the Essay as a Literary Genre	3
ENGL	2020	Business English and Communication	3
SOHU	2010	Socio-Humanistic Studies I	3
SOHU	2020	Socio-Humanistic Studies II	3
HIST	3010	History of Puerto Rico	3
HIST	3020	History of the United States	3
		Socio-Humanistic and Language Free Elective	3

**EDUCATION COMPONENTS
36 CREDIT-HOURS**

COURSE	TITLE	CREDIT-HOURS	
PSYC	3020	Human Growth & Development	3
EDUC	2010	Foundations of Education I : Learning Theories	3
EDUC	2020	Foundations of Education II Sociological and Philosophical	3
EDUC	2030	Ethics and Education	3
EDUC	2040	Exceptional Children	3
EDUC	3010	Teaching and Learning with Technology	3
EDUC	3020	Learning Evaluation	3

EDUC	3030	The Integration of Language through the Curriculum	3
EDUC	4020 or 4022	Teaching and Methodology: Secondary Math or Science	3
EDUC	4030	Practicum	5
EDUC	4031	Service Learning Project	1
EDUC	4010	Standards-based Curriculum, Instruction & Assessment	3

AREA OF INTEREST: PHYSICS
Students select 15 credits
to satisfy the area of interest

COURSE	TITLE	CREDIT-HOURS	
SCIE	1433	Introduction to Astronomy	3
SCIE	1434	Energy and the Environment	3
SCIE	1450	Thermodynamics and Statistical Mechanics	3
SCIE	1460	Electrodynamics	3
SCIE	1470	Optics	3
SCIE	1480	Nuclear Physics	3
SCIE	1490	Quantum Mechanics	3
SCIE	1491	Seminar in Physics	2
SCIE	2460	Electromagnetic Oscillations and Topics of Modern Physics	3
SCIE	2461	Modern Physics Lab.	1
SCIE	2470	Principles of Material Science	3

Area of Interest: Secondary Mathematics
(15 credits)
Secondary Mathematics Required

Courses	TITLE	CREDIT-HOURS	
MATH	2360	Linear Algebra	3
MATH	3019	College Geometry I	3
MATH	4035	Discrete Mathematics I	3
MATH	4060	Modern Algebra for Teachers	3
MATH	3040	Number Theory	3
Free Elective in Math			
MATH	1356	Probability and Statistics II	3
MATH	1357	Math Statistics and Probability	3

MATH	1370	Calculus III	4
MATH	2350	Differential Equations	3
MATH	4020	History of Mathematics	3
MATH	4390	Special Topics in Mathematics	3
MATH	5310	Partial Differential Equations	3

AREA OF INTEREST: CHEMISTRY

Students select 15 credits to satisfy the area of interest

COURSE	TITLE	CREDIT-HOURS
SCIE 1230	Organic Chemistry	4
SCIE 1231	Organic Chemistry Lab.	0
SCIE 2270	Inorganic Chemistry	4
SCIE 2271	Inorganic Chemistry Lab.	0
SCIE 2204	Analytical Chemistry	4
SCIE 2205	Analytical Chemistry Lab.	0
SCIE 2250	Physical Chemistry I	4
SCIE 2251	Physical Chemistry I Laboratory	0
SCIE 2260	Physical Chemistry II	4
SCIE 2261	Physical Chemistry II Laboratory	0
SCIE 3240	Analysis and Instrumentation	4
SCIE 3241	Instrumentation Laboratory	0
SCIE 2240	Environmental Chemistry	3
SCIE 2281	Seminar in Chemistry	2

CURRICULUM SEQUENCE FOR SECONDARY MATHEMATICS TEACHING

FIRST YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
PSYC 3020	Human Growth & Development	3
SCIE 1110	General Biology I	4
SCIE 1111	General Biology Lab	0
SPAN 1010	Linguistic Analysis of Literary Genres	3

MATH	1330	Pre-calculus I	3
SECOND QUARTER			
COURSE	TITLE	CREDIT-HOURS	
EDUC 2010	Foundations of Education I : Learning Theories	3	
SCIE 1214	General Chemistry I	4	
SCIE 1215	General Chemistry LAB. I	0	
MATH 1340	Pre-calculus II	3	
ENGL 1010	The Study of the Essay as a Literary Genre	3	

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC 2020	Foundations of Education II : Sociological and Philosophical	3
SCIE 1220	General Chemistry II	4
SCIE 1221	General Chemistry LAB. II	0
	Socio-Humanistic Studies and Language Free Elective	3
MATH 1350	Calculus I	4

SUMMER #1

COURSE	TITLE	CREDIT-HOURS
HIST 3010	History of Puerto Rico	3
SOHU 2010	Socio-Humanistic Studies I	3

SECOND YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
EDUC 2030	Ethics & Education	3
MATH 1360	Calculus II	4
MATH 1355	Probability and Statistics I	3
SOHU 2020	Socio-Humanistic Studies II	3

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC 2040	Exceptional Children	3
EDUC 3010	Teaching and Learning with technology	3

SCIE	1430	Physics I	4
SCIE	1431	Physics I Laboratory	1
MATH	3019	College Geometry	3

THIRD QUARTER

COURSE	TITLE	CREDITS-HOURS.
EDUC	3020 Learning Evaluation	3
MATH	2360 Lineal Algebra	3
SCIE	1440 Physics II	4
SCIE	1441 Physics II Lab.	1
EDUC	3030 (Education Elective) The Integration of Language Arts through the Curriculum	3

SUMMER #2

COURSE	TITLE	CREDIT-HOURS
HIST	3020 History of the United States	3

THIRD YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC	4010 Standards-based Curriculum, Instruction & Assessment	3
MATH	4060 Modern Algebra for Teachers	3
SCIE	1435 Scientific Methods & Research	3
MATH	4035 Discrete Mathematics	3

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC	4020 Teaching and Methodology: Secondary Math	3
MATH	3040 Number Theory	3
ENGL	2020 Business English and Communication	3
SPAN	2020 Business Spanish	3

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC	4030 Practicum	5
EDUC	4031 Service Learning Project	1

CURRICULUM SEQUENCE
FOR SECONDARY PHYSICS TEACHING

FIRST YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
PSYC	3020 Human Growth & Development	3
SCIE	1110 General Biology I	4
SCIE	1111 General Biology Lab	0
SPAN	1010 Linguistic Analysis of Literary Genres	3
MATH	1330 Pre-calculus I	3

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC	2010 Foundations of Education I : Learning Theories	3
SCIE	1214 General Chemistry I	4
SCIE	1215 General Chemistry LAB. I	0
MATH	1340 Pre-calculus II	3
ENGL	1010 The Study of the Essay as a Literary Genre	3

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC	2020 Foundations of Education II : Sociological and Philosophical	3
SCIE	1220 General Chemistry II	4
SCIE	1221 General Chemistry LAB. II	0
	Socio-Humanistic Studies and Language Free Elective	3
MATH	1350 Calculus I	4

SUMMER #1

COURSE	TITLE	CREDIT-HOURS
HIST	3010 History of Puerto Rico	3
SOHU	2010 Socio-Humanistic Studies I	3

SECOND YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
EDUC 2030	Ethics & Education	3
MATH 1360	Calculus II	4
MATH 1355	Probability and Statistics I	3
SOHU 2020	Socio-Humanistic Studies II	3

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC 2040	Exceptional Children	3
EDUC 3010	Teaching and Learning with technology	3
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
SCIE 1433	Introduction to Astronomy	3

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC 3020	Learning Evaluation	3
SCIE 1434	Energy and the Environment	3
SCIE 1440	Physics II	4
SCIE 1441	Physics II Lab. (Education Elective)	1
EDUC 3030	The Integration of Language Arts through the Curriculum	3

SUMMER #2

COURSE	TITLE	CREDITS-HOURS.
HIST 3020	History of the United States	3

THIRD YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
EDUC 4010	Standards-based Curriculum, Instruction & Assessment	3
SCIE 1450	Thermodynamics and Statistical Mechanics	3

SCIE 1435	Scientific Methods & Research	3
SCIE 1460	Electrodynamics	3

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC 4022	Teaching and Methodology: Secondary Science	3
SCIE 1470	Optics	3
ENGL 2020	Business English and Communication	3
SPAN 2020	Business Spanish	3

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC C 4030	Practicum	5
EDUC C 4031	Service Learning Project	1

CURRICULUM SEQUENCE FOR SECONDARY CHEMISTRY TEACHING**FIRST YEAR****FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
PSYC 3020	Human Growth & Development	3
SCIE 1110	General Biology I	4
SCIE 1111	General Biology Lab	0
SPAN 1010	Linguistic Analysis of Literary Genres	3
MAT H 1330	Pre-calculus I	3

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
EDUC 2010	Foundations of Education I : Learning Theories	3
SCIE 1214	General Chemistry I	4
SCIE 1215	General Chemistry LAB. I	0
MATH 1340	Pre-calculus II	3

ENGL	1010	The Study of the Essay as a Literary Genre	3
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THIRD QUARTER

COURSE	TITLE	CREDITS-HOURS	
EDUC	2020	Foundations of Education II : Sociological and Philosophical	3
SCIE	1220	General Chemistry II	4
SCIE	1221	General Chemistry LAB. II	0
		Socio-Humanistic Studies and Language Free Elective	3
MATH	1350	Calculus I	4

SUMMER #1

COURSE	TITLE	CREDIT-HOURS	
HIST	3010	History of Puerto Rico	3
SOHU	2010	Socio-Humanistic Studies I	3

SECOND YEAR**FIRST QUARTER**

COURSE	TITLE	CREDITS-HOURS	
EDUC	2030	Ethics & Education	3
MATH	1360	Calculus II	4
MATH	1355	Probability and Statistics I	3
SOHU	2020	Socio-Humanistic Studies II	3

SECOND QUARTER

COURSE	TITLE	CREDITS-HOURS.	
EDUC	2040	Exceptional Children	3
EDUC	3010	Teaching and Learning with technology	3
SCIE	1430	Physics I	4
SCIE	1431	Physics I Laboratory	1

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS	
EDUC	3020	Learning Evaluation	3
SCIE	1230	Organic Chemistry	4
SCIE	1231	Organic Chemistry Lab.	0

SCIE	1440	Physics II	4
SCIE	1441	Physics II Lab. (Education Elective)	1
EDUC	3030	The Integration of Language Arts through the Curriculum	3

SUMMER #2

COURSE	TITLE	CREDITS-HOURS	
HIST	3020	History of the United States	3

THIRD YEAR**FIRST QUARTER**

COURSE	TITLE	CREDITS-HOURS	
EDUC	4010	Standards-based Curriculum, Instruction & Assessment	3
SCIE	1435	Scientific Methods & Research	3
SCIE	2270	Inorganic Chemistry	4
SCIE	2271	Inorganic Chemistry Lab.	0

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS	
EDUC	4022	Teaching and Methodology: Secondary Science	3
ENGL	2020	Business English and Communication	3
SPAN	2020	Business Spanish	3
SCIE	2204	Analytical Chemistry	4
SCIE	2205	Analytical Chemistry Lab.	0

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS	
EDUC	4030	Practicum	5
EDUC	4031	Service Learning Project	1

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SCHOOL OF ARCHITECTURE

The School of Architecture, ARQPOLI, provides each student an opportunity to grow knowledgeable in the theoretical, technical, social, cultural, and practical aspects of the profession, and thus be able to enter and excel in the field. Towards such end, our balanced curriculum is both structured and flexible. It includes professional core courses, liberal arts, sciences, and mathematics, integrating representational, verbal and written skills. The field of architecture requires the command of architectural design, theory, history, technology, structures, representation, programmatic and pragmatic aspects related to practice.

The student's understanding of Architecture, upon completion of the minimum graduation requirements, combines a broad social, cultural and technical foundation. Our program prepares students to face situations of considerable complexity, comprehensiveness and social responsibility, allowing for personal interests to mature in individually chosen fields. The curriculum integrates initiatives in architectural conservation, sustainability, and collaboration with the community. Graduates of the program are thus expected to operate in a multidisciplinary approach to Architecture.

PROGRAM MISSION: Through joint intellectual, humanistic, creative and technical pursuits, the School of Architecture encourages individuals from diverse backgrounds to acquire the knowledge, skills and sense of social responsibility that are considered to be fundamental to a discipline concerned with the betterment of the human condition and the physical environment. By expounding an understanding of historical processes, rapidly-advancing technology and ever-present social predicaments, the school empowers students to exercise their potential for service, collaboration, creativity, productivity, leadership and civic engagement within society.

PROGRAM EXPECTED GOALS: The graduate of the Architecture Program will:

1. Identify urban, spatial, and tectonic conceptions that are characteristic of the Caribbean Region to challenge the cultural vantage points and boundaries from which the architectural discipline has been so far understood in Puerto Rico.
2. Articulate the limits and possibilities of the land and the regional landscape, as framed within society's ecological obligations.
3. Assess technology as myth, discourse, resource and possibility, given the Caribbean's perennial (and sometimes questionable) efforts to contemporize.
4. Illustrate the relevance, quality and dissemination of architectural research –formal, technical, historical, or

cultural – as integral to professional practice.

5. Compare and contest the prevailing modes and metaphors of our age and culture, remaining critically sensitive to change, transformations and evolving trends and ideals.
6. Discuss past and prevailing architectural debates within the academy, the profession, and the community in general, engaging at the same time with other disciplines in the effort.
7. Generate designs that fulfill society's expectations regarding health and safety-related priorities and responsibilities, but also cost-effective and esthetic concerns.
8. Contribute as a member in team and/or interdisciplinary efforts.

PROGRAM EDUCATIONAL OBJECTIVES: Within a few years of graduation, the PUPR Architecture Program graduates are expected to attain the following:

1. To uphold the contemporary relevance of a holistic understanding of Architecture, one that facilitates comprehension of how different professional components are interrelated and integrated.
2. To further creative, critical and ethical stances framed within an understanding of multiculturalism, diversity and citizenship to best fulfill the basic demands of the architecture profession, if not transcend them.
3. To nurture personal, intellectual, and professional skills and competencies needed to research, conceive, design, coordinate, supervise, and evaluate the construction of buildings and spaces.
4. To increase technological knowledge and proficiency as fundamental to in-depth learning, professional performance, innovation and lifelong learning, all supported by scientific and quantitative reasoning.
5. To foster information literacy and expertise in modes of communication (oral, written, graphic) as essential for the exchange of ideas, analysis, problem solving, collaboration, and knowledge transfer.
6. To encourage initiatives that build up leadership and entrepreneurial dexterity in organizational skills related to planning, management, finances, the identification of business opportunities, and civic engagement.
7. To promote a wide-scoped approach to social accountability, encompassing health and safety concerns, stewardship of the land, endorsement of sustainability practices, the ethical use of information, and the preservation of cultural and built legacies.
8. To advance mutual trust between academia and practice, encouraging interaction with architects and representatives of the construction industry through collaborative research, team effort, interdisciplinary initiatives and community service.

STUDENT OUTCOMES: Graduates of the Architecture Program will have:

Critical Thinking and Representation:

1. *Ability to read, write, speak and listen effectively.*
2. *Ability to raise clear and precise questions, use abstract ideas to interpret information, consider diverse points of view, reach well-reasoned conclusions, and test alternative outcomes against relevant criteria and standards.*
3. *Ability to use appropriate representational media, such as traditional graphic and digital technology skills, to convey essential formal elements at each stage of the programming and design process.*
4. *Ability to make technically clear drawings, write outline specifications, and prepare models illustrating and identifying the assembly of materials, systems, and components appropriate for a building design.*
5. *Ability to gather, assess, record, apply, and comparatively evaluate relevant information within architectural coursework and design processes.*
6. *Ability to effectively use basic architectural and environmental principles in design.*
7. *Ability to examine and comprehend the fundamental principles present in relevant precedents and to make choices regarding the incorporation of such principles into architecture and urban design projects.*
8. *Understanding of the fundamentals of both natural and formal ordering systems and the capacity of each to inform two- and three-dimensional design.*
9. *Understanding of parallel and divergent canons and traditions of architecture, landscape and urban design including examples of indigenous, vernacular, local, regional, national settings from the Eastern, Western, Northern, and Southern hemispheres in terms of their climatic, ecological, technological, socioeconomic, public health, and cultural factors.*
10. *Understanding of the diverse needs, values, behavioral norms, physical abilities, and social and spatial patterns that characterize different cultures and individuals and the implication of this diversity on the societal roles and responsibilities of architects.*
11. *Understanding the role of applied research in determining function, form, and systems and their impact on human conditions and behavior.*

Integrated Building Practices, Technical Skills and Knowledge:

1. *Ability to prepare a comprehensive program for an architectural project, such as preparing an assessment of client and user needs, an inventory of space and equipment requirements, an analysis of site conditions (including existing buildings), a review of the relevant laws and*

standards and assessment of their implications for the project, and a definition of site selection and design assessment criteria.

2. *Ability to design sites, facilities, and systems to provide independent and integrated use by individuals with physical (including mobility), sensory, and cognitive disabilities.*
3. *Ability to design projects that optimize, conserve, or reuse natural and built resources, provide healthful environments for occupants/users, and reduce the environmental impacts of building construction and operations on future generations through means such as carbon-neutral design, bioclimatic design, and energy efficiency.*
4. *Ability to respond to site characteristics such as soil, topography, vegetation, and watershed in the development of a project design.*
5. *Ability to apply the basic principles of life-safety systems with an emphasis on egress.*
6. *Ability to produce a comprehensive architectural project that demonstrates each student's capacity to make design decisions across scales while integrating the following SPC:*

- A.2. Design Thinking Skills
- A.4. Technical Documentation
- A.5. Investigative Skills
- A.8. Ordering Systems
- A.9. Historical Traditions and Global Culture
- B.2. Accessibility
- B.3. Sustainability
- B.4. Site Design
- B.5. Life Safety
- B.8. Environmental Systems
- B.9. Structural Systems

7. *Understanding of the fundamentals of building costs, such as acquisition costs, project financing and funding, financial feasibility, operational costs, and construction estimating with an emphasis on life-cycle cost accounting.*

8. *Understanding the principles of environmental systems' design such as embodied energy, active and passive heating and cooling, indoor air quality, solar orientation, daylighting and artificial illumination, and acoustics; including the use of appropriate performance assessment tools.*

9. *Understanding of the basic principles of structural behavior in withstanding gravity and lateral forces and the evolution, range, and appropriate application of contemporary structural systems.*

10. *Understanding of the basic principles involved in the appropriate application of building envelope systems and associated assemblies relative to fundamental performance, aesthetics, moisture transfer, durability, and energy and material resources.*

11. *Understanding* of the basic principles and appropriate application and performance of building service systems such as plumbing, electrical, vertical transportation, security, and fire protection systems.

12. *Understanding* of the basic principles utilized in the appropriate selection of construction materials, products, components, and assemblies, based on their inherent characteristics and performance, including their environmental impact and reuse.

Realm C: Leadership and Practice:

1. *Ability* to work in collaboration with others and in multidisciplinary teams to successfully complete design projects.

2. *Understanding* of the relationship between human behavior, the natural environment and the design of the built environment.

3. *Understanding* of the responsibility of the architect to elicit, understand, and reconcile the needs of the client, owner, user groups, and the public and community domains.

4. *Understanding* of the methods for competing for commissions, selecting consultants and assembling teams, and recommending project delivery methods.

5. *Understanding* of the basic principles of architectural practice management such as financial management and business planning, time management, risk management, mediation and arbitration, and recognizing trends that affect practice.

6. *Understanding* of the techniques and skills architects use to work collaboratively in the building design and construction process and on environmental, social, and aesthetic issues in their communities.

7. *Understanding* of the architect's responsibility to the public and the client as determined by registration law, building codes and regulations, professional service contracts, zoning and subdivision ordinances, environmental regulation, and historic preservation and accessibility laws.

8. *Understanding* of the ethical issues involved in the formation of professional judgment regarding social, political and cultural issues in architectural design and practice.

9. *Understanding* of the architect's responsibility to work in the public interest, to respect historic resources, and to improve the quality of life for local and global neighbors.

CAREER OPPORTUNITIES: Architects engage in diverse interrelated branches of design: architectural design, management, administration and construction, among others. They work for the public sector, for private enterprise, for communities and civic organizations, as well as individuals. Some focus their professional development on specific building types, environmental issues or urban design. Most, however, keep a diversified practice,

addressing changes in programmatic requirements and needs of contemporary society.

DEGREE OFFERED: Polytechnic University's School of Architecture ARQPOLI offers the five-year Bachelor of Architecture professional degree program. The School opened in Fall 1995 and was granted accreditation January 1, 2001 by the *National Architectural Accrediting Board* (NAAB). In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure.

In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes three types of degrees: Bachelor of Architecture, Master of Architecture, and Doctor of Architecture. A program may be granted a 6-year, 3-year, or 2-year term of accreditation, depending on the extent of its conformance with established educational standards.

Master's degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree that, when earned sequentially, constitute an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

Polytechnic University of Puerto Rico, School of Architecture offers the following NAAB accredited degree program:

B. Arch. (213 undergraduate credits)

Next accreditation visit: 2015

MINIMUM GRADUATION REQUIREMENTS

27	Credit-hours in Developmental Studies
27	Credit-hours in Socio-Humanistic Studies and Languages
9	Credit-hours in Mathematics and Sciences
117	Credit-hours in Professional Core Courses
33	Credit-hours in Electives
213	Total Credit-Hours

LABORATORIES: The School of Architecture includes a Computers Laboratory, Photography, a Materials and Digital Fabrication Laboratory and a Ceramics' Laboratory for student and faculty use. An Architectural Conservation Laboratory provides mechanisms to explore related subjects with a primary focus on the Caribbean Region. The School is currently committed to research on architectural conservation techniques. In addition, the School benefits from the availability of additional laboratories in the Civil Engineering Department on campus: a Soils' Mechanics Laboratory, a Materials' Laboratory, and a Mechanics of

Materials' Laboratory. These strengthen the Technology and Structures components.

DEVELOPMENTAL STUDIES: All students who apply and are admitted to the Architecture School must show evidence that they have acquired the necessary academic abilities and skills to make the most of the curriculum. Those not demonstrating the command of these abilities and skills (as reflected by results of their College Entrance Examination Board Test and SAT; results in Polytechnic University's placement tests; previous university experience; or other *ad hoc* tests and criteria) will be required to take developmental courses to overcome the deficiencies in Languages, Mathematics and Science. These developmental courses (equivalent to a maximum of 27 credit-hours) are in addition to the 186 credits required by the Architecture Program, for a total of 213 credit-hours. The developmental courses are awarded their corresponding credits according to contact hours, as follows:

DEVELOPMENTAL STUDIES COMPONENT
(MAXIMUM OF 27 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
SCIE 0110	Introduction to Physics	3

In order to register in any Professional Core Courses, students must have approved MATH 0102 Preparatory Mathematics. They must also have approved three credit-hours in either ENGL 0100 Preparatory English, or SPAN 0100 Preparatory Spanish.

STUDENT ORGANIZATIONS: Two student chapters of national and international reach are in operation:

- The American Institute of Architects Students' Chapter (AIAS).
- *Coordinadora Latinoamericana de Estudiantes de Arquitectura* (CLEA).

Students may participate in one or both chapters. The two groups provide opportunities to participate in events, symposia, seminars, and field trips in and outside Puerto Rico.

SCHOOL OF ARCHITECTURE
CURRICULUM STRUCTURE

SOCIO-HUMANISTIC STUDIES
(27 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGL 1010	The Essay as Literary Genre	3
ENGL 2010	Analysis of World Literature	3
HIST 2010	History of Puerto Rico in the Caribbean Context	3
SOHU 2010	Socio Humanistic Studies I	3
HIST 4030	Historiography	3
SOHU 2020	Socio Humanistic Studies II	3
SPAN 1010	Linguistic Analysis of Literary Form	3
SPAN 2010	Hispanic Literature	3
SOHU ELECTIVE	Socio Humanistic or Language Elective	3

SCIENCES AND MATHEMATICS
(9 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 1330	Precalculus I	3
MATH 1340	Precalculus II	3
SCIE 2410	General Physics I	3

PROFESSIONAL CORE
(117 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
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ARCC-Architectural Representation

ARCC 1010	Architectural Representation I	3
ARCC 2010	Basic Computer Aided Drafting: Basic Cad	3

ARCH-Design

ARCH 1010	Basic Design I	4
ARCH 1020	Basic Design II	4
ARCH 1030	Basic Design III	4
ARCH 2010	Design Fundamentals I	4
ARCH 2020	Design Fundamentals II	4
ARCH 2030	Design Fundamentals III	4
ARCH 3010	Intermediate Design I	4
ARCH 3020	Intermediate Design II	4
ARCH 3030	Intermediate Design II: Mid-Career Research	4
ARCH 4010	Advanced Design I	4
ARCH 4020	Advanced Design II	4
ARCH 4030	Advanced Design III	4
ARCH 5010	Capstone Design I	4
ARCH 5020	Capstone Design II	4
ARCH 5030	Capstone Design III	4

ARCT-Theory

ARCT 1010	Introduction to Architectural Theory	3
ARCT 1011	Introduction to Architectural Theory Laboratory	0

ARHH-History			
ARHH	1010	History of Architecture	3
ARHH	1011	History of Architecture Laboratory	0
ARHH	2010	History of Modern Architecture	3
ARHH	2011	History of Modern Architecture Laboratory	0
ARHH	3010	Neo-Avant-Garde and the Contemporary Scene	3

ARPP- Practice			
ARPP	3010	Practice/Experience	3
ARPP	5010	Ethics	3
ARPP	5020	Construction Documents	3
ARPP	5030	Office Management and Finances	3

ARST-Structures			
ARST	3010	Structural Concepts I	3
ARST	3020	Structural Concepts II	3
ARST	4010	Structures III: Steel	3
ARST	4020	Structures IV: Concrete	3

ARTE-Technology			
ARTE	1010	Introduction to Technology	3
ARTE	2010	Materials and Methods	3
ARTE	3010	Site Planning	3
ARTE	4010	Electricity, Accoustics, & Telecommunications	3
ARTE	4020	Environmental and Mechanical Systems	3

ELECTIVES (33 CREDIT-HOURS)			
COURSE	TITLE	CREDIT-HOURS	
ARCC	Advanced Elective in Architectural Representation (0400 Level)	3	
ARHH ARCT	Advanced Elective in History or Theory (0400 Level)	3	
ARST ARTE	Advanced Elective in Technology or Structures (0400 Level)	3	
	Open ELECTIVES	24	

Total minimum of required credit-hours is 213.

ARCHITECTURAL PROGRAM ELECTIVES

COURSE	TITLE	CREDIT-HOURS
Electives in Architectural Representation		
ARCC	0100 Spatial Visualization	3
ARCC	0120 Cyberpublications	3
ARCC	0130 Basic Digital Graphics and Architectural Presentations	3
ARCC	0140 Collage Making + Design Studio	3
ARCC	0160 Anthropomorphic Awareness	3
ARCC	0170 Perspective	3
ARCC	0180 3D-Exploration	3

ARCC	0190	Architecture and Social media	3
ARCC	0210	Photography Fundamentals	3
ARCC	0211	Photography Laboratory	0
ARCC	0220	Set Design	3
ARCC	0240	Introduction to Industrial Design	3
ARCC	0250	Sculpture	3
ARCC	0310	Color for Architects	3
ARCC	0315	Ceramics	3
ARCC	0330	Installations	3
ARCC	0340	Public Speaking	3
ARCC	0403	Advanced Computer Aided Design and Drafting	3
ARCC	0404	Advanced Digital Graphics and Architectural Presentations	3
ARCC	0410	Parametric Modeling and Digital Fabrication	3

Electives in Design			
ARCH	0100	Design Abroad	4
ARCH	0203	Design Seminar	4
ARCH	0210	Collaborative Design Studio	4
ARCH	0391	Landscape Architecture	4
ARCH	0599	Vertical Studio	4

Electives in History			
ARHH	0410	Selected Topics on Modern Architecture	3
ARHH	0430	Architecture of the Italian Renaissance	3
ARHH	0440	Advanced Topics on History	3

Electives in Professional Practice			
ARPP	0310	The Architect as Entrepreneur	3
ARPP	0320	Ecology and Tourism	3
ARPP	1010	Introduction to Architecture	3

Electives in Technology			
ARTE	0302	Architecture and Industry	3
ARTE	0403	Ecological Terraces	3
ARTE	0400A	Construction Details	3
ARTE	0400B	Interior Architecture	3
ARTE	0410	Preservation Technology	3
ARTE	0401	Wood Technology	3
ARTE	0440	Architectural Light and Lighting	3
ARTE	0451	Architectural Conservation Laboratory	3

Electives in Structures			
ARST	0410	Advanced Structures	3

Electives in Theory			
ARCT	0110	Visual Culture	3
ARCT	0430	Preservation Theory	3
ARCT	0440	Advanced Topics on Theory	3

Electives in Landscape Architecture			
ARCL	0100	City & Environment	3
ARCL	0315	Geography	3
ARCL	0391	Landscape Architecture	4

Architecture-related Socio-Humanistic Studies and Languages			
LITE	3040	Writing About Architecture	3
SOHU	3030	Archeology for Architects	3
SPAN	2020A	Business Language and Communication	3
		History of Puerto Rico in the Caribbean	
ARHH	2010	Context	3
HIST	4030	Historiography	3

CURRICULUM SEQUENCE

FIRST YEAR

FIRST QUARTER			
COURSE	TITLE	CREDIT-HOURS	
	(Developmental Program prerequisites)	6	
ARCH	1010	Basic Design I	4
ARHH	1010	History of Architecture	3
ARHH	1011	History of Architecture Lab.	0
ATUL	0100	Adjustment to University Life	3
MATH	0106	Elementary Algebra	3
			19

SECOND QUARTER			
COURSE	TITLE	CREDIT-HOURS	
ARCH	1020	Basic Design II	4
ARCC	1010	Architectural Representation I	3
ARTE	1010	Introduction to Technology	3
ENGL	0100	Preparatory English	3
SPAN	0100	Preparatory Spanish	3
MATH	0110	Intermediate Algebra	3
			16

THIRD QUARTER			
COURSE	TITLE	CREDIT-HOURS	
ARCH	1030	Basic Design III	4
ARCT	1010	Introduction Architectural Theory	3
ARCT	1011	Introduction Architectural Theory Lab.	0
ENGL	0110	English Grammar	3
SPAN	0110	Spanish Grammar	3
			13

SECOND YEAR

FIRST QUARTER			
COURSE	TITLE	CREDIT-HOURS	
ARCH	2010	Design Fundamentals I	4
		History of Puerto Rico in the Caribbean	
ARHH	2010	Context	3
SCIE	0110	Introduction to Physics	3
MATH	1330	Precalculus I	3
			13

SECOND QUARTER			
COURSE	TITLE	CREDIT-HOURS	
ARCH	2020	Design Fundamentals II	4
ARTE	2010	Materials & Methods	3
MATH	1340	Precalculus II	3
SOHU	2010	Socio-Humanistic Studies I	3
			13

THIRD QUARTER			
COURSE	TITLE	CREDIT-HOURS	
ARCH	2030	Design Fundamentals III	4
		Basic Computer Aided Drafting: Basic	
ARCC	2010	Cad	3
ARHH	2010	History of Modern Architecture	3
ARHH	2011	History of Modern Architecture Lab.	0
SCIE	2410	General Physics I	3
		ELECTIVE Open	3
			16

THIRD YEAR

FIRST QUARTER			
COURSE	TITLE	CREDIT-HOURS	
ARCH	3010	Intermediate Design I	4
ARPP	3010	Practice/Experience	3
ENGL	1010	The Essay as a Literary Genre	3
SOHU	2020	Socio-Humanistic Studies II	3
			13

SECOND QUARTER			
COURSE	TITLE	CREDIT-HOURS	
ARCH	3020	Intermediate Design II	4
ARST	3010	Structural Concepts I	3
		Neo-Avant-Garde and the Contemporary	
ARHH	3010	Scene	3
SPAN	1010	Linguistic Analysis of Literary Forms	3
			13

THIRD QUARTER			
COURSE	TITLE	CREDIT-HOURS	
ARCH	3030	Intermediate Design III: Mid- Career Research	4
ARST	3020	Structural Concepts II	3
ARTE	3010	Site Planning	3
SPAN	2010	Hispanic Literature	3
		ELECTIVE Open	3
			16

FOURTH YEAR

FIRST QUARTER			
COURSE	TITLE	CREDIT-HOURS	
ARCH	4010	Advanced Design I	4

ARST	4010	Structures III: Steel	3
ARTE	4010	Electricity, Acoustics & Telecommunications	3
		ELECTIVE Socio-Humanistic Studies or Languages	3
			13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS	
ARCH	4020	Advanced Design II	4
ARST	4020	Structures IV: Concrete	3
ARTE	4020	Environmental Systems	3
		ELECTIVE Theory or History 0400 Level	3
			13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS	
ARCH	4030	Advanced Design III	4
ENGL	2010	Analysis of World Literature	3
HIST	4030	Historiography	3
		ELECTIVE Representation 0400 Level	3
		ELECTIVE Open	3
			16

FIFTH YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS	
ARCH	5010	Capstone Design I	4
ARPP	5010	Ethics	3
		ELECTIVE Technology or Structure 0400 Level	3
		ELECTIVE Open	3
			13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS	
ARCH	5020	Capstone Design II	4
ARPP	5020	Construction Documents	3
		ELECTIVE Open	3
		ELECTIVE Open	3
			13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS	
ARCH	5030	Capstone Design III	4
ARPP	5030	Office Management and Finances	3
		ELECTIVE Open	3
		ELECTIVE Open	3

COURSE DESCRIPTIONS**ARCC 0100- SPATIAL VISUALIZATION**

Three credit-hours. Two two-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: None

Elemental techniques of representing space are introduced. Geometry, as projected three dimensionally, allows students to manipulate form, shadows and projections. Explanation of techniques for depicting spatial relationships are included as part of the course.

ARCC 0120- CYBERPUBLICATIONS

Three credit-hours. Two two-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: None

Introduction to the operative mechanisms of the Internet and the Web's potential as a vehicle for architectural expression and research. Visual techniques are explored to increase the effectiveness of cyberspace's interactive potential.

ARCC 0130- BASIC DIGITAL GRAPHICS AND ARCHITECTURAL PRESENTATIONS

Three credit-hours. Two two-hour Lecture/laboratory period per week. Prerequisite: ARCC 2010

Introduction to the basic concepts, software and techniques for developing architectural presentations. The course main focus in on drawing manipulation, basic rendering techniques, printing, board layout and design using the digital tools currently available.

ARCC 0140- COLLAGE MAKING + DESIGN STUDIO

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: ARCH 1020, ARCC 1010

This course explores the origins of collage, its use in various movements of both art and architecture, how influenced and continue to influenced one another, as well as an intense material investigation.

ARCC 0150- DRAWING

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: None

Diverse drawing techniques and a variety of media are introduced. Gesture and movement are explored at different scales in relationship to graphic space. Personal expression is validated as integral to the process.

ARCC 0160- ANTHROPOMORPHIC AWARENESS

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: None

An introduction to the processes of observation, recognition and control of the human body in space. Everyday movement and basic manifestations of habitation are used as point of departure for the creation and interpretation of personal movement.

ARCC 0170- PERSPECTIVE

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: ARCC 1010

The techniques for graphic construction of three-dimensional space, both as representational and design tool are presented. Free-hand sketching and one and two point constructions are explored.

ARCC 0180- 3D EXPLORATION

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: ARCH 1010

Different artistic techniques and materials, methods and procedures are explored in search of representational effectiveness and the successful communication of ideas and concepts.

ARCC 0190- ARCHITECTURE AND SOCIAL MEDIA

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: ARCH 1020, ARCC 2010

Introduction to the basic principles of web-based Social Media platforms and its potential uses in the development of Architecture as a multivalent profession. This knowledge will allow students to help visualize new trends in design matters, market the profession and help Architects to fully integrate into the mainstream in order to influence society in more effective ways.

ARCC 0202- SKETCHING

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: None

Experimentation with analytical methods for representing the essence of an architectural work through free-hand sketching, focusing on diverse scales and techniques, and drawing on location.

ARCC 0210- PHOTOGRAPHY FUNDAMENTALS

Three credit-hours. Two one-hour lectures. Prerequisite: None Corequisite: ARCC 0211

Introduction to black & white photography, its history and pertinence to Architecture, emphasizing composition, pinhole camera design, and camera manipulation as tools to understand and explore the representation of space.

ARCC 0211- PHOTOGRAPHY LABORATORY

Zero credit-hours. One two-hour laboratory period per week. Laboratory Fee. Corequisite: ARCC 0210

This course is taken simultaneously with ARCC 0210, focusing on hands-on experience in laboratory techniques, including familiarity with the basic chemistry of negatives. Developing and printing are understood as processes that can be influenced by creative manipulation.

ARCC 0220- SET DESIGN

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: ARCH 1030

Plays are studied and interpreted to render spatial solutions for the stage, akin to both interpretation and realization.

Design explorations include experimentation with light, materials and textures. Tectonic and symbolic dimensions of scenery are emphasized, as well as construction concerns.

ARCC 0240- INTRODUCTION TO INDUSTRIAL DESIGN

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: None

Product design is conceived as a vehicle for introducing students to analytical thinking in relationship to the practicality of materials, descriptions and other concerns related to industrial design.

ARCC 0250- SCULPTURE

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: None

Form in space and three-dimensional thinking are tested against the wide array of materials with which shapes and volumes -but also ideas and concepts- become present in a specific surrounding.

ARCC 0310- COLOR FOR ARCHITECTS

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: None

Color, tone, value and hue are discussed in relationship to theories of perception. Changing psychological and cultural interpretations are examined; practical applications are explored and debated.

ARCC 0315- CERAMICS

Three credit-hours. One four-hour studio per week. Prerequisite: None

Introduction to basic techniques for hand-building with clay: modeling, slab construction, coiling, draping and mold-making for small-scale production of tiles, textures, finishes and objects where clay becomes a malleable membrane that encloses space.

ARCC 0330- INSTALLATIONS

Three credit-hours. One four-hour studio per week. Prerequisite: None

A critical analysis of our evolving media culture, examining the nature and functions of it in diverse contexts. Students produce installations as creative comments reflecting the reshaping of contemporary cultural systems.

ARCC 0340- PUBLIC SPEAKING

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: None

Oral communication is understood as a tool for conveying ideas accurately. Students plan, rehearse and evaluate public presentations after being exposed to exercises pertaining thematic organization, diction, and voice projection. Video becomes a tool for self-assessment.

ARCC 0401- COLOR & RENDERING

Three credit-hours. Two two-hour lecture/laboratory

periods per week. Prerequisites: ARCC 2010, ARCH 2030

Advanced techniques for representation of architectural space are introduced, including perspective construction, shades, shadows, reflections and textures. Color and different techniques for its application are studied; related work by other architects is examined.

ARCC 0403- ADVANCED COMPUTER AIDED DESIGN AND DRAFTING

Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisite: ARCC 2010, ARCH 2010

Introduction to the concepts for the creation of 3D Architectural Models Database and the extraction of bidimensional drawing. The course main focus is on 3D model development, drawing linking and basic rendering techniques using building information modeling (BIM) software.

ARCC 0404- 3D COMPUTER STUDIO

Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisite: ARCC 0130, ARCH 2010

Introduction to the concepts of 2D and 3D rendering and animation. The course main focus is on 3D rendering techniques, 3D animation concepts, advanced 2D drawing rendering, 2D animation using the digital tools currently available.

ARCC 0410- PARAMETRIC MODELING AND DIGITAL FABRICATION

Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisite: ARCC 2010

This course explores three-dimensional design with parametric modeling at the same time develop their education in digital technologies to materials properties. Through a series of short exercises the student will learn digital fabrication techniques that will serve as models of exploration for an installation to be fabricated in real scale.

ARCC 1010- ARCHITECTURAL REPRESENTATION I

Three credit-hours, Two two-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCH 1010, ARHH 1010

Basic drawing, drafting, and recording, techniques in pencil are introduced as tools for visual and technical communication, all considered to be essential to the architect's trade and expression.

ARCC 2010- BASIC COMPUTER AIDED DRAFTING: BASIC CAD

Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisite: ARCC 1010, ARCH 1020

Introduction to the basic concepts, software and drawing techniques for digital drafting. The course main focus is on

bidimensional drawings, its representation and basic 3D modeling using the digital tools currently available.

ARCH 0100- DESIGN ABROAD

Four credit-hours. Two two-hour lecture/laboratory Periods per week and a trip. Laboratory Fee.

Prerequisite: By approval

The history, urbanism, architecture, geography and culture of a given country or city are studied as part of the course prior to actual travel to the place. Exercises undertaken before the trip exposes students to background historical information, on-site sketching and enhanced analytical experiences.

ARCH 0203- DESIGN SEMINAR

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee.

Prerequisite: ARCH 1030

Principles of design are addressed in short exercises in which the students use previous projects to confront different skills related to proportions, composition, structural logic, sequence, and materiality.

ARCH 0210- COLLABORATIVE DESIGN STUDIO

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee.

Prerequisite: ARCH 1020, ARCC 1010

The purpose of this workshop is to introduce architecture students to the use of the spaces they project in a collective environment. Students will learn from the experience of people (inhabitants/users/clients with whom they will collaborate) in the spaces they inhabit and take into account their needs, their aspirations and their knowledge about the place when designing.

ARCH 0290- INDEPENDENT STUDY

Two credit-hours. One-one and a half hour lecture/laboratory period per week. Prerequisite: By approval

The course offers the opportunity to formulate and investigate projects of personal interest, or regional relevance pertinent to the school's possible contributions to the profession and to society, broadening the relatively fixed structure of the curriculum.

ARCH 0391- LANDSCAPE ARCHITECTURE

Four credit-hours. Two three-and-a-half hour lecture/studios per week. Laboratory Fee. Prerequisite: ARCH 2020, ARTE 3010.

Earth manipulation and use of vegetation are addressed along with other landscape strategies at both urban and rural scales. Soils, drainage systems, plant materials and ecological concerns are underlined as integral to the development of contemporary projects.

ARCH 0499- VERTICAL STUDIO

Four credit-hours. Two three-and-a-half hour lecture/

studios per week. Laboratory Fee. Prerequisite: By approval

An elective design studio for *ad-hoc* topics to be explored as a complement to the required courses in this area, according to the shared interests of the teachers and students from different levels. This course may substitute for a required design course, by approval.

ARCH 1010- BASIC DESIGN I

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee. Prerequisite: MATH 0102 and one of two language courses, SPAN 0100 or ENGL 0100; Corequisite: ARHH 1010

Introduction to basic design elements, principles and concerns, focusing on spatial organization. Problem solving and analytical models become tools to understand underlying compositional principles.

ARCH 1020- BASIC DESIGN II

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCH 1010, ARHH 1011; Corequisite: ARCC 1010

Spatial organization, form, structure, and figure-ground gestalt issues are explored through geometry in projects developed from two-dimensional graphic design into three dimensional architectural abstractions.

ARCH 1030- BASIC DESIGN III

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCH 1020, ARCC 1010

Notion of contexts are analyzed as an introduction to the complexities inherent to architecture and place. Precedents are examined in order to link programmatic concerns and formal composition, in order to integrate them in design.

ARCH 2010- DESIGN FUNDAMENTALS I

Four credit-hours. Two three-and-a-half-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCH 1030, ARCT 1010, ARCT 1011, ARTE 1010, ATUL 0100

Plan, section and elevation are jointly manipulated to expound architecture's three dimensional possibilities. Circulation and spatial sequence, structure, enclosure and tectonics are simultaneously considered in the genesis of form.

ARCH 2020- DESIGN FUNDAMENTALS II

Four credit-hours. Two three-and-a-half-hour lecture/studio periods per week. Laboratory Fee. Pre-requisite: ARCH 2010, ENGL 0110, SPAN 0110 and MATH 0110.

Projects of intermediate complexity are related to the larger backdrop of culture and themes related to identity politics. The appropriateness of concept to form and context is emphasized, as well as the architect's larger responsibilities to his/her work in society.

ARCH 2030- DESIGN FUNDAMENTALS III

Four credit-hours. Two three-and-a-half-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCH 2020, ARTE 2010

Design development addresses site orientation, building envelope issues, and detail as pertinent to these. Precedents expound programmatic complexity and design concerns are pursued at various scales within the project.

ARCH 3010- INTERMEDIATE DESIGN I

Four credit-hours. Two three-and-a-half-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCH 2030, ARHH 2010, ARHH 2011

Design is related to structures of historical significance and issues of contemporary and traditional vocabularies. Preservation theory, legislation and programming, building pathology and hands-on exercises with materials are integral to the course.

ARCH 3020- INTERMEDIATE DESIGN II

Four credit-hours. Two three-and-a-half-hour lecture/studio periods per week. Laboratory Fee. Prerequisite: ARCH 3010, ARCC 2010

Design methods are highlighted, exploring techniques used to articulate the components of an architectural project. Problem-solving is confronted from different angles of understanding in an introspective, critical manner.

ARCH 3030- INTERMEDIATE DESIGN III: MID- CAREER RESEARCH

Four credit-hours. Two three-and-a-half-hour lecture/studio periods per week. Prerequisites: ARCH 3020, ARPP 3010, ARHH 3010, SOHU 2010

A project investigation of limited focus is developed, reflecting each student's specific concerns related to architecture, locus and culture. Discussions and readings on information-gathering theories and techniques facilitate the definition of individual research objectives.

ARCH 4010- ADVANCED DESIGN I

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee. Prerequisite: ARCH 3030, ARTE 3010, ARST 3010

Housing and urbanism are confronted in a term-long project. Typological housing precedents and social issues are framed against the economic and political background which both fosters and hinders housing.

ARCH 4020- ADVANCED DESIGN II

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee. Prerequisite: ARCH 4010

Urban design is considered from a two-fold approach: one, the ecologically minded posture; the other, based on historic and prevalent urban design ideas both to be expanded and contested in studio. Present-day urban problems in Latin America are customarily addressed.

ARCH 4030- ADVANCED DESIGN III

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee. Prerequisite: ARCH 4020, ARTE 4010, ARTE 4020, ARST 3020

A term-long project addresses the integration of the multiple disciplines: programming, design, technology and structures come together in an all-encompassing problem that elucidates the multilayered nature of architecture.

ARCH 5010- CAPSTONE DESIGN I

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCH 4030, HIST 3012, HISTORY OR THEORY ELECTIVE (0400 LEVEL); SOHU 2020, ENGL 2010, SPAN 2010, ARTE 4010, ARTE 4020, ARST 3010, ARST 3020, ARST 4010

At this first phase of the Capstone Design Project, parameters, objectives and methodologies to be pursued are defined. A written document to guide the design phase of the project is developed through research and debate.

ARCH 5020- CAPSTONE DESIGN II

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee. Prerequisite: ARCH 5010, ARST 4020

The second Capstone course requires the development of a comprehensive preliminary design to reflect the accomplishment of goals stated in ARCH 5010. Design development issues regarding conceptual and tectonic interpretation are incorporated to a final presentation.

ARCH 5030- CAPSTONE DESIGN III

Four credit-hours. Two three-and-a-half hour lecture/studio periods per week. Laboratory Fee. Prerequisite: ARCH 5020

The course culminates the Capstone Design sequence with attention to the technical resolution of the project and its (re)presentation. This all-inclusive final project mirrors the student's acquired skills, maturity and expanded professional outlook.

ARCL 0100- CITY & ENVIRONMENT

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARCH 1010

The course introduces the themes of city, tourism, and architecture. It emphasizes environmental pollution and urban development sustainability. Field trips constitute a fundamental tool to illustrate the thematic contents of the course.

ARCL 0315- GEOGRAPHY

Three credit-hours. Two two-hour lecture periods per week. Pre-requisite: ARCH 1030

An introduction to basic and interdisciplinary concepts pertaining to geography and its diverse fields of reach. Tools for spatial and social understanding of context in contemporary society are presented and valued.

ARCT 0110- VISUAL CULTURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: None

Theories of vision and representation nurture reflection, debate and exercises related to the construction of images in contemporary culture. Modes of perception that have influenced human communication in the past are discussed.

ARCT 0430- CONSERVATION THEORY

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARCH 3010, ARHH 3010

Ideas and theories linked with preservation ideals are presented and debated upon. Aspiration versus realization within the conservation field becomes the background against which the history of building and rebuilding is examined.

ARCT 0440- ADVANCED TOPICS ON THEORY

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARCH 3020, ARHH 3010

Architectural design history and theories foster debate and criticism of works and ideas of architects and architectural theorists throughout time, nurturing an understanding of the different ideologies interweaving with Architecture.

ARCT 1010- INTRODUCTION TO ARCHITECTURAL THEORY

Three credit-hours. Two two-hour lectures per week. Prerequisite: ARCC 1010, ARCH 1020

Corequisite: ARCT 1011

A critical exposition of architectural thinking throughout time, examining selected treatises of architectural theory from Classical antiquity to the 19th century. Attention is given to the sociopolitical contexts in which ideas were generated.

ARCT 1011- ARCHITECTURAL THEORY LABORATORY

Zero credit-hour. One one-hour recitation period per week. Prerequisite: ARCH 1020

Corequisite: ARCT 1010

Small group discussion sessions allow students to expand and debate upon the subjects addressed at lectures in the co-required course. Written submittals and projects are individually commented in these meetings.

ARHH 0410- SELECTED TOPICS ON MODERN ARCHITECTURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARHH 3010

Precedents, cultural contexts, key figures and seminal texts most representative of the Modern Movement's aspirations and its ideological pursuits are discussed. Apperceptions of the movement's impact around the world are debated upon.

ARHH 0440- ADVANCED TOPICS ON HISTORY

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: HIST 3510

A specific architectural period or movement become the object of analysis, taking into account the cultural background against which it developed. Ideas are examined in relation to time frames of public endorsement, reasons for dissemination and eventual disfavor.

ARHH 1010- HISTORY OF ARCHITECTURAL SPACE

Three credit-hours. Two two-hour lecture period per week, Prerequisite: MATH 0102 and one of two language courses, SPAN 0100 or ENGL 0100

Corequisite: ARHH 1011

A survey to introduce the history of Architecture, including basic elements of architectural design, composition, form-making and spatial concepts, all examined against the historical and natural forces that have influenced the art of building.

ARHH 1011- HISTORY OF ARCHITECTURE LABORATORY

Zero credit-hour. One one-hour recitation period per week. Prerequisite: MATH 0102 and one of two language courses, SPAN 0100 or ENGL 0100

Co-requisite: ARHH 1010

Small-group discussion sessions allow students to expand and debate upon the subjects addressed at lectures in the co-required course and go beyond these. Required projects are individually reviewed in these meetings.

ARHH- 2010 HISTORY OF MODERN ARCHITECTURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARHH 1010/1011; ARCT 1010/1011

Corequisite: ARHH 2011

Links between the romantic and rationalist outlooks of the 18th Century, together with the fragmentation and simultaneity of the end of the 20th century are addressed. The architectural production and theories expounded elucidate the ruptures and continuities of a non-linear history.

ARHH 2011- HISTORY OF MODERN ARCHITECTURE LABORATORY

Zero credit-hours. One-hour recitation period per week.

Corequisite: ARHH 2010

Small group discussion sessions allow students to expand and debate upon the subjects addressed at lectures in the co-required course. Written submittals and oral presentations are individually commented in these meetings.

ARHH - 3010 NEO-AVANT-GARDE AND THE CONTEMPORARY SCENE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARHH 2010/2011

Corequisite: None

The discursive wear and tear of the modern movement in architecture, experienced during the 1960's gave way to a number of theoretical proposals and models of practice with a profound impact on architectural thinking. The result of

this body of work, decentralized and stray, found in the 1970's and 1980's a space for further development, giving architecture an unusual cultural role.

ARPP 0310- THE ARCHITECT AS ENTREPRENEUR

Three credit-hours. One two-hour lecture period per Week. Prerequisite: None

Pursuing an understanding of the architect as entrepreneur, the course addresses the analysis and management of concepts and skills that assist the design professional in assuming leadership in practice by becoming knowledgeable of the multiple conditions and processes that influence the construction industry.

ARPP 1010- INTRODUCTION TO ARCHITECTURE

Three credit-hours. One two-hour lecture period per Week. Prerequisite: None

Introduction to fundamental topics of human perception as a point of reference in architectural design. Basic concepts are explored in order to discuss the parameters of interaction between human body and its constructed context and space.

ARPP 3010- PRACTICE/EXPERIENCE

Three credit-hours. One two-hour lecture period per week; field time by arrangement. Prerequisite: ARCH 2020

Real-life office experience grants a glance at professional procedures in architectural practice and related fields, while a classroom overview provides the necessary reference for understanding processes ranging from proposal preparation to project close-out.

ARPP 5010- ETHICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARCH 3020

An introduction to moral dilemmas inherent to professional practice, considering wide-ranging implications of ethics in a globalized society where disciplines overlap, but also obscure responsibilities. Case studies of professional interest are researched and debated.

ARPP 5020- CONSTRUCTION DOCUMENTS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARCH 4010, ARST 4020, ARTE 4010, ARTE 4020

Exposure to the breadth and depth of documentation required for any architectural project and the development of its construction drawings and specifications. Cost estimates complement the proposed design.

ARPP 5030- OFFICE MANAGEMENT AND FINANCES

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARCH 3020

The role of the practitioner - scope, duties, and potential - is questioned from different standpoints: ethical, financial and managerial. Personnel organization, supervision, office

procedures, payments for services, marketing and career options are examined.

ARST 0410- ADVANCED TOPICS ON STRUCTURES

Three credit-hours. One two-hour lecture period per Week. Prerequisite: ARST 4020

Comprehensive outlook of different structural systems when exposed to extreme conditions both internal and external, like earthquakes, hurricanes, and flooding.

ARST 3010- STRUCTURAL CONCEPTS I

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARTE 2010, SCIE 2410

Statics, strength of materials and basic analysis of simple structural elements provide a framework for understanding architecture in terms of the analysis of systems of forces and the laws of equilibrium.

ARST 3020- STRUCTURAL CONCEPTS II

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARST 3010

As a continuation to ARST 3010, topics addressed include: stress and strain due to axial, bending and torsion loads, shear and bending moments and diagrams. Tension and compression stresses in beams are also discussed

ARST 4010- STRUCTURES III: STEEL

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARST 3020

The properties of steel are discussed as issues of combined axial compression and bending are presented, including the behavior of steel structural beams and columns with and without lateral support. Existing structures are analyzed in these terms.

ARST 4020- STRUCTURES IV: CONCRETE

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARST 4010

Design of reinforced concrete structures following the ultimate strength method is aimed at developing safe, economical and efficient design stances regarding reinforced concrete beams, columns and one-way slabs, according to A.C.I. codes.

ARTE 0400A – CONSTRUCTION DETAILS

Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisites: ARTE 4020,

In this course, the students will be exposed to the wide range of documents conventionally handled by the Architects and Interior Designers in the process to achieve the development of a project and construction of the building. This includes drawings and specifications, cost estimates, permit forms, shop drawings, certifications for payment, change orders quotes and contract modifications procedures, among others. Considering the availability of computer software commonly used to assist the architect

and Interior Designers in this task, the course examines and introduces the different programs and templates available for the preparation of these documents.

ARTE 0401- WOOD TECHNOLOGY

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARST 3020

Wood's properties and possibilities as a construction material are expounded. Lumber types, framing systems, and typical connections are examined in relationship to load transfer and wind stresses, granting special attention to hurricane impact and termite control.

ARTE 0410- PRESERVATION TECHNOLOGY

Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisites:, ARCH 3010, ARTE 3010

Technical aspects pursuant to historic preservation are discussed and demonstrated through laboratory problems. Materials used in restoration, rehabilitation and conservation projects are tested and weathered to consider short and long range effects of their use.

ARTE 0430- ECOLOGICAL TERRACES

Three credit-hours. Two two-hour lecture/laboratory periods per week. Prerequisite: ARCH 3030, ARTE 2010

Environmental and technological issues pertaining urban naturation and ecological or green surfaces are presented from both theoretical and practical aspects. Case studies from Europe, as well as local ones, are analyzed.

ARCC 0440- ARCHITECTURE LIGHT & LIGHTING

Three credit-hours. Two two-hour lecture/laboratory periods per week. Prerequisite: ARCH 2030, ARTE 2010

Light is analyzed as a compositional and psychological device. Its effect in indoor and outdoor space is examined and complemented by the creation of atmospheres through the use of different lighting typologies. Students design a lighting device for which a prototype is built.

ARTE 0400A- CONSTRUCTION DETAILS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARCH 3010, ARTE 3010.

This course addresses the importance of the constructive knowledge of the architect and interior architect in the process of architectural design; achieving innovative and varied designs and at the same time reduce energy consumption and avoid contamination.

ARTE 0400B- INTERIOR ARCHITECTURE

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: NONE

This course is an introduction to the profession of interior architecture and its importance within the construction industry and our society. It will provide students with a comprehensive understanding of the role of the interior architect, the creative and technical scope of the profession,

the responsibilities that it entails and the close relationship it must maintain with other professions for the success of any interior architecture project.

ARTE 0451- ARCHITECTURAL CONSERVATION LABORATORY

Three credit-hours. Two two-hour lecture periods per week. Laboratory Fee. Prerequisites: ARCH 3010, ARTE 3010.

Through a series of field and scientific laboratory exercises the student expands the knowledge of traditional building materials. The course includes class lectures, site visits, documentation, condition survey and collection of field samples and laboratory experiments.

ARTE 1010- INTRODUCTION TO TECHNOLOGY

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARCH 1010, ARHH 1010

An early overview of building technologies (structural, plumbing, HVAC, electricity and site work) that work as a system affecting architectural design, focusing on the designer's challenge to coordinate all elements in a coherent project.

ARTE 2010- MATERIALS AND METHODS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARCC 1010, ARCH 1030, ARTE 1010

Materials, their history, and their application to construction technology are studied, including characteristics, behavior, manufacturing, conventions, standards, and restrictions. Issues of assembly are addressed regarding building envelope systems.

ARTE 3010- SITE PLANNING

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARCH 2020, ARTE 2010

The placement of building on land is confronted from different perspectives: geographic, climatic, geologic, topographic and ecological. Attention is focused on the man-made world impacting the natural realm as, it pertains, specifically, to site infrastructure.

ARTE 4010- ELECTRICITY AND TELECOMMUNICATIONS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARTE 3010

Electrical power systems and lighting are examined to ascertain their application to different types of projects. Performance, adaptability, flexibility and code compliance of these applications are considered, including comparative costs.

ARTE 4020- ENVIRONMENTAL AND MECHANICAL SYSTEMS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARTE 3010, ARST 3010

Examination of basic support systems in buildings includes attention to plumbing, ventilation, air conditioning, vertical

transportation, security, fire protection and acoustics. Versatility, applicable codes, related costs and limitations are analyzed.

DEPARTMENTAL FACULTY

ABRUÑA LOJO, ENRIQUE – Lecturer II, Architecture; M Arch, Architecture; University of Puerto Rico (1976); BA Environmental Design; University of Puerto Rico (1974).

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PR (1993); BA Environmental Design; University of Puerto Rico, Río Piedras, PR (1991).

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TOLEDO MALDONADO, NELLY – Lecturer II, Architecture; MA Industrial Design, Wayne State University (1977); MA Management; Michigan State University (1986); BA Arts; University of Puerto Rico, Río Piedras, PR (1974).

TORRES GAVINO, WILMA – Associate Professor, Architecture; MArch., University of Puerto Rico, Río Piedras Campus (1993); BA Environmental Design, University of Puerto Rico, Río Piedras Campus (1990).

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Interior Design

The offering of a Bachelor of Interior Design at the School of Architecture is consonant with the School's long term goals and continuing commitment for growth and expansion. It allows students an interdisciplinary, multidisciplinary and all inclusive approach to education by having common courses to both programs. The School of Architecture of Polytechnic University in Puerto Rico sees Interior Design as a profession with a strong architectural and technical base formation combined with the aesthetics and functionality of both interior and industrial design.

The interior designer should be able to plan, design and execute spaces that follow the principles of architecture, art, humans' needs and development. As such, the course curriculum has been designed to include architectural, technology, socio humanistic, human development, color, and materials courses that are the basis of the design thought process, with the purpose of preparing the best possible interior designers.

PROGRAM MISSION: Following on from the mission of Polytechnic University of Puerto Rico (PUPR) and its School of Architecture, the Interior Design Program will provide opportunities for individuals from diverse backgrounds to develop their intellectual and personal potential to become socially responsible professionals. In consequence, these individuals will be aware of their surroundings, community, culture, history, and role in improving other people's surroundings, productivity and competitiveness. Through students' exposure to intellectual, creative, humanistic and technological advancements; blending art, science and technology; integrating creativity and art tools with analysis, and technical problem-solving skills, all the above mentioned shall be possible.

VISION: To be recognized as Puerto Rico's leading and only program in Interior Design that, in coordination with the multiple and related fields of study available at PUPR, will provide individuals with the education and experience necessary to offer aesthetic, functional, safe, healthy and sustainable design through the creation of professional working teams that collaborate to meet health, safety, societal and industrial standards in general.

GOALS:

- To contribute to the social, cultural and economic development of Puerto Rico through the formation of socially and professionally responsible Interior Designers.
- To foster cultural and professional exchange of ideas within countries with similar traditions regardless of its geographic locations.
- To achieve long-term interest in continuous learning, exchange of ideas and research.

- To promote communication and a working relation with related professionals and industry partners, government, commerce and professional associations.
- To develop critical thinking and a scientific approach in the analysis of Interior Design projects and life's queries.
- To nurture the development and perfecting bilingual language reading and writing skills.
- To utilize technology to create and provide for safe, aesthetic, functional and healthy surroundings.
- To instill in students a profound ethical commitment and a sense of social and ecological responsibility.
- To promote unity of purpose and collaboration between the different academic units and university components.

PROGRAM EDUCATIONAL OBJECTIVES:

- To explore the intricacies of the Interior Design profession, laws, codes and regulations that set constraints on design.
- To expand studies through information research.
- To rethink the life of existing buildings, through design alterations, rehabilitation and adaptive reuse.
- To develop creative designers who can formulate, propose, and execute creative design solutions for the physical, social, and psychological needs of a changing society with a global perspective that is influenced by rapid changes in technology.
- To encourage philosophical explorations, ethical responsibility, aesthetic expressions, and practical applications in line with professional standards.
- To maintain continuous evaluation of our services in association with public and private enterprises pertaining to the profession.
- To stimulate exchange of ideas and respect for others opinions and their creative capabilities.
- Recognize that part of the Interior Design process and responsibility is to protect the environment through sustainable design initiatives, and selection of green materials and equipment.

STUDENT OUTCOMES: The Interior Design student upon graduation is expected to:

1. Develop Interior Design construction documents and technical specifications.
2. Work a comprehensive space planning design that meets: programming, construction, health and safety code regulations, is functional, creative and also meets user/client expectations.
3. Develop projects following a systematic and coordinated methodology, including research, information analysis, and integration of knowledge into the creative process.

4. Be an innovative and creative designer capable of critical thinking and problem solving with effective oral, written and visual communication in both Spanish and English.
5. Create designs that encompass behavioral, environmental, technical, and sustainability issues.
6. Apply the acquired creative and technical knowledge within a structure to achieve a built interior environment that takes into consideration the structures' physical location and social context of the project.
7. Plan and create interior spaces that serve human, commercial, institutional and corporate needs in relation to physical, functional, social, psychological, spiritual and aesthetic elements.
8. Function as a professional committed to excellence in design.
9. Have high professional ethics within the context of the profession, community, society, environment and global design practice.
10. Be committed to continuous professional and personal growth, becoming a collaborative partner in the arts, among the arts, in communion with other disciplines and society; therefore, becoming a participatory community member.

CAREER OPPORTUNITIES: Interior Designers offer services to residential, commercial, institutional, industrial clients that require their services of space planning and distribution, furniture selection and allocation, color and materials selection for the interior or exterior of existing or new structures with the purpose of contributing to work communication and productivity, health improvement and family interaction. The Interior Designer may also work on stage design for television and cinema and design objects and furniture with a specific purpose.

DEGREE OFFERED: The School of Architecture offers a Bachelor of Interior Design in a three year curriculum sequence with a 138 credits. This program starting in August 2014 will be applying for accreditation of the Council of Interior Design Accreditation, thus the program has been developed following its educational standards, having a strong architectural technical base to ensure an education of excellence.

MINIMUM GRADUATION REQUIREMENTS

18	Credit-hours in Developmental Studies
15	Credit-hours in Socio Humanistic Studies and Languages
0	Credit-hours in Mathematics and Sciences
93	Credit-hours in Professional Core Courses
12	Credit-hours in Electives
138	Total Credit-hours

LABORATORIES: The Interior Design program students have access and use of the School of Architecture laboratories including: Computer Laboratory, Photographic Darkroom facilities, a Wood Shop and a Ceramics' Studio for student and faculty use. An Architectural Conservation Laboratory provide mechanisms to explore related subjects with a primary focus on the Caribbean Region. The school is currently committed to research on two areas: architectural conservation techniques and the ecological treatment of green roofs and other urban surfaces. In addition, the School benefits from the availability of additional laboratories in the Civil Engineering Department on campus: a Soils' Mechanics Laboratory, a Materials' Laboratory, and a Mechanics of Materials' Laboratory. They strengthen and provide back up to the professional core courses.

DEVELOPMENTAL STUDIES: All students who apply and are admitted to the Architecture School and the Interior Design program must show evidence that they have acquired the necessary academic abilities and skills to make the most of the curriculum. Those not demonstrating the command of these abilities and skills (as reflected by results of their College Entrance Examination Board Test and SAT; results in Polytechnic University's placement tests; previous university experience; or other *ad hoc* tests and criteria) will be required to take preparatory courses to overcome the deficiencies in Languages, Mathematics and Science. These developmental courses (equivalent to 18 credit hours maximum) are part of the 138 credits required by the Interior Design Program. The developmental courses are awarded their corresponding credits according to contact hours, as follows:

DEVELOPMENTAL STUDIES COMPONENTS
(MAXIMUM OF 18 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ATUL 0100	Adjustment to University Life	3
ENGL 0110	English Grammar	3
SPAN 0110A	Spanish Grammar/ Lab 0111A	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
SCIE 0110	Introduction to Physics	3

In order to register in any Professional Core Course, students must have approved MATH 0102 Preparatory Mathematics. They must also have approved six credit-hours in ENGL 0100 Preparatory English, and SPAN 0100 Preparatory Spanish.

STUDENT ORGANIZATIONS: This new program starting in Fall 2014, has no student chapters of professional associations at the present time.

**INTERIOR DESIGN
CURRICULUM STRUCTURE**

SOCIO HUMANISTIC STUDIES AND LANGUAGES
(15 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGL 1010	The Essay as Literary Genre	3
SPAN 1010	Basic Spanish	3
SOHU 2010	Socio Humanistic Studies I	3
PSYC 3020	Human development	3
SOHU 2020	Socio Humanistic Studies II	3

PROFESSIONAL CORE
(93 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ARCH- Architectural Representation (12 CREDIT-HOURS)		

ARCC 1010	Architectural Representation I	3
ARCH 1120	Analyzing Architecture	3
ARCC 2010	Architectural Representation II	3
ARCC 3140	Architectural Representation III	3

ARCH-ARIN Design
(36 CREDIT-HOURS)

ARCH 1010	Basic Design I	4
ARCH 1020	Basic Design II	4
ARCH 1030	Basic Design III	4
ARIN 2010	Design Fundamentals I	4
ARIN 2020	Design Fundamentals II	4
ARIN 2030	Intermediate Design	4
ARIN 3010	Advanced Design	4
ARIN 3020	Capstone Design I	4
ARIN 3030	Capstone Design II	4

ARCH-ARIN History
(12 CREDIT-HOURS)

ARHH 1010	History of Architecture	3
ARHH 1011	History of Architecture Laboratory	0
ARHH 2010	History of Modern Architecture	3
	History of Modern Architecture	
ARHH 2011	Laboratory	0
ARIN 2210	Furniture History I	3
ARIN 3220	Furniture History II	3

ARCH- Practice
(12 CREDIT-HOURS)

ARTE 0400A	Construction Details	3
ARPP 5010	Ethics	3
ARPP 5020	Construction Documents	3
ARPP 5030	Office Management and Finances	3

ARCH-ARIN Technology
(21 CREDIT-HOURS)

ARTE 1010	Introduction to Technology	3
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ARTE	2010	Materials and Methods	3
ARTE	0440	Lighting	3
ARIN	2320	Materials (Textiles)	3
ARIN	2310	Color (Theory and Psychology)	3
ARTE	4010	Building Systems (Electricity, Acoustics and Telecommunications)	3
ARTE	4020	Environmental Systems (Mechanical and Plumbing)	3

ELECTIVES
(12 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
	Program Electives	6
	Open ELECTIVES	6

Total minimum of required credit-hours is 138

ARCHITECTURAL PROGRAM ELECTIVES

COURSE	TITLE	CREDIT-HOURS
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Electives in Architectural Representation

ARCH	0100	Spatial Visualization	3
ARCC	0120	Cyber publications	3
ARCC	0140	Collage Making + Design Studio	3
ARCC	0160	Anthropomorphic Awareness	3
ARCC	0170	Perspective	3
ARCC	0180	3D-Exploration	3
ARCC	0190	Architecture and Social media	3
ARCC	0210	Photography Fundamentals	3
ARCC	0211	Photography Laboratory	0
ARCC	0220	Set Design	3
ARCC	0240	Introduction to Industrial Design	3
ARCC	0250	Sculpture	3
ARCC	0310	Color for Architects	3
ARCC	0315	Ceramics	3
ARCC	0330	Advanced Installations	3
ARCC	0340	Public Speaking	3
ARCC	0403	Advanced Computer Aided Design and Drafting	3
ARCC	0404	Advanced Digital Graphics and Architectural Presentations	3
ARCC	0420	Parametric Modeling and Digital Fabrication	3

Electives in Design

ARCH	0203	Design Seminar	4
ARCH	0210	Collaborative Design Studio	4
ARCH	0391	Landscape Architecture	4
ARCH	0399	Design Abroad	4
ARCH	0599	Vertical Studio	4

Electives in History

ARHH	0410	Selected Topics on Modern Architecture	3
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ARHH	0430	Architecture of the Italian Renaissance	3
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Electives in Professional Practice

ARPP	0310	The Architect as Entrepreneur	3
ARPP	0320	Ecology and Tourism	3
ARPP	1010	Introduction to Architecture	3

Electives in Technology

ARTE	0302	Architecture and Industry	3
ARTE	0410	Preservation Technology	3
ARTE	0401	Wood Technology	3
ARTE	0451	Architectural Conservation Laboratory	3
ARTE	0400B	Interior Architecture	3

Electives in Landscape Architecture

ARCL	0100	City & Environment	3
ARCL	0315	Geography	3
ARCL	0391	Landscape Architecture	4

Architecture-related socio-humanistic studies and languages

LITE	3040	Writing About Architecture	3
SOHU	3030	Archeology for Architects	3
SPAN	2020A	Business Language and Communication	3
ARHH	2010	Context	3
HIST	4030	Historiography	3

CURRICULUM SEQUENCE

FIRST YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS	
	(Developmental Program prerequisites)	9	
ARCH	1010	Basic Design I	4
ARCC	1010	Architectural Representation I	3
SPAN	0110A	Spanish Grammar	3
SPAN	0111A	Spanish Grammar Lab	0
ATUL	0100	Adjustment to University Life	3
MATH	0106	Elementary Algebra	3
		16	

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS	
ARCH	1020	Basic Design II	4
ARCH	1120	Analyzing Architecture	3
SOHU	2010	Socio Humanistic Studies I	3
SPAN	1010	Basic Spanish	3
MATH	0110	Intermediate Algebra	3
		16	

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ARCH 1030	Basic Design III	4
ARHH 1010	History of Architecture I	3
ARHH 1011	History of Architecture Lab.	0
ENGL 0110	English Grammar	3
SCIE0 0110	Introduction to Physics	3
SOHU 2020	Socio Humanistic Studies II	3
		16

SECOND YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
ARIN 2010	Design Fundamentals I	4
ARCC 2010	Architectural Representation II	3
ARHH 2010	History of Modern Architecture	3
ARHH 2011	History of Modern Architecture Lab.	0
ARTE 2010	Introduction to Technology	3
ENGL 1010	The Study of the Essay as Literary a Genre	3
		16

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ARIN 2020	Design Fundamentals II	4
ARTE 2010	Materials & Methods	3
ARTE 4010	Bldg. Service Systems (Electricity, Acoustics, Telecommunications)	3
PSYC 3020	Human Development	3
ARIN 2310	Color (Theory and Psychology)	3
		16

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ARIN 2030	Intermediate Design	4
ARTE 0440	Lighting	3
ARIN 2210	History of Furniture I	3
ARIN 2320	Materials (Textiles)	3
ARTE 4020	Bldg. Environmental Services	3
		16

THIRD YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
ARIN 3010	Advanced Design I	4

ARCC 0130	Architectural Representation III	3
ARIN 3220	History of Furniture II	3
ARTE 0400A	Construction Details	3
ARPP 5020	Construction Documents	3
		16

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ARIN 3020	Capstone I	4
ARPP 5010	Ethics	3
	Program Elective	3
	Open Elective	3
		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ARIN 3030	Capstone II	4
ARPP 5030	Office Management and Finances	3
	Program Elective	3
	Open Elective	3
		13

COURSE DESCRIPTIONS

ARCH 1010- BASIC DESIGN

Four credit-hours. Two three-and-half-hour lecture/studio periods per week/Laboratory fee.

Pre-requisites: MATH 0102 and one of two language courses SPAN 0100 or ENGL 0100

Introduction to basic design elements, principles and concerns, focusing on spatial organization. Problem solving and analytical models become tools to understand underlying compositional principles.

ARCC 1010- ARCHITECTURAL REPRESENTATION 1

Three credit-hours. Two three-and-half-hour lecture/studio periods per week/Laboratory fee.

Pre-requisites: MATH 0102, SPAN 0100 and ENGL 0100

Basic drawing, drafting, and recording, techniques in pencil are introduced as tools for visual and technical communication, all considered to be essential to the architect's trade and expression.

ARCH 1020- BASIC DESIGN 2

Four credit-hours. Two three-and-half-hour lecture/studio periods per week/Laboratory fee.

Pre-requisites: ARCH 1010, ARCC 1010, ATUL 0100

Spatial organization, form, structure, and figure-ground gestalt issues are explored through geometry in projects developed from two-dimensional graphic design into three dimensional architectural abstractions.

ARCH 1120- Analyzing Architecture

Three credit-hours. Two two-hour lecture/studio periods per week/Laboratory fee. Pre-requisites: ARCH 1010, ARCC 1010

Three credit-hours. Two two-hour lecture/studio periods per week/Laboratory fee. Pre-requisites: ARCH 1010, ARCC 1010 This course introduces research methods applied to the discipline of architecture, exploring fundamentals design strategies realized artistically and practically in the works of selected architects. Emphasis is given on individual initiative and analysis, imagination and craft are incorporated into projects investigating the relationship between culture and content, media and image, narrative and object, and issues of representation and design. The course encourages disciplined attitudes towards drawing through reasoning and develops the ability to present and explain creative ideas. It will provide students with a comprehensive understanding of the role of the architect and the Interior Designer in defining the creative and technical scope of the profession.

ARCH 1030- BASIC DESIGN 3

Four credit-hours. Two three-and-half-hour lecture/studio periods per week/Laboratory fee.

Pre-requisites: ARCH 1020, ARCC 1010, MATH 0106, ARCH 1120, SPAN 0110A, SPAN 0111A

Notion of contexts are analyzed as an introduction to the complexities inherent to architecture and place. Precedents are examined in order to link programmatic concerns and formal composition, in order to integrate them in design.

ARCC 2010- ARCHITECTURAL REPRESENTATION II

Three credit-hours. Two two-hour lecture/studio periods per week/Laboratory fee. Pre-requisites: ARCH 1010, ARCC 1010

Introduction to the basic concepts, software and drawing techniques for digital drafting. The course main focus is on bidimensional drawings, its representation and basic 3D modeling using the digital tools currently available.

ARTE 1010- INTRODUCTION TO TECHNOLOGY

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: MATH 0110, ARCC 1010, ARCH 1030, ARHH 1010/1011

An early overview of building technologies (structural, plumbing, HVAC, electricity and site work) that work as a system affecting architectural design, focusing on the designer's challenge to coordinate all elements in a coherent project.

ARTE 2010- MATERIALS AND METHODS

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: ARCH 1030, ARTE 1010

Materials, their history, and their application to construction technology are studied, including characteristics, behavior, manufacturing, conventions, standards, and restrictions. Issues of assembly are addressed regarding building envelope systems.

ARTE 4010- BUILDING SERVICE SYSTEMS

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: ARTE 2010, ARCH 1030, ARCC 1010, SCIE 0110

Electrical power systems and lighting are examined to ascertain their application to different types of projects. Performance, adaptability, flexibility and code compliance of these applications are considered, including comparative costs.

ARTE 4020- BUILDING ENVIRONMENTAL SYSTEMS

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: ARTE 4010, ARTE 0440, ARIN 2020

Examination of basic support systems in buildings includes attention to plumbing, ventilation, air conditioning, vertical transportation, security, fire protection and acoustics. Versatility, applicable codes, related costs and limitations are analyzed.

ARCC 0130- ARCHITECTURAL REPRESENTATION III

Three credit-hours. Two two-hour lecture/studio periods per week/Laboratory fee. Pre-requisites: ARCC 2010

Introduction to the basic concepts, software and techniques for developing architectural presentations. The course main focus is on drawing manipulation, basic rendering techniques, printing, board layout and design using the digital tools currently available.

ARTE 0400A- CONSTRUCTION DETAILS

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: ARTE 4020, ARIN 2030

In this course, the students will be exposed to the wide range of documents conventionally handled by the Architects and Interior Designers in the process to achieve the development of a project and construction of the building. This includes drawings and specifications, cost estimates, permit forms, shop drawings, certifications for payment, change orders quotes and contract modifications procedures, among others. Considering the availability of computer software commonly used to assist the architect and Interior Designers in this task, the course examines and introduces the different programs and templates available for the preparation of these documents.

ARPP 5020- CONSTRUCTION DOCUMENTS

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: ARTE 4020, ARIN 2030

Exposure to the breadth and depth of documentation required for any architectural project and the development of its construction drawings and specifications. Cost estimates complement the proposed design.

ARPP 5010- ETHICS

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: ARIN 3010, SOHU 2020, PSYC 3020, ARHH 2010/2011

An introduction to moral dilemmas inherent to professional practice, considering wide-ranging implications of ethics in a globalized society where disciplines overlap, but also obscure responsibilities. Case studies of professional interest are researched and debated.

ARPP 5030- OFFICE MANAGEMENT AND FINANCES

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: ARIN 3010

The role of the practitioner - scope, duties, and potential - is questioned from different standpoints: ethical, financial and managerial. Personnel organization, supervision, office procedures, payments for services, marketing and career options are examined.

ARHH 1010- HISTORY OF ARCHITECTURE

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: MATH 0102, and one of two language courses, SPAN 0100, ENGL 0100, MATH 0106, SPAN 0110A, SPAN 0111A, ATUL 0100. Co-requisite ARHH 1011

A survey to introduce the History of Architecture, including basic elements of architectural design, composition, form-making and spatial concepts, all examined against the historical and natural forces that have influenced the art of building.

ARHH 1011- HISTORY OF ARCHITECTURE LABORATORY

Zero credit-hour. One, one hour recitation period per week. Co-requisite ARCH 2010

Small group discussion sessions allow students to expand and debate upon the subjects addressed at lectures in the co-required course and go beyond these. Required projects are individually reviewed in these meetings.

ARHH 2010- HISTORY OF MODERN ARCHITECTURE

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: ARHH 1010/1011, Co-requisite ARHH 2011

Links between the romantic and rationalist outlooks of the 18th century, together with the fragmentation and simultaneity of the end of the 20th century are addressed. The architectural production and theories expounded elucidate the ruptures and continuities of a non-linear history.

ARHH 2011- HISTORY OF MODERN ARCHITECTURE LABORATORY

Zero credit-hour. One, one hour recitation period per week. Pre-requisite: ARHH 1010/1011. Co-requisite: ARHH 2010

Small group discussion sessions allow students, to expand and debate upon the subjects addressed at lectures in the corequired course. Written submittals and oral presentations are individually commented in these meetings.

ARIN 2310- COLOR (THEORY AND PSYCHOLOGY)

Three credit-hours. Two two-hour lecture periods per week. Pre requisites: ARHH 1010/1011, SOHU 2010

This course is an introduction to the study of color, its origins and different color theories. It also addresses color use and the optical, physiological and psychological effects it creates on spaces, objects and humans. Students will develop an understanding of the use of color as a design tool for creating emotions and the appropriate atmosphere in architecture and its interiors.

ARIN 2210- HISTORY OF FURNITURE 1

Three credit-hours. Two two-hour lecture periods per week. Pre requisites: ARHH 1010/1211

Study of the history, evolution and characteristics pertaining to the different stylistic periods and movements from Prehistoric times (7000 BC to 1700AC) to the Baroque movement. Emphasis is given to furniture, the space they were designed for and the different materials and methods used in its manufacture, the ornamentation and accessories for each style period.

ARIN 3220- HISTORY OF FURNITURE 2

Three credit-hours. Two two-hour lecture periods per week. Pre requisites: ARHH 2010/2011

Study of the characteristics pertaining to the different stylistic periods and movements from the Rococo (1700-2000) to the modern, contemporary and new art movements including Puerto Rico and South America. Emphasis is given to interiors, furniture and its materials, ornamentation and accessories for each style period.

ARIN 2320- MATERIALS (TEXTILES)

Three credit-hours. Two two-hour lecture periods per week. Pre requisites: ARHH 1010/1011, SOHU 2020

This course will study the history, evolution, manufacturing and production of textiles. The course will include both natural and synthetic fibers, its different uses and applications. Emphasis will be given to the adequate use in upholstery, draperies, bedcovers, wall coverings, rugs and carpets for both interiors and exteriors in accordance to their use, style, construction, its strength, durability, ornamentation and code compliance.

ARTE 0440- LIGHTING

Three credit-hours. Two two-hour lecture/studio periods per week. Pre-requisites: ARIN 2010, ARCC 1010, ARTE 1010

The aim of this course is to inspire creative thinking in regards to the relation of light and the illumination of the architectural environment, while studying the physical and perceptual characteristics of light. The student will have an awareness of the history of illumination, from the torch-lit caves to the contemporary innovations of Ingo Maurer. The class will develop an understanding of the variety of luminaries and types of lamps, and will study their

characteristics and limitations, while becoming aware of their photometric properties.

ARIN 2010- DESIGN FUNDAMENTALS 1

Four credit-hours. Two three-and-half-hour lecture/studio periods per week/Laboratory fee.

Pre-requisites: ARCH 1030, ARCH 1120, ARHH 1010/1011, SOHU 2010, SPAN 1010, MATH 0106

This course is designed to enter the interior space, and be aware of the dimension the outer architectural shell creates such as: planes, surfaces, and interior volumes, environmental and human factors. Develop the sensibility of the interaction, relation between man and his surrounding interior space, through the study of the design process and two and three dimensional scale drawings and models.

ARIN 2020- DESIGN FUNDAMENTALS 2

Four credit-hours. Two three-and-half-hour lecture/studio periods per week/Laboratory fee.

Pre-requisites: ARIN 2010, ARCC 2010, ARHH 2010/2011, ENGL 0110

This course is designed to work in the creation of interior space projects of small scale either residential or office with the intention to work on critical thinking, and in depth design analysis based on research of and with client/user. Continues with the study of the interior dimension the outer architectural shell creates and the environmental and human factors to further develop the sensibility of the interaction, relation between man and his surrounding interior space, through the study of the design process and two and three dimensional scale drawings and models.

ARIN 2030- INTERMEDIATE DESIGN

Four credit-hours. Two three-and-a-half hour studio periods per week/Laboratory fee.

Pre-requisites: ARIN 2020, ARCC 2010, ARTE 1010, ARHH 2010/2011, SOHU 2020, PSYC 3020

This studio course is an introduction to designing residential and light commercial interior spaces. It will include the Interior Design project concept, analysis, programming and development. Emphasis is placed on human factors and ergonomics; accessibility, space planning, space scale and proportions, materials, green materials, sustainable design and the furniture and equipment required for the function and needs of the user.

ARIN 3010- ADVANCED DESIGN

Four credit hours. Two three-and-a-half hour studio periods per week/Laboratory fee.

Pre-requisites: ARIN 2030, ARIN 2210, ARIN 2320, ARTE 4010

This studio course refers to the process of designing contract (nonresidential) Interior Design. It will include Interior Design project concept, analysis, programming and development. Emphasis is placed on human factors and ergonomics; accessibility, space planning, space scale and proportions, color, furniture, textiles, materials, green

materials, sustainable design and the equipment required for the function and needs of the user.

ARIN 3020- CAPSTONE 1

Four credit hours. Two three-and-a-half hour studio periods per week/Laboratory fee.

Pre-requisites: ARIN 3010, ARIN 3220, ARTE 0400A

This studio course proposes to develop a medium size real interior contract project where students will apply their acquired knowledge about the design process. It will develop a multifunction interior project with concept, analysis, programming and development of drawings. Application of human factors and ergonomics; health and life safety; structure and interior space interaction, accessibility, space planning and design, human space scale and proportions, lighting, color, furniture, textiles, materials, green materials, sustainable design and the equipment required for the function and needs of the user.

ARIN 3030- CAPSTONE 2

Four credit hours. Two three-and-a-half hour studio periods per week/Laboratory fee.

Prerequisites: ARIN 3020, ARCC 0130, ARIN 3220, ARPP 5020, ARPP 5010

This studio course projects to develop a large real interior project where students will apply their acquired knowledge about the design process and concept. It will address a multifunction interior building project with complex functional and social requirements from concept, analysis, programming and development of construction documents. Application of human factors and ergonomics; structure and interior space interaction with light, lighting, electricity, building and environmental systems, accessibility, life and safety issues, space planning, human space scale and proportions, color, furniture, textiles, materials, green materials, sustainable design and the application of the same to meet client/user requirements.

DEPARTMENTAL FACULTY

BURGOS DIAZ, JOEMI - Lecturer; PhD Mujeres, Escritura y Comunicación, Universidad de Sevilla, España (2011); MA Interior Design, Universidad de Salamanca, España (2011); MA Professional Development and Gender Studies, Universidad de Sevilla, España (2010); BA Art History, University of Puerto Rico Río Piedras (2008); AD Interior Design, University of Puerto Rico Carolina (2003)

CARBALLEIRA VICÉNS, CATALINA - Lecturer; MA Interior Design, Universidad de Salamanca, España (2005); BA Humanities, University of Puerto Rico, Río Piedras (2002); AD Interior Design UPR Carolina (2000).

COBAS RODRÍGUEZ, JAIME – Lecturer II, Architecture; MArch. Architecture; Yale University, New Haven, CT (1967); BA Architecture; Cornell University, Ithaca, NY (1963).

MAURÁS MODESTI, SMYRNA M. – Auxiliary Professor; MA Interior Design; Texas Woman's University (1969); BA. Arts; University of Puerto Rico (1967).

PADRÓ SALVÁ, LUIS – Lecturer; PhD Candidate, History of Puerto Rico and the Caribbean, Centro de Estudios Avanzados de PR y el Caribe; MA Interior Design, Universidad de Salamanca, España (2004); BA Humanities, University of Puerto Rico, Río Piedras (2007); AD Interior Design, University of Puerto Rico, Carolina (2001).

QUINTERO, HEIDI – Lecturer; Juris Doctor Candidate, University of Puerto Rico, Río Piedras; MA Interior Design, Universidad de Salamanca, España (2008); BA Humanities, University of Puerto Rico, Río Piedras (2003); AD Interior Design, University of Puerto Rico, Carolina (2000).

UREÑA, YEHIMAR – Lecturer; PhD Candidate, Centro de Estudios Avanzados de Puerto Rico y el Caribe; MA Painting, Sculpture, New York School of Art (2004); BA Fine Arts, Design and Painting, University of Puerto Rico, Río Piedras,(2002).

SCHOOL OF ENGINEERING SURVEYING AND GEOSPATIAL SCIENCE

The School of Engineering, Surveying and Geospatial Science consists of six academic departments and nine programs at the undergraduate level as follows:

- Chemical Engineering Department
- Civil Engineering and Environmental Engineering Department
- Electrical & Computer Engineering and Computer Science Department
- Surveying and Geospatial Science Department
- Industrial Engineering Department
- Mechanical Engineering Department

The nine bachelor of science degrees currently offered in the school are: Chemical Engineering, Civil Engineering, Computer Engineering, Computer Sciences, Electrical Engineering, Environmental Engineering, Industrial Engineering, Land Surveying and Mapping, Mechanical Engineering. Thanks to the institutional trimester academic system all these degrees are designed to be completed in four years of study. Students enter this School in their first year by taking some engineering science courses coded ENGI. The last two years serve to teach/train students in engineering field applications, in which the engineering design component is stressed to attain the working knowledge of professional engineers.

The courses in engineering science (ENGI) are arranged in five groups and each one is administered by one of the engineering departments. As an example, the courses related to the electricity and computer programming are under the Electrical Engineering Department; probabilities, statistics, and engineering economics are under the Industrial Engineering Department; engineering graphics and statics are under the Civil and Environmental Engineering Department; dynamics and fluid mechanics are under the Mechanical Engineering Department; engineering materials and thermal systems are under the Chemical Engineering Department.

Chemical Engineering Department

CHEMICAL ENGINEERING PROGRAM

The chemical engineering department offers fundamental knowledge in chemical engineering subjects. This will allow the students to understand and apply the principles of mathematical, physical, and life sciences in combination with the principles of engineering, economics, and social sciences to design and develop ways for the optimum use of the natural resources. In this way, the chemical engineer can create goods, products and services for the benefit of humankind, following ethical principles for a sustainable development in order to preserve nature for future generations.

Fundamental studies in physics and mathematics, and a major emphasis on chemistry, are combined with essential courses in chemical engineering and other engineering related areas to develop students' capabilities to analyze and solve a multiplicity of modern day problems, all together with the synthesis and invention of new methods for the use of materials in production processes. Courses are offered in key areas such as mass and energy balances, thermodynamics, fluid mechanics, heat and mass transfer, together with kinetics and catalysis, process design, automatic control, and numerical analysis applied to chemical engineering. In addition, the program offers elective courses in environmental engineering, biochemical technology, polymers technology, nanotechnology, and pharmaceutical operations, among others, to address job market opportunities.

PROGRAM MISSION

To provide quality education to students from different backgrounds in the principles and application of chemical engineering fundamentals, so they can successfully deal with situations involving technological and societal issues. The program emphasizes development of the ability and competency of its students to become significant contributors to community development and to take leadership roles in industry, academia, and government.

PROGRAM EDUCATIONAL OBJECTIVES:

A few years after graduation, Chemical Engineering Program graduates are expected to:

1. Work effectively in the chemical engineering career by providing the services required in accordance to the standards and ethics of the profession.
2. Become professional leaders committed to the solution of community and social problems by formulating

solutions that are technically sound, economically feasible and sustainable

3. Perform as responsible team members in projects that may involve multidisciplinary activities, communicating effectively in both Spanish and English
4. Improve their professional knowledge through lifelong learning.

PROGRAM EXPECTED OUTCOMES: The Chemical Engineering Program must demonstrate that its students attain:

- (a) An ability to apply mathematics, science, and engineering in the solution of Chemical Engineering problems.
- (b) An ability to design and conduct experiments, to collect, analyze, and interpret experimental data.
- (c) Proficiency to analyze and design chemical systems, components or processes to meet desired needs.
- (d) An ability to function in multidisciplinary teams and interrelate with professionals of other disciplines.
- (e) Skills to identify, formulate, and solve problems in Chemical Engineering.
- (f) An understanding of the demands of responsible professional practice and related ethical principles.
- (g) An ability to effectively communicate orally, in writing, and graphically.
- (h) An ability to assess the impact that different design alternatives could have on society.
- (i) An ability to learn independently and the motivation to engage in continuing education activities.
- (j) Knowledge of contemporary issues related to the Chemical Engineering practice.
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for Chemical Engineering practice.

CAREER OPPORTUNITIES: In today's industries, Chemical Engineers can be found almost everywhere. They are involved with planning, designing, constructing, and operating manufacturing processes in a variety of industries. These range from the pharmaceutical, petrochemical and agricultural industries to biotechnology, nanotechnology, and advanced materials to even finance, food, electronics, and consumer products. Growing public awareness of the problems of energy and environmental pollution also

provides opportunities for chemical engineers in these areas.

The B.S. program in chemical engineering prepares graduates for professional careers in industry, government, private laboratories, in engineering design and construction companies, and also for graduate programs.

DEGREE OFFERED: The Chemical Engineering Department offers undergraduate instruction leading to the degree of Bachelor of Science in Chemical Engineering (B.S.Ch.E). To obtain the degree, the student must complete the following minimum requirements:

MINIMUM GRADUATION REQUIREMENTS

15	Credit-hours in Mathematics
30	Credit-hours in Basic Science
21	Credit-hours in Socio-Humanistic Studies and Languages
18	Credit-hours in Engineering Science
50	Credit-hours in Chemical Engineering
6	Credit-hours in free electives
6	Credit-hours in Chemical Engineering Electives

146 Total Credit-hours

DEVELOPMENTAL STUDIES: All students admitted to the Chemical Engineering Program must show evidence that they have acquired the academic abilities and skills necessary to progress through the program. Those not demonstrating the complete acquisition of these abilities and skills, as reflected by their College Entrance Examination Board (CEEB) tests results, PUPR's placement tests results, previous university experience, or other tests or criteria, will be required to take developmental courses. These courses are designed to help them overcome deficiencies in languages, mathematics, and science. These courses are in addition to the 146 credit-hours of the Chemical Engineering Program. The courses are awarded their corresponding credit-hours according to contact hours. Developmental courses are shown below:

DEVELOPMENTAL STUDIES COMPONENT (MAXIMUM OF 37 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
MATH 1330	Precalculus I	3
MATH 1340	Precalculus II	3
SCIE 0110	Introduction to Physics	3
SCIE 1110	General Biology	4
SCIE 1111	General Biology Laboratory	0
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

LABORATORIES: The Chemical Engineering Department at PUPR offers students the opportunity to receive hands-on experience to practice the concepts and techniques learned in the classroom.

The Chemical Engineering Department's Unit Operations Laboratory covers fluid mechanics experiments, heat transfer unit operations, and primarily mass transfer unit operations, such as batch and continuous distillation, gas absorption, and liquid-liquid extraction. Chemical reactors and process control systems are also part of this laboratory. In addition, a modern computer center with state of the art computational software is available for the exclusive use of chemical engineering students. The program also owns a Materials Processing Laboratory where different research projects are usually taking place.

Laboratories in science areas are also available for Chemical Engineering students. They include: General Biology, General Chemistry, Organic Chemistry, Analytical Chemistry, Physical Chemistry, Instrumentation, and Physics laboratories.

STUDENT ORGANIZATIONS: At Polytechnic University of Puerto Rico, there are two active student chapters which are especially attractive to chemical engineering students:

- Student Chapter of the Institute of Chemical Engineers (IIQ) of the College of Engineers and Land Surveyors of Puerto Rico (CIAPR).
- Student Chapter of the American Institute of Chemical Engineers (AIChE).

Students may participate in one or both chapters. Both groups provide the students with opportunities to get involved in different activities that include, but are not limited to, conferences, seminars, field trips, and social activities that help develop the students' leadership and teamwork skills. The Chemical Engineering Department encourages its students to participate actively in both chapters.

Students can also enroll in student chapters of other important professional organizations, such as the Society of Women Engineers (SWE) and the Society of Hispanic Professional Engineers (SHPE), among others.

CHEMICAL ENGINEERING PROGRAM CURRICULUM STRUCTURE

MATHEMATICS COMPONENT (15 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
MATH 1360	Calculus II	4
MATH 1370	Calculus III	4
MATH 2350	Differential Equations	3

BASIC SCIENCES COMPONENT
(30 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SCIE 1214	General Chemistry I	4
SCIE 1215	General Chemistry I Laboratory	0
SCIE 1220	General Chemistry II	4
SCIE 1221	General Chemistry II Laboratory	0
SCIE 1230	Organic Chemistry	4
SCIE 1231	Organic Chemistry Laboratory	0
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory I	1
SCIE 1440	Physics II	4
SCIE 1441	Physics II Laboratory II	1
SCIE 2204	Analytical Chemistry	4
SCIE 2205	Analytical Chemistry Laboratory	0
SCIE 2240	Physical Chemistry	4
SCIE 2241	Physical Chemistry Laboratory	0

**SOCIO-HUMANISTIC STUDIES
AND LANGUAGES COMPONENT**
(21 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SPAN 2020	Business Spanish	3
SOHU 2010	Socio-Humanistic Studies I	3
SOHU 2040	Socio-Humanistic Studies II : Ethics & Global and Contemporary Issues	3
XXXX XXXX	Socio-Humanistic Studies or Languages Elective	3

Students are required to choose one 3-credit-hour course in this area

ENGINEERING SCIENCES COMPONENT
(18 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGI 2110	Engineering Mechanics-Statics	3
ENGI 2260	Engineering Economics	3
ENGI 2270	Engineering Probability and Statistics	3
ENGI 2310	Computer Programming and Algorithms	3
ENGI 2320	Principles of Electrical Engineering	3
ENGI 3510	Engineering Materials	3

CHEMICAL ENGINEERING COMPONENT
(50 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
CHE 2010	Introduction to Chemical Engineering	3
CHE 2500	Basic Principles of Chemical Engineering I	3
CHE 2510	Thermodynamics	3
CHE 3106	Basic Principles of Chemical Engineering II	3
CHE 3116	Fluid Mechanics for Chemical Engineers	3

CHE 3117	Fluid Mechanics Laboratory for Chemical Engineering	1
CHE 3118	Applied Mathematics in Chemical Engineering	3
CHE 3310	Chemical Engineering Thermodynamics	3
CHE 3320	Heat Transfer	3
CHE 3321	Heat Transfer Operations Laboratory	1
CHE 3520	Mass Transfer Operations I	3
CHE 3530	Chemical Reaction Engineering	3
CHE 4130	Mass Transfer Operations II	3
CHE 4131	Mass Transfer Operations Laboratory	1
CHE 4140	Process Dynamics and Control	3
CHE 4141	Reactor Design and Process Control Laboratory for Chemical Engineering	1
CHE 4150	Chemical Engineering Process Design	3
CHE 4930	Chemical Engineering Seminar	1
CHE 4940	Chemical Engineering Capstone Course I	3
CHE 4950	Chemical Engineering Capstone Course II	3

CHEMICAL ENGINEERING ELECTIVE COMPONENT
(6 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
CHE 5000	Undergraduate Research in Chemical Engineering	3
CHE 5110	Fundamentals of Industrial Hygiene	3
CHE 5120	Chemical Engineering Practice *	3
CHE 5210	Principles of Environmental Engineering	3
CHE 5212	Air Pollution Control *	3
CHE 5214	Industrial Water Treatment *	3
CHE 5216	Solid Waste Management *	3
CHE 5218	Environmental Laws and Regulations	3
CHE 5310	Principles of Pharmaceutical Operations *	3
CHE 5312	Biochemistry Applied to Chemical Engineering	3
CHE 5314	Introduction to Polymers	3
CHE 5318	Bio-Based Polymers and Composites *	3
CHE 5350	Food Technology *	3
CHE 5410	Nano-Structures in Chemical Processes	3
CHE 5450	Petrochemical Processes *	3
CHE 5500	Transport Phenomena	3
CHE 5510	Special Topics in Chemical Engineering	3
CHE 5520	Special Topics in Chemical Engineering Design *	3

(DESIGN COURSES)*

Students are required to choose two courses from this list in order to complete six credit-hours of Chemical Engineering electives, and at least one of them has to be a design course

FREE ELECTIVE COMPONENT
(6 CREDIT-HOURS)

Six credit-hours of free electives in any area are to be chosen by the student

MINIMUM TOTAL PROGRAM CREDIT-HOURS: 146

CHEMICAL ENGINEERING PROGRAM CURRICULUM SEQUENCE

FIRST YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
SCIE 1214	General Chemistry I	4
SCIE 1215	General Chemistry I Laboratory	0
ENGL 1010	The Study of the Essay as a Literary Genre	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
Total Credit- Hours		14

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1360	Calculus II	4
SCIE 1220	General Chemistry II	4
SCIE 1221	General Chemistry II Laboratory	0
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
Total Credit- Hours		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1370	Calculus III	4
SCIE 1230	Organic Chemistry	4
SCIE 1231	Organic Chemistry Laboratory	0
SCIE 1440	Physics II	4
SCIE 1431	Physics II Laboratory	1
Total Credit- Hours		13

SECOND YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
SPAN 2020	Business Spanish	3
CHE 2010	Introduction to Chemical Engineering	3
SCIE 2204	Analytical Chemistry	4
SCIE 2205	Analytical Chemistry Laboratory	0
ENGI 2270	Engineering Probability and Statistics	3
Total Credit- Hours		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 2350	Differential Equations	3
SCIE 2240	Physical Chemistry	4
SCIE 2241	Physical Chemistry Laboratory	0
ENGI 2110	Engineering Mechanics-Statics	3
ENGI 2310	Computer Programming and Algorithms	3
Total Credit- Hours		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
CHE 2500	Basic Principles of Chemical Engineering I	3
CHE 2510	Thermodynamics	3
ENGI 2260	Engineering Economics	3
ENGI 2320	Principles of Electrical Engineering	3
Total Credit- Hours		12

THIRD YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
CHE 3106	Basic Principles of Chemical Engineering II	3
CHE 3116	Fluid Mechanics for Chemical Engineers	3
CHE 3118	Applied Mathematics in Chemical Engineering	3
SOHU 2010	Socio-Humanistic Studies I	3
Total Credit- Hours		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
CHE 3310	Chemical Engineering Thermodynamics	3
CHE 3320	Heat Transfer	3
CHE 3117	Fluid Mechanics Laboratory for Chemical Engineering	1
ENGL 2020	Business English and Communication	3
SOHU 2040	Socio-Humanistic Studies II: Ethics, Global and Contemporary Issues	3
Total Credit- Hours		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
CHE 3520	Mass Transfer Operations	3
CHE 3530	Chemical Reaction Engineering	3
CHE 3321	Heat Transfer Operations Laboratory	1
ENGI 3510	Engineering Materials	3
Total Credit- Hours		10

FOURTH YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
CHE 4130	Mass Transfer Operations II	3
CHE 4140	Process Dynamics and Control	3
CHE 4150	Chemical Engineering Process Design	3
CHE 4930	Chemical Engineering Seminar	1
XXXX XXXX	Socio-Humanistic Studies or Languages Elective	3
Total Credit- Hours		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
CHE 4940	Chemical Engineering Capstone Course I	3
CHE 4131	Mass Transfer Operations Laboratory	1
CHE XXXX	Chemical Engineering Elective	3
XXXX XXXX	Free Elective	3
Total Credit- Hours		10

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
CHE 4950	Chemical Engineering Capstone Course II	3
CHE 4141	Reactor Design and Process Control Laboratory for Chemical Engineering	1
CHE XXXX	Chemical Engineering Elective	3
XXXX XXXX	Free Elective	3
Total Credit- Hours		10

COURSE DESCRIPTIONS**GENERAL ENGINEERING COURSES**

This courses are intended for students enrolled in the Chemical Engineering Program or in other engineering programs

ENGI 3510 – ENGINEERING MATERIALS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1214 or SCIE 1210, SCIE 1440, and SCIE 1441

Atomic Structure and Atomic Bonding in Solids, The Structure of Crystalline Solids, Imperfections in Solids, Diffusion, Mechanical Properties of Metals, Dislocations and Strengthening Mechanisms, Failure, Phase Diagrams, Applications and Processing of Metal Alloys, Structure and Properties of Ceramics, Polymer Structures. This course will give the students the knowledge of the solid materials properties required for applications to engineering; and an introduction of method to modify them for different applications and processes.

ENGI 3520 – THERMAL SYSTEMS ENGINEERING

Four credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGI 2410

This course addresses the three main components of the thermal fluid sciences: thermodynamics, fluid mechanics, and heat transfer. The purpose of this course is to provide an integrated introductory presentation of the basic tools required to solve problems in these areas of engineering. At the end of the course the students should be able to solve problems in thermodynamics, fluid mechanics, and heat transfer presented in future courses.

CHEMICAL ENGINEERING COURSES**CHE 2010 – INTRODUCTION TO CHEMICAL ENGINEERING**

Three credit-hours. Two two-hour sessions per week. Prerequisite: SCIE 1220. Co-requisite: SCIE 1230

This course emphasizes the importance of the chemical engineering profession and its contribution to society. The first part of the course involves a study of engineering graphics and its application in chemical engineering. The second part comprises an introduction to the fundamental steps in design and three methods of analysis: mathematical modeling, graphical methods, and dimensional analysis. In addition, students are familiarized with the application of engineering skills, such as verifying and simplifying calculations through assumptions and approximations, and appropriate use of conversion factors, significant figures, spreadsheets, graphing, and data maps. Students learn engineering skills by working on the design and analyzing chemical processes and process units in order to assess product quality, economics, safety, and environmental impact. The lectures are complemented with four workshops in engineering graphics and math software.

CHE 2500 – BASIC PRINCIPLES OF CHEMICAL ENGINEERING I

Three credit-hours. Two two-hour sessions per week. Prerequisites: CHE 2010, SCIE 1230, SCIE 2204, and ENGI 2310. Co-requisite: MATH 2350

This course applies chemical and stoichiometric principles in calculations involving the Law of Conservation of Mass. There is an emphasis on solving problems where the focus is on mass balance. It develops students' abilities for finding solutions to these problems using special techniques and computer based tools. Also, this course comprises the study of basic concepts including: units, dimensionless analysis, temperature, and pressure.

CHE 2510 – THERMODYNAMICS

Three credit-hours. Two two-hour sessions per week. Prerequisites: SCIE 2240 and MATH 2350. Co-requisite: CHE 2500

This course comprises the study of the basic concepts of thermodynamics, energy, Newton's First Law, conservation of mass and energy, volumetric properties of pure fluids, heat effects, entropy, second law analysis of engineering systems, thermodynamic properties of fluids, and application of thermodynamics to flow processes.

CHE 3106 – BASIC PRINCIPLES OF CHEMICAL ENGINEERING II

Three credit-hours. Two two-hour sessions per week. Prerequisites: CHE 2500 and CHE 2510

This course introduces the concepts of energy balance and integrates them with mass balance for the solution of chemical engineering problems. It also introduces different problem solving techniques and develops additional

computer skills in the student for the solution of chemical process problems.

CHE 3116 – FLUID MECHANICS FOR CHEMICAL ENGINEERS

Three credit-hours. Two two-hour sessions per week.
Prerequisites: ENGI 2110 and CHE 2510

Introduction to fluid properties, fluid statics and buoyancy, mass, energy and momentum balances; mechanical energy balances and Bernoulli's equation. Frictional losses in pipes and fittings, flow systems design, flow around submerged objects, pump selection and sizing, flow through porous media, models, dimensional analysis, and analogies.

CHE 3117 – FLUID MECHANICS LABORATORY FOR CHEMICAL ENGINEERING

One four-hour session per week. Prerequisite: CHE 3116

Experimental study of momentum transfer operations in the context of unit operations. Laboratory experiments are planned and performed in fluid dynamics. Experimental design along with correlation and interpretation of data are introduced. Technical communications are emphasized.

CHE 3118 – APPLIED MATHEMATICS IN CHEMICAL ENGINEERING

Three credit-hours. Two two-hour sessions per week.
Prerequisites: MATH 2350 and CHE 2500

Numerical approach to solve problems of interest in chemical engineering. Methods of interpretation, analysis and modeling of experimental data, formulation and solution of mass and energy balance equations in open and closed systems; numerical solution of ODEs, interpolation, and numerical integration, Fourier series and numerical solution of partial differential equations. The solution of problems by means of computers complements the course.

CHE 3310 – CHEMICAL ENGINEERING THERMODYNAMICS

Three credit-hours. Two two-hour sessions per week.
Prerequisite: CHE 2510

The course discusses the study of vapor-liquid equilibrium (VLE) in both: (1) pure component, in which thermodynamics is applied to work-fluids operating in power plants, refrigeration or liquefaction operations; (2) mixtures, where thermodynamics is applied to solutions resulting in mathematical models of the behavior of solutions. Ideal and non-ideal solutions are discussed using Raoult's and modified Raoult's Law. Fugacity and fugacity coefficient definitions are used to determine VLE of pure components and solutions.

CHE 3320 – HEAT TRANSFER

Three credit-hours. Two two-hour sessions per week.
Prerequisites: CHE 3116, CHE 3118, and CHE 3106

Heat transfer in one dimensional and multidimensional systems under steady and unsteady state conditions; principles of convection, empirical and practical relations for forced convection heat transfer, natural convection systems, radiation heat transfer, condensation and boiling heat transfer, and design of heat exchangers.

CHE 3321 – HEAT TRANSFER OPERATIONS LABORATORY

One credit-hour. One four-hour session per week.
Prerequisite: CHE 3320

Experimental study of heat transfer operations in the context of unit operations. Laboratory experiments are planned and performed in heat transfer operations. Experimental design along with correlation and interpretation of data are introduced. Technical communications are emphasized.

CHE 3520 – MASS TRANSFER OPERATIONS I

Three credit-hours. Two two-hour sessions per week.
Prerequisites: CHE 3310 and CHE 3320

This course covers diffusion and mass transfer; molecular diffusion in fluids, convective mass transfer, mass transfer coefficients, mass transfer correlations, mass transfer between phases, gas-liquid operations, equipment for gas-liquid operations, gas absorption, and distillation. Application of these concepts to design mass transfer equipment.

CHE 3530 – CHEMICAL REACTION ENGINEERING

Three credit-hours. Two two-hour sessions per week.
Prerequisites: CHE 3310 and CHE 3320. Co-requisite: CHE 3520

The course deals with the basic concepts and principles needed for the design and analysis of batch and continuous flow reactors. The calculations of isothermal reactors use rate laws from reaction-mechanisms or experimental data, and equilibrium criteria. Concerns about non-isothermal reactors, catalysis, and mass transfer effects complete the structure of the course.

CHE 4130 – MASS TRANSFER OPERATIONS II

Three credit-hours. Two two-hour sessions per week.
Prerequisite: CHE 3520. Co-requisite: CHE 4930

This course includes leaching and extraction, adsorption, drying, solid-fluid operations, and membrane separations. The application of this knowledge to the design of mass transfer equipment is the core of the course.

CHE 4131 – MASS TRANSFER OPERATIONS LABORATORY

One credit-hour. One four-hour session per week.
Prerequisites: CHE 3117, CHE 4130

Experimental study of mass transfer operations. Laboratory experiments are planned and performed in mass transfer operations. Experimental design along with correlation and interpretation of data are reinforced. Technical communications are emphasized.

CHE 4140 – PROCESS DYNAMICS AND CONTROL

Three credit-hours. Two two-hour sessions per week.
Prerequisites: CHE 3530 and ENGI 2320. Corequisite: CHE 4130.

This course comprises the study of Analysis of Process Dynamics: Mathematical Modeling of Dynamic Systems, Linear Systems Analysis, Analysis and Design of Control Systems, Discrete-Time Systems, Analysis in Frequency and Time Domain, and Stability Analysis.

CHE 4141 – REACTOR DESIGN AND PROCESS CONTROL LABORATORY FOR CHEMICAL ENGINEERING

One credit-hour. One four-hour session per week. Prerequisites: CHE 3117 and CHE 4140. Corequisite: CHE 3321.

Experimental study of reaction kinetics, reactor design, and process control. Laboratory experiments are planned and performed in reaction kinetics, reactor design, and process control. Experimental design along with correlation and interpretation of data are reinforced. Technical communications are emphasized.

CHE 4150 – CHEMICAL ENGINEERING PROCESS DESIGN

Three credit-hours. Two two-hour sessions per week. Prerequisites: ENGI 2260 and ENGI 3510. Corequisites: CHE 4130 and CHE 4140.

The course involves the developing of chemical process configurations, estimating capital investment and manufacturing costs. The synthesis and optimization of chemical processes and the integration of energy using Pinch Technology complement the body of the course.

CHE 4930 – CHEMICAL ENGINEERING SEMINAR

One credit-hour. One two-hour session per week. Prerequisites: None. Corequisite: CHE 3320.

This course focuses on effective communication and at the same time familiarizes the chemical engineering student close to graduation with different aspects of the practice of the profession. Topics include an overview of workplace communication and business writing; and planning, writing, and completing formal reports and oral presentations. Presentations on subjects related to different industry fields such as chemicals, pharmaceutical, environmental, petroleum and energy, etc., as well as research and development, graduate studies, ethical and professional responsibilities and safety, health and regulatory awareness complete the course.

CHE 4940 – CHEMICAL ENGINEERING CAPSTONE COURSE I

Three credit-hours. Two two-hour sessions per week. Prerequisite: CHE 4140, CHE 4130, and CHE 4930. Corequisite: CHE 4150

This course, in combination with Capstone II, exposes chemical engineering students to a meaningful research and design experience. Teams initiate the systematic development of a solution for an open-ended chemical engineering problem.

CHE 4950 – CHEMICAL ENGINEERING CAPSTONE COURSE II

Three credit-hours. Two two-hour sessions per week. Prerequisite: CHE 4940 and CHE 4150

This course, as the follow-up to Capstone I, exposes chemical engineering students to a meaningful research and design experience. Teams continue to completion the systematic development of a solution for an open-ended chemical engineering problem.

CHE 5000 – UNDERGRADUATE RESEARCH IN CHEMICAL ENGINEERING

Three credit-hours. Two four-hour laboratory period per week or equivalent. Prerequisite: Approval from the Chemical Engineering Department Head

This course is designed to stimulate undergraduate students in reading and writing technical and scientific publications, and learning new techniques and concepts. The principles of experimental design using simple and multivariate experiments and their statistical and mathematical modeling are discussed to prepare the students to be able to work in the Materials Processing Laboratory. In all topics of research a requirement of the statistical techniques and optimization techniques must be applied to reduce the amount of experiments.

CHE 5110 – FUNDAMENTALS OF INDUSTRIAL HYGIENE

Three credit-hours. Two two-hour sessions per week. Corequisite: CHE 3320

The overall objective of this course is to provide an introduction to the principles and practice of industrial hygiene. It is concerned with the anticipation, recognition, evaluation, and control of workplace hazards to health and safety. Topics covered include anatomy and physiology, chemical and physical principles review, toxicology and chemical exposure, physical, ergonomic, and biologic hazards, sampling methodology and exposure limits, ventilation and other engineering controls, and government regulations.

CHE 5120 – CHEMICAL ENGINEERING PRACTICE

Three credit-hours. By arrangement. Prerequisite: CHE 3116 and approval from the Chemical Engineering Department Head

This course is intended to provide the students with hands-on experience in chemical engineering. It consists of a kind of internship in which the student participates outside the campus. It is coordinated with the private industry and government. The work will be jointly supervised by a faculty

member and a representative of the private or government organization in which the student performs the practice.

CHE 5210 – PRINCIPLES OF ENVIRONMENTAL ENGINEERING

Three credit-hours. Two two-hour sessions per week.

Prerequisite: CHE 3116. **Co-requisite:** CHE 3320

An introduction to the theory, principles and practices related to environmental engineering including: environmental legislation, water usage and conservation, water chemistry, air pollution, global atmospheric changes, solid waste management and transport of contaminants in water, soils and air media. Introduction to the design of biological processes control, water plants and air control equipment is presented.

CHE 5212- AIR POLLUTION CONTROL

Three credit-hours. Two two-hour sessions per week.

Prerequisites: CHE 3520 and CHE 3530

Overview of the air pollution problem; cost estimation methodology, incineration for control of VOC emissions, absorption devices, flue gas desulphurization, control of nitrogen oxides, fundamentals of particulate emissions control, cyclonic devices, electrostatic precipitators, fabric filters, and biogenic pollutants.

CHE 5214 – INDUSTRIAL WATER TREATMENT

Three credit-hours. Two two-hour sessions per week.

Prerequisites: CHE 3520 and CHE 3530

This course includes the design and operation of manufacturing plants, treatment, and disposal of industrial wastes to minimize the industrial water pollution.

CHE 5216 – SOLID WASTE MANAGEMENT

Three credit-hours. Two two-hour sessions per week.

Prerequisites: CHE 3520 and CHE 3530

This course covers the management of solid waste material, hazardous and non-hazardous, according to environmental laws and regulations from a local and general perspective. It studies chemical and physical properties of hazardous and non-hazardous waste material, engineering control, design, operation and closure of municipal landfills, solid waste management planning to apply the optimum combination of reduction at the source, recycling and reuse, and state-of-the-art waste to energy conversion techniques.

CHE 5218 – ENVIRONMENTAL LAWS AND REGULATIONS

Three credit-hours. Two two-hour sessions per week.

Prerequisites: None. **Corequisite:** CHE 4940

This course covers federal and local applicable laws and regulations: NEPA, CERCLA, SARA, RCRA, Clean Air Act, Safe Drinking Water Act, Clean Water Act, State Laws and Regulations; Environmental Public Policy Law, Regulation for the Control of Atmospheric Pollution, Regulation for Underground Injection, Underground Storage Tanks Regulation, Regulation for the Control of Noise Pollution,

Non Hazardous Solid Waste Regulation, Hazardous Solid Waste Regulation, Biomedical Waste Regulation.

CHE 5310 – PRINCIPLES OF PHARMACEUTICAL OPERATIONS

Three credit-hours. Two two-hour sessions per week.

Prerequisite: CHE 4130

This course is an introduction to the theory, principles and practices related to the manufacture of pharmaceutical products, with emphasis on good manufacturing practices, related equipment details, plant design and operations, and pharmaceutical dosage forms. The course includes pharmaceutical industry related topics, such as qualification, processing, packaging, evaluation, and regulations.

CHE 5312 – BIOCHEMISTRY APPLIED TO CHEMICAL ENGINEERING

Three credit-hours. Two two-hour session per week.

Prerequisite: CHE 2500. **Co-requisite:** CHE 2510

This course comprises the study of fundamentals of biology and microbiology, emphasizing in the chemistry of compounds of biological importance such as proteins, nucleic acids, carbohydrates and lipids. Besides, it introduces the study of enzymes, their structure, mechanisms and kinetics, combined with the study of microbial systems and its application to bioprocesses and biotechnology.

CHE 5314 – INTRODUCTION TO POLYMERS

Three credit-hours. Two two-hour sessions per week.

Prerequisites: None. **Co-requisite:** CHE 3320

This course is an introduction to the world of plastics presented at three levels of focus (1) the molecular, (2) the micro (polymer chains and crystals), and (3) the macro (mechanical, physical, and chemical properties). Through the knowledge of these levels, the student should be able to understand the properties of various polymers and their performance in products. Similar concepts and principles will be compared for commodity and engineering, thermoplastics, thermosets, and elastomers. An introduction to plastic design is examined.

CHE 5318 – BIO-BASED POLYMERS AND COMPOSITES

Three credit-hours. Two two-hour sessions per week.

Prerequisite: CHE 3530

The overall objective of this course is to provide an application to several biological materials including plants materials to use as alternative material for the production of polymers, resins and composites. The course includes several stages: from the conceptual separations processes in plants to the chemical modifications of vegetable oils to produce polymers with industrial applications.

CHE 5350– FOOD TECHNOLOGY**Three credit-hours. Two two-hour sessions per week.****Prerequisites: CHE 3520 and CHE 3530**

The course involves the study of food chemistry, food microbiology, food additive and the different chemical processes and operations used in the preservation, conservation, processing, and packaging of food, taking in account the different food regulations.

CHE 5410 – NANOSTRUCTURES IN CHEMICAL PROCESSES**Three credit-hours. Two two-hour sessions per week.****Prerequisites: CHE 3106 and ENGI 3510**

This course introduces the science of nano-particles alongside the concepts that drive the assembly of such particles into two-and three-dimensional arrays and organized structures.

CHE 5450 – PETROCHEMICAL PROCESSES**Three credit-hours. Two two-hour sessions per week.****Prerequisites: CHE 3520 and CHE 3530**

This course is an introduction to the theory, principles and practices related with petroleum production and its main products. The characteristics of crude oil and its production are discussed, followed by the main processes to separate and transform it into industrially important products. The environmental aspects of oil production and processing are also discussed.

CHE 5500 – TRANSPORT PHENOMENA**Three credit-hours. Two two-hour sessions per week.****Prerequisite: CHE 4130**

This course focuses on the rates of momentum, energy and mass transfer in one-dimensional and, for the most part, steady state systems.

CHE 5510 – SPECIAL TOPICS IN CHEMICAL ENGINEERING**Three credit-hours. Two two-hour sessions per week.****Prerequisites: Upon Chemical Engineering Department Head recommendation.**

Open course to include topics of special interest and actuality in the manufacturing and service environment.

CHE 5520 – SPECIAL TOPICS IN CHEMICAL ENGINEERING DESIGN**Three credit-hours. Two two-hour sessions per week.****Prerequisites: CHE 3520 and CHE 3530**

Open course to include topics of special interest and actuality in the manufacturing and service environment that includes a special chemical engineering design project.

DEPARTMENTAL FACULTY

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Civil and Environmental Engineering Department

CIVIL ENGINEERING PROGRAM

Civil engineers are responsible for providing the world's infrastructure facilities, which are basic to the existence of modern society. These facilities can be large and complex, thus requiring the civil engineers to be broadly trained and able to deal with the latest technologies. The goal of the Civil Engineering Program at Polytechnic University of Puerto Rico is to develop in the students a professional knowledge of the technology needed to enter into these highly competitive fields, and to prepare the graduates to pursue a productive civil engineering career that is characterized by continued professional growth. The student develops the ability to apply pertinent knowledge to the practice of engineering design in the major discipline areas of civil engineering: Structural Engineering, Geotechnical Engineering, Highway and Transportation Engineering, Water Resources and Environmental Engineering, and Construction Engineering. This engineering design experience is built upon the fundamental concepts of mathematics, basic sciences, engineering sciences, and the humanistic and social sciences. This will provide civil engineers a healthy self-image, a well-rounded knowledge of their role in society, the ability to communicate, and to develop their creativity to apply engineering design with originality.

The graduates of the Bachelor of Science in Civil Engineering Program will have the theoretical and conceptual knowledge, the capability to use modern technologies effectively, and the basic technical skills to successfully work as engineers, to pursue graduate studies, to become engineers in training, and to continue their professional development and education on their way to become practicing professional civil engineers with a sense of social responsibility.

PROGRAM MISSION: The mission of the Civil Engineering Program is to prepare and motivate students from diverse backgrounds to achieve excellence through intellectual, humanistic, scientific and technological advancement on their way to becoming practicing professional civil engineers with a sense of social responsibility.

PROGRAM EDUCATIONAL OBJECTIVES: Within a few years of graduation, the PUPR Civil Engineering Program graduates are expected to attain the following:

1. Establish themselves as practicing professionals in the industry and government of their communities in accordance with the standards and ethics of the profession.

2. Demonstrate professional competence by holding positions of increasing responsibility in a civil engineering field.
3. Contribute to their organizations by serving as liaisons in a bilingual (Spanish-English) environment, performing as effective leaders and as active members of a professional team.
4. Enhance their professional knowledge through a lifetime of continuing education and through the active participation in professional societies.

STUDENT OUTCOMES: The graduates of the Civil Engineering Program will have:

1. An ability to apply knowledge of mathematics, probability and statistics, science, and engineering.
2. An ability to conduct laboratory experiments and to critically analyze and interpret data in a minimum of two of the following areas: structural, geotechnical, environmental, and transportation engineering.
3. Proficiency to analyze and design systems, components, or processes in a minimum of four of the following areas: structural, geotechnical, water resources and environmental, highway and transportation, and construction engineering.
4. An ability to work in teams and to interact with professionals of other disciplines.
5. An ability to identify, formulate, and solve civil engineering problems.
6. A comprehension of professional practice issues and ethical principles.
7. An ability to communicate orally, in writing, and graphically in an effective way.
8. An ability to evaluate the impact that design alternatives will have on society.
9. An ability to learn independently and an awareness of the need to be engaged in continuing education.
10. A knowledge of contemporary issues related to the civil engineering practice.
11. An ability to model civil engineering problems and to interpret results through the use of modern technologies.

CAREER OPPORTUNITIES: Civil engineers are involved in almost all aspects of public works and utilities infrastructure development. They provide the engineering design of a multistory building, a highway, a bridge, a retaining wall to support soil pressure, a water supply system, a storm sewer, a sanitary sewer system, a dam, among other things. They may analyze the hydrologic conditions of a particular area, the mechanical properties of soils, the transportation needs of a community, or the expected behavior of a structure. They may also plan, overview, and manage the execution of the jobs previously mentioned.

DEGREE OFFERED: The Department of Civil and Environmental Engineering offers undergraduate instruction leading to the degree of Bachelor of Science in Civil Engineering (B.S.C.E.). To earn the degree, the student must complete the following minimum requirements:

MINIMUM GRADUATION REQUIREMENTS

15	Credit-hours in Mathematics
14	Credit-hours in Basic Sciences
21	Credit-hours in Socio-Humanistic Studies and Languages
16	Credit-hours in General Engineering
17	Credit-hours in Civil and Environmental Engineering
60	Credit-hours in Civil Engineering
6	Credit-hours in Technical Elective
149	Total Credit-hours

DEVELOPMENTAL STUDIES: All students that are admitted to the Civil Engineering Program must show evidence that they have acquired the academic abilities and skills necessary to progress through this major. Those not demonstrating the complete acquisition of these abilities and skills (as reflected by the results of their College Entrance Examination Board test, results in PUPR’s placement test, previous university experience, or other tests or criteria) will be required to take developmental courses. These courses are designed to help them overcome deficiencies in languages, mathematics, and science. These developmental courses are in addition to the 149 credit-hours of the Civil Engineering Program. Developmental courses are the following:

DEVELOPMENTAL STUDIES COMPONENT
(MAXIMUM OF 33 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
MATH 1330	Precalculus I	3
MATH 1340	Precalculus II	3
SCIE 0110	Introduction to Physics	3
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

LABORATORIES: The Civil Engineering Curriculum requires the following laboratory courses: Principles of Chemistry Laboratory, two Physics Laboratories, Fluid Mechanics Laboratory, Algorithms, Programming, and

Numerical Analysis Laboratory, Principles of Surveying for Engineers Laboratory, Structural Engineering Laboratory, two Geotechnical Engineering Laboratories, Highway and Transportation Engineering Laboratory, Environmental Engineering Laboratory, and Construction Materials Laboratory. Two additional courses (Introduction to Civil Engineering and Civil Engineering Senior Design Project I) also have laboratory experiences. The Civil and Environmental Engineering Department has on campus a Civil and Environmental Engineering Simulations Laboratory.

STUDENT ORGANIZATIONS: There are five active student chapters at the Department of Civil and Environmental Engineering, which are especially attractive to civil engineering students:

- a. Institute of Civil Engineers of the College of Engineers and Land Surveyors of Puerto Rico (CIAPR)
- b. American Society of Civil Engineers (ASCE)
- c. American Concrete Institute (ACI)
- d. Associated General Contractors of America (ACG)
- e. Puerto Rico Water and Environment Association (PRW&EA)

Students may participate in any or all of the student chapters. These chapters provide the opportunities to get involved and participate in conferences, seminars, field trips, and other social and academic activities. This type of activities allows the development of leadership and teamwork skills, and get the student more involved in academic life and extra-curricular activities. The Civil Engineering Program encourages its students to participate actively in these chapters. In addition, there are other student chapters at the University, such as the Society of Hispanic Professional Engineers, in which civil engineering students are enrolled.

CIVIL ENGINEERING CURRICULUM

MATHEMATICS COMPONENT
(15 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
MATH 1360	Calculus II	4
MATH 1370	Calculus III	4
MATH 2350	Differential Equations	3

BASIC SCIENCES COMPONENT
(14 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SCIE 1210	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory	0
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1

SCIE	1440	Physics II	4
SCIE	1441	Physics II Laboratory	1

**SOCIO-HUMANISTIC STUDIES
AND LANGUAGES COMPONENT**
(21 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SPAN 1010	Linguistic Analysis of Literary Genres	3
SPAN 2020	Business Spanish	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English and Communication	3
SOHU 2010	Socio-humanistic Studies	3
SOHU 2040	Ethics, Global, and Contemporary Issues	3
	Socio-humanistic Studies or Language Elective	3

GENERAL ENGINEERING COMPONENT
(16 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGI 2110	Engineering Mechanics-Statics	3
ENGI 2120	Mechanics of Materials	3
ENGI 2260	Engineering Economics	3
ENGI 2410	Engineering Mechanics-Dynamics	3
ENGI 2420	Fluid Mechanics	3
ENGI 2421	Fluid Mechanics Laboratory	1

**CIVIL AND ENVIRONMENTAL
ENGINEERING COMPONENT**
(17 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
CEE 1010	Engineering Graphics for Civil and Environmental Engineers	4
CEE 2110	Engineering Geology	3
CEE 2210	Probability and Statistics for Civil and Environmental Engineers	3
CEE 2310	Algorithms, Programming, and Numerical Analysis	3
CEE 2311	Algorithms, Programming, and Numerical Analysis Laboratory	1
CEE 3410	Water Resources and Hydraulic Engineering	3

CIVIL ENGINEERING COMPONENT
(60 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SURV 2095	Principles of Surveying for Engineers Laboratory	1
CE 1011	Introduction to Civil Engineering	1
CE 2510	Construction Materials	3
CE 2511	Construction Materials Laboratory	1

CE 3110	Structural Analysis I	3
CE 3120	Structural Analysis II	3
CE 3121	Structural Engineering Laboratory	1
CE 3130	Steel Structures Design	3
CE 3210	Geotechnical Engineering I	3
CE 3211	Geotechnical Engineering Laboratory	1
CE 3220	Geotechnical Engineering II	3
CE 3221	Geomechanics Laboratory	1
CE 3310	Route Location and Geometric Design	3
CE 3320	Highway Engineering	3
CE 3330	Transportation Engineering and Urban Planning	3
CE 3331	Highway and Transportation Engineering Laboratory	1
CE 3420	Water Supply Engineering	3
CE 3520	Construction Project Management	3
CE 4140	Concrete Structures Design	3
CE 4150	Foundation Engineering	3
CE 4430	Wastewater Engineering	3
CE 4440	Environmental Engineering for Civil Engineers	3
CE 4441	Environmental Engineering Laboratory	1
CE 4530	Construction Methods and Productivity Improvement	3
CE 4911	Civil Engineering Senior Design Project I	1
CE 4920	Civil Engineering Senior Design Project II	3

TECHNICAL ELECTIVE COMPONENT
(6 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
	Technical Elective Course (*)	3
	Technical Elective Course (*)	3

(*) Technical Elective Course: any Civil Engineering (CE) elective course; or any Civil and Environmental Engineering (CEE) elective course; or an Environmental Engineering (ENVE) course approved by the Department Head; or any of the following General Engineering courses: ENGI 2320-Principles of Electrical Engineering, ENGI 2430-Engineering Thermodynamics, or ENGI 3510-Engineering Materials; or a technical course approved by the Department Head. Those students enrolled in the Combined Bachelor's-Master's Degree Program may take a graduate level course as a Technical Elective Course with the approval of the Department Head and the Coordinator of the Graduate Program.

MINIMUM TOTAL PROGRAM CREDIT-HOURS: 149

CIVIL ENGINEERING ELECTIVE COURSES

COURSE	TITLE	CREDIT-HOURS
CE 5010	Principles of Architecture for Civil	3

Engineers			
CE	5108	Prestressed Concrete Structures Design	3
CE	5116	Design of Wood Structures	3
CE	5208	Soil Improvement	3
CE	5220	Pavement Design	3
CE	5308	Urban Transportation Planning	3
CE	5312	Public Transportation	3
CE	5510	Planning, Scheduling, and Cost Estimates	3
CE	5522	Construction Documents for Civil Engineering	3

CIVIL AND ENVIRONMENTAL ENGINEERING ELECTIVE COURSES

COURSE	TITLE	CREDIT-HOURS
CEE 1012	Advanced AutoCAD for Civil and Environmental Engineers	3
CEE 5002	Civil and Environmental Engineering Practice	3
CEE 5020	Environmental Laws and Regulations	3
CEE 5030	Advanced Hydraulics	3
CEE 5050	Civil and Environmental Engineering Undergraduate Research	3
CEE 5052	Civil and Environmental Engineering Undergraduate Research II	3
CEE 5090	Special Topics in Civil and Environmental Engineering	3

CURRICULUM SEQUENCE

FIRST YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
SCIE 1210	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory	0
CEE 1010	Engineering Graphics for Civil and Environmental Engineers	4
		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1360	Calculus II	4
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
SPAN 1010	Linguistic Analysis of Literary Genres	3
CE 1011	Introduction to Civil Engineering	1
		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1370	Calculus III	4
SCIE 1440	Physics II	4
SCIE 1441	Physics II Laboratory	1
ENGL 1010	The Study of the Essay as a Literary Genre	3
		12

SECOND YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 2350	Differential Equations	3
SPAN 2020	Business Spanish	3
ENGI 2110	Engineering Mechanics-Statics	3
CEE 2210	Probability and Statistics for Civil and Environmental Engineers	3
		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGL 2020	Business English and Communication	3
ENGI 2120	Mechanics of Materials	3
ENGI 2410	Engineering Mechanics-Dynamics	3
CEE 2310	Algorithms, Programming, and Numerical Analysis	3
CEE 2311	Algorithms, Programming, and Numerical Analysis Laboratory	1
		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGI 2260	Engineering Economics	3
ENGI 2420	Fluid Mechanics	3
SURV 2095	Principles of Surveying for Engineers Laboratory	1
CE 2510	Construction Materials	3
CE 2511	Construction Materials Laboratory	1
CEE 2110	Engineering Geology	3
		14

THIRD YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGI 2421	Fluid Mechanics Laboratory	1
CE 3110	Structural Analysis I	3
CE 3210	Geotechnical Engineering I	3
CE 3211	Geotechnical Engineering Laboratory	1
CE 3310	Route Location and Geometric Design	3
SOHU 2010	Socio Humanistic Studies	3
		14

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
CE 3120	Structural Analysis II	3
CE 3121	Structural Engineering Laboratory	1
CE 3220	Geotechnical Engineering II	3
CE 3221	Geomechanics Laboratory	1
CE 3320	Highway Engineering	3
CEE 3410	Water Resources and Hydraulic Engineering	3
		14

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
CE 3130	Steel Structures Design	3
CE 3330	Transportation Engineering and Urban Planning	3
CE 3331	Highway and Transportation Engineering Laboratory	1
CE 3420	Water Supply Engineering	3
CE 3520	Construction Project Management	3
		13

FOURTH YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
CE 4140	Concrete Structures Design	3
CE 4430	Wastewater Engineering	3
CE 4530	Construction Methods and Productivity Improvement	3
SOHU 2040	Ethics, Global, and Contemporary Issues	3
		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
CE 4150	Foundation Engineering	3
CE 4440	Environmental Engineering for Civil Engineers	3
CE 4911	Civil Engineering Senior Design Project I	1
	Technical Elective	3
		10

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
CE 4441	Environmental Engineering Laboratory	1
CE 4920	Civil Engineering Senior Design Project II	3
	Technical Elective	3
	Socio-Humanistic Studies or Language Elective	3
		10

ENVIRONMENTAL ENGINEERING PROGRAM

The Environmental Engineering Program leads to the Bachelor of Science degree in Environmental Engineering. The program offers knowledge in environmental engineering subjects that will allow the students to understand and subsequently acquire additional knowledge in their specialized areas of interest, according to personal inclination and available opportunities. Throughout the curriculum the student develops the ability to apply pertinent knowledge to the practice of engineering design in the major discipline areas of environmental engineering. The program includes courses in the fields of water supply engineering, wastewater engineering, groundwater pollution control, air pollution control, solid and hazardous waste management, occupational safety and health, environmental impact assessment, environmental toxicology, and pollution prevention engineering. Elective courses in the specialization component are also offered. The engineering design experience is built upon the fundamental concepts of mathematics, basic sciences, engineering sciences, and the humanistic and social sciences. This will provide environmental engineers a healthy self-image, a well-rounded knowledge of their role in society, the ability to communicate, and to develop their creativity to apply engineering design with originality.

The graduates of the Bachelor of Science in Environmental Engineering Program will have the theoretical and conceptual knowledge, the capability to use modern technologies effectively, and the basic technical skills to successfully work as engineers, to pursue graduate studies, to become engineers in training, and to continue their professional development and education on their way to become practicing professional civil engineers with a sense of social responsibility.

PROGRAM MISSION: The mission of the Environmental Engineering Program is to prepare and motivate students from diverse backgrounds to achieve excellence through intellectual, humanistic, scientific, and technological advancements on their way to becoming practicing professional environmental engineers with a sense of social responsibility.

PROGRAM EDUCATIONAL OBJECTIVES: Within a few years of graduation, the PUPR Environmental Engineering Program graduates are expected to attain the following:

1. Establish themselves as practicing professionals in the industry and government of their communities in accordance with the standards and ethics of the profession.
2. Demonstrate professional competence by holding positions of increasing responsibility in an environmental engineering field.
3. Contribute to their organizations by serving as liaisons in a bilingual (Spanish-English) environment, performing

as effective leaders and as active members of a professional team.

- Enhance their professional knowledge through a lifetime of continuing education and through the active participation in professional societies.

STUDENT OUTCOMES: Graduates of the Environmental Engineering Program will have:

- An ability to apply knowledge of mathematics, probability and statistics, science, and engineering.
- An ability to conduct laboratory experiments and to critically analyze and interpret data in a minimum of two of the following areas: water supply, wastewater management, air pollution control, and solid waste management.
- Proficiency to analyze and design systems, components, or processes in a minimum of three of the following areas: water resources engineering, water supply engineering, wastewater engineering, air pollution and control, solid waste management, hazardous waste management, occupational safety and health, environmental toxicology, and environmental impact assessment.
- An ability to work in teams and to interact with professionals of other disciplines.
- An ability to identify, formulate, and solve environmental engineering problems.
- A comprehension of ethical principles, professional practice issues, and the roles and responsibilities of public institutions and private organizations in environmental management.
- An ability to communicate orally, in writing, and graphically in an effective way.
- An ability to evaluate the impact that design alternatives will have on society.
- An ability to learn independently and an awareness of the need to be engaged in continuing education.
- A knowledge of contemporary issues related to the environmental engineering practice.
- An ability to model environmental engineering problems and to interpret results through the use of modern technologies.

CAREER OPPORTUNITIES: Modern engineering is one of the great pillars of economic and social development. But development must not occur at the expense of environmental degradation. Therefore, the engineering design of urban, agricultural, and industrial facilities must have environmental protection mechanisms or systems built in. The environmental engineer is the professional who is academically prepared to design these environmental protection mechanisms and systems; and to collaborate with other professionals in the creation of environmentally sound engineering works. The graduates from this program will have their place in government agencies with regulatory, construction, or maintenance responsibilities; in design and consulting engineering firms; and in the industrial sector,

especially in the type of industry that, because of its industrial operations, results in significant environmental impact. On the other hand, environmental engineering bachelors will be much better prepared to pursue successfully graduate degrees in this field if they so desire.

DEGREE OFFERED: The Civil and Environmental Engineering Department offers undergraduate instruction leading to the degree of Bachelor of Science in Environmental Engineering (B.S.Env.E.). To obtain the degree the student must complete the following minimum requirements:

MINIMUM GRADUATION REQUIREMENTS

15	Credit-hours in Mathematics
26	Credit-hours in Basic Sciences
21	Credit-hours in Socio-Humanistic Studies and Languages
13	Credit-hours in General Engineering
17	Credit-hours in Civil and Environmental Engineering
49	Credit-hours in Environmental Engineering
6	Credit-hours in Technical Electives
147	Total Credit-hours

DEVELOPMENTAL STUDIES: All students that are admitted to the Environmental Engineering Program must show evidence that they have acquired the academic abilities and skills necessary to progress through this major. Those not demonstrating the complete acquisition of these abilities and skills (as reflected by the results of their College Entrance Examination Board tests, results in PUPR's placement test, previous university experience, and other tests or criteria) will be required to take developmental courses. These courses are designed to help the students overcome deficiencies in languages, mathematics and science. These developmental courses are in addition to the 147 credit-hours of the Environmental Engineering Program. Developmental courses are the following:

DEVELOPMENTAL STUDIES COMPONENT (MAXIMUM OF 37 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
MATH 1330	Precalculus I	3
MATH 1340	Precalculus II	3
SCIE 0110	Introduction to Physics	3
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3
SCIE 1110	General Biology (*)	4

SCIE	1111	General Biology Laboratory (*)	0
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(*) To be taken by students who have not taken a Biology course in High School.

LABORATORIES: The Environmental Engineering Curriculum requires the following laboratory courses: two General Chemistry and one Organic Chemistry Laboratories, two Physics Laboratories, Environmental Microbiology Laboratory, Fluid Mechanics Laboratory, Algorithms, Programming, and Numerical Analysis Laboratory, and two Environmental Engineering Laboratories. Two additional courses (Introduction to Environmental Engineering and Environmental Engineering Senior Design Project I) also have laboratory experiences. The Civil and Environmental Engineering Department has on campus a Civil and Environmental Engineering Simulations Laboratory.

STUDENT ORGANIZATIONS: There are two active student chapters at the Department of Civil and Environmental Engineering, which are especially attractive to environmental engineering students:

- Puerto Rico Water and Environment Association (PRW&EA)
- Institute of Environmental Engineers of the College of Engineers and Land Surveyors of Puerto Rico (CIAPR)

Students may participate in any of the student chapters. These chapters provide the opportunities to get involved and participate in conferences, seminars, field trips, and other social and academic activities. This type of activities allows the development of leadership and teamwork skills, and get the student more involved in academic life and extra-curricular activities. The Environmental Engineering Program encourages its students to participate actively in these chapters. In addition, there are other student chapters at the University, such as the Society of Hispanic Professional Engineers, in which environmental engineering students are enrolled.

ENVIRONMENTAL ENGINEERING CURRICULUM

MATHEMATICS COMPONENT (15 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
MATH 1360	Calculus II	4
MATH 1370	Calculus III	4
MATH 2350	Differential Equations	3

BASIC SCIENCES COMPONENT (26 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SCIE 1214	General Chemistry I	4
SCIE 1215	General Chemistry I Laboratory	0
SCIE 1220	General Chemistry II	4
SCIE 1221	General Chemistry II Laboratory	0
SCIE 1230	Organic Chemistry	4
SCIE 1231	Organic Chemistry I Laboratory	0
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
SCIE 1440	Physics II	4
SCIE 1441	Physics II Laboratory	1
SCIE 2110	Environmental Microbiology	4
SCIE 2111	Environmental Microbiology Laboratory	0

SOCIO-HUMANISTIC STUDIES AND LANGUAGES COMPONENT (21 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SPAN 1010	Linguistic Analysis of Literary Genres	3
SPAN 2020	Business Spanish	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English and Communication	3
SOHU 2010	Socio-Humanistic Studies	3
SOHU 2040	Ethics, Global, and Contemporary Issues	3
	Socio-Humanistic Studies or Language Elective	3

GENERAL ENGINEERING COMPONENT (13 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGI 2260	Engineering Economics	3
ENGI 2420	Fluid Mechanics	3
ENGI 2421	Fluid Mechanics Laboratory	1
ENGI 2430	Engineering Thermodynamics	3
ENGI 2910	Engineering Mechanics-Statics and Dynamics	3

CIVIL AND ENVIRONMENTAL ENGINEERING COMPONENT

COURSE	TITLE	CREDIT-HOURS
CEE 1010	Engineering Graphics for Civil and Environmental Engineers	4
CEE 2110	Engineering Geology	3
CEE 2210	Probability and Statistics for Civil and Environmental Engineers	3

CEE	2310	Algorithms, Programming, and Numerical Analysis	3
CEE	2311	Algorithms, Programming, and Numerical Analysis Laboratory	1
CEE	3410	Water Resources and Hydraulic Engineering	3

ENVIRONMENTAL ENGINEERING COMPONENT
(49 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENVE 1011	Introduction to Environmental Engineering	1
ENVE 3010	Environmental Engineering Operations and Processes	3
ENVE 3110	Environmental Toxicology	3
ENVE 3210	Fundamentals of Air Pollution	3
ENVE 3220	Air Pollution Control Design	3
ENVE 3310	Solid Waste Management	3
ENVE 3320	Hazardous Waste Management	3
ENVE 3420	Design of Aqueducts and Sanitary Sewer Systems	3
ENVE 3430	Water Quality and Treatment	3
ENVE 3440	Municipal Wastewater Treatment and Disposal	3
ENVE 3450	Groundwater Pollution Control	3
ENVE 4460	Industrial Wastewater Treatment, Reuse, and Disposal	3
ENVE 4511	Environmental Engineering Laboratory I	1
ENVE 4513	Environmental Engineering Laboratory II	1
ENVE 4610	Environmental Impact Assessment	3
ENVE 4710	Pollution Prevention Engineering	3
ENVE 4810	Occupational Safety and Health	3
ENVE 4911	Environmental Engineering Senior Design Project I	1
ENVE 4920	Environmental Engineering Senior Design Project II	3

TECHNICAL ELECTIVE COMPONENT
(6 CREDIT-HOURS)

(*) Technical Elective Course: any Environmental Engineering (ENVE) elective course; or any Civil and Environmental Engineering (CEE) elective course; or a Civil Engineering (CE) course approved by the Department Head; or any of the following General Engineering courses: ENGI 2120-Mechanics of Materials, ENGI 2320-Principles of Electrical Engineering, or ENGI 3510-Engineering Materials; or a technical course approved by the Department Head. Those students enrolled in the Combined Bachelor's-Master's Degree Program may take a graduate level course as a Technical Elective Course with the approval of the Department Head and the Coordinator of the Graduate Program.

MINIMUM TOTAL PROGRAM CREDIT-HOURS: 147

ENVIRONMENTAL ENGINEERING ELECTIVE COURSES

COURSE	TITLE	CREDIT-HOURS
ENVE 5620	Environmental Audits	3
ENVE 5670	Environmental Remediation	3

CIVIL AND ENVIRONMENTAL ENGINEERING ELECTIVE COURSES

COURSE	TITLE	CREDIT-HOURS
CEE 1012	Advanced AutoCAD for Civil and Environmental Engineers	3
CEE 5002	Civil and Environmental Engineering Practice	3
CEE 5020	Environmental Laws and Regulations	3
CEE 5030	Advanced Hydraulics	3
CEE 5050	Civil and Environmental Engineering Undergraduate Research	3
CEE 5052	Civil and Environmental Engineering Undergraduate Research II	3
CEE 5090	Special Topics in Civil and Environmental Engineering	3

CURRICULUM SEQUENCE

FIRST YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
SCIE 1214	General Chemistry I	4
SCIE 1215	General Chemistry I Lab	0
CEE 1010	Engineering Graphics For Civil and Environmental Engineers	4
		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
		14
		14
COURSE	TITLE	CREDIT-HOURS
		3
		3
MATH 1360	Calculus II	4
SCIE 1220	General Chemistry II	4
SCIE 1221	General Chemistry II Laboratory	0
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
ENVE 1011	Introduction to Environmental Engineering	1
		14

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1370	Calculus III	4
SCIE 1230	Organic Chemistry	4
SCIE 1231	Organic Chemistry Laboratory	0
SCIE 1440	Physics II	4
SCIE 1441	Physics II Laboratory	1
		13

SECOND YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
MATH 2350	Differential Equations	3
SCIE 2110	Environmental Microbiology	4
SCIE 2111	Environmental Microbiology Laboratory	0
ENGI 2910	Engineering Mechanics-Statics and Dynamics	3
CEE 2210	Probability and Statistics for Civil and Environmental Engineers	3
		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
SPAN 1010	Linguistic Analysis of Literary Genres	3
ENGI 2420	Fluid Mechanics	3
CEE 2110	Engineering Geology	3
CEE 2310	Algorithms, Programming, and Numerical Analysis	3
CEE 2311	Algorithms, Programming, and Numerical Analysis Laboratory	1
		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
SPAN 2020	Business Spanish	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGI 2260	Engineering Economics	3
ENGI 2421	Fluid Mechanics Laboratory	1
ENGI 2430	Engineering Thermodynamics	3
		13

THIRD YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
ENGL 2020	Business English and Communication	3
CEE 3410	Water Resources and Hydraulic Engineering	3
ENVE 3010	Environmental Engineering Operations and Processes	3

ENVE 3110	Environmental Toxicology	3
		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ENVE 3210	Fundamentals of Air Pollution	3
ENVE 3310	Solid Waste Management	3
ENVE 3420	Design of Aqueducts and Sanitary Sewer Systems	3
ENVE 3430	Water Quality and Treatment	3
		12

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ENVE 3220	Air Pollution Control Design	3
ENVE 3320	Hazardous Waste Management	3
ENVE 3440	Municipal Wastewater Treatment and Disposal	3
ENVE 3450	Groundwater Pollution Control	3
		12

FOURTH YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
SOHU 2010	Socio-Humanistic Studies	3
ENVE 4460	Industrial Wastewater Treatment, Reuse, and Disposal	3
ENVE 4511	Environmental Engineering Laboratory I	1
ENVE 4610	Environmental Impact Assessment	3
		10

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
SOHU 2040	Ethics, Global, and Contemporary Issues	3
ENVE 4513	Environmental Engineering Laboratory II	1
ENVE 4710	Pollution Prevention Engineering	3
ENVE 4911	Environmental Engineering Senior Design Project I	1
	Technical Elective	3
		11

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ENVE 4810	Occupational Safety and Health	3
ENVE 4920	Environmental Engineering Senior Design Project II	3
	Technical Elective	3
	Socio-Humanistic Studies or Language Elective	3
		12

COURSE DESCRIPTIONS

GENERAL ENGINEERING COURSES (FOR STUDENTS ENROLLED IN CIVIL, ENVIRONMENTAL, OR OTHER ENGINEERING PROGRAMS)

ENGI 2110 - ENGINEERING MECHANICS-STATICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 1360 and SCIE 1430

Analysis of force systems. Vectors. Laws of equilibrium of particles and rigid bodies. Structural analysis of trusses, frames, and machines. Centers of gravity and moments of inertia. Internal forces. Friction.

ENGI 2120 - MECHANICS OF MATERIALS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGI 2110

Introduction to the mechanics of deformable bodies. Study and analysis of stresses and strains on connections and bar elements subjected to axial, torsional, and transverse loads. Internal forces as stress resultants; shear force and bending moment diagrams. Analysis of structural elements subjected to combined stresses. Transformation of stresses, Mohr's Circle. Column stability analysis and buckling.

ENGI 2910 - ENGINEERING MECHANICS - STATICS AND DYNAMICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 1360 and SCIE 1430

Corequisite: MATH 1370

Examines vector representation of force and moment, equivalent force systems, centroids and centers of gravity, distributed forces, free body diagrams and equations of equilibrium, applications to trusses, and beams. Examines fundamentals of dynamics, kinematics of particles, and kinetics of particles using force, mass, and acceleration.

GENERAL ENGINEERING COURSES (FOR STUDENTS NOT ENROLLED IN CIVIL OR ENVIRONMENTAL ENGINEERING PROGRAMS)

ENGI 1110- ENGINEERING GRAPHICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: None

An introduction to the field of engineering graphics as a design and documentation tool. Topics include orthographic projection, pictorial drawings, dimensioning, feature control symbols and tolerancing. Use of a computer aided design (CAD) system to create engineering drawings.

CIVIL AND ENVIRONMENTAL ENGINEERING COURSES

CEE 1010 - ENGINEERING GRAPHICS FOR CIVIL AND ENVIRONMENTAL ENGINEERS

Four credit-hours. Two-two and half hour lecture periods per week. Prerequisite: None

An introduction to the field of engineering graphics and descriptive geometry as a design and documentation tool. Topics include orthographic projection, pictorial drawings, dimensioning, feature control symbols, and tolerancing. Use of a computer aided design (CAD) system to create engineering drawings.

CEE 1012 - ADVANCED AUTOCAD FOR CIVIL AND ENVIRONMENTAL ENGINEERS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CEE 1010

Introduction to the knowledge of graphical vocabulary for the preparation of construction documents, including the technical specifications and their development by computer assisted tools. The topics include AutoCAD used as tool for the preparation of civil engineering construction documents. Use of tridimensional drawings using Sketchup and Civil 3D in the development of grading and presentation technics. Includes the evaluation of technical specifications for the civil engineering area and the relation with the drawings.

CEE 2110 - ENGINEERING GEOLOGY

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: SCIE 1210 or SCIE 1214

Evolution of geology principles through history. The rock cycle. Mineral characteristics and rock formations. Rock types. Rock characteristics and engineering issues. Volcanism. Plate tectonics. Soil formation. Rock weathering. Mass movements. Seismology. Structural geology. Overview of the hydrological cycle. The relation of surface and groundwater hydrology to engineering geology.

CEE 2210 - PROBABILITY AND STATISTICS FOR CIVIL AND ENVIRONMENTAL ENGINEERS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 1370, and CE 1011 or ENVE 1011

An introduction to the role of probability and statistics in civil and environmental engineering. Fundamentals of probability theory. Random variables. Probability distributions. Functions of random variables. Sampling. Hypothesis testing and confidence intervals. Regression and correlation analysis.

CEE 2310 - ALGORITHMS, PROGRAMMING, AND NUMERICAL ANALYSIS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 2350 and CEE 2210

An introduction to programming and algorithms applied to numerical analysis. The most commonly used numerical

methods in civil and environmental engineering practice are introduced. Roots of equations, systems of linear equations, curve fitting techniques, numerical differentiation and integration, and ordinary differential equations.

CEE 2311 - ALGORITHMS, PROGRAMMING, AND NUMERICAL ANALYSIS LABORATORY

One credit-hour. Two two-hour lecture and laboratory periods per week. Prerequisites: MATH 2350 and CEE 2210. Corequisite: CEE 2310

An introduction to programming and algorithms applied to numerical analysis. Programming of numerical methods commonly used in civil and environmental engineering practice, using Visual Basic for Applications within Excel as the programming environment.

CEE 3410 - WATER RESOURCES AND HYDRAULIC ENGINEERING

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENGI 2420, ENGI 2421, CEE 2310, and CEE 2311

Fundamental concepts of hydrology and hydraulics. Hydrologic processes and the elements of the hydrologic cycle. Rainfall-runoff relationship. Hydrograph and unit hydrograph theory. Frequency analysis. Design of storm sewer systems. Reservoir: yield, capacity, and sedimentation. Open channel flow. Performance and design of culverts. Groundwater hydrology concepts. Well hydraulics.

CEE 5002 - CIVIL AND ENVIRONMENTAL ENGINEERING PRACTICE

Three credit-hours. By agreement.

Prerequisite: Approval of the Department Head

Civil and environmental engineering design procedures are applied to the solution of problems under the supervision of a non-faculty member. The problem may deal with any of the fields of civil and environmental engineering, as determined by the instructor.

CEE 5020 - ENVIRONMENTAL LAWS AND REGULATIONS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CE 4440 or ENVE 4610

Introduction to the technical, economic, political, administrative, and social forces that influence the environmental quality regulations and the use of natural resources. Review of federal and state laws, regulations, and programs enacted to minimize air, land, and water pollution. Review of public participation mechanisms.

CEE 5030 - ADVANCED HYDRAULICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CEE 3410

Advanced hydraulics for the design and analysis of systems concerned with the use and control of water, storage, water transmission; design of open channels and pressure

conduits. Design of storm and sewer systems. Performance and design of culverts. Sediment transport and sedimentation in reservoirs. Groundwater hydraulics and well hydraulics.

CEE 5050 - CIVIL AND ENVIRONMENTAL ENGINEERING UNDERGRADUATE RESEARCH

Three credit-hours. One four-hour lecture period per week.

Prerequisite: Approval of the Department Head

Introduction to research methodologies including: title and objectives development, literature review, research justification, experiment or analytical design, and proposal preparation. Open-ended research project in a specific area of Civil and Environmental Engineering.

CEE 5052 - CIVIL AND ENVIRONMENTAL ENGINEERING UNDERGRADUATE RESEARCH II

Three credit-hours. One four-hour lecture period per week. Prerequisite: CEE 5050

Continuation of the research project started in CEE 5050. Detailed literature review. Research cost estimates. Application of probability and statistics. Selection of instrumentation and tests. Experimentation or analytical development. Results manipulation and evaluation. Development of scientific publication and report presentation.

CEE 5090 - SPECIAL TOPICS IN CIVIL AND ENVIRONMENTAL ENGINEERING

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: According to special topics to be covered.

Special topics in any of the areas of specialization in civil engineering (structural engineering, geotechnical engineering, transportation engineering, water resources engineering, and construction engineering), environmental engineering (water supply engineering, wastewater engineering, air pollution control, solid and hazardous waste management, occupational safety and health, environmental toxicology, environmental impact assessment, and pollution prevention engineering), or related fields relevant to engineering practice.

CIVIL ENGINEERING COURSES

CE 1011 - INTRODUCTION CIVIL ENGINEERING

One credit-hour. Two-two hour lecture and laboratory periods per week. Prerequisite: CEE 1010

An introduction to the civil engineering profession, design philosophy, techniques, theory, methodology, and creative problem solving with emphasis on teamwork, as well as on design issues and practices in the profession. The course includes several design cases. Project design explicitly concerns technical approaches as well as consideration of the existing built environment, natural environment,

economic, social, and cultural factors. Critical thinking and logic presentation of an engineering analysis.

CE 2510 - CONSTRUCTION MATERIALS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENGI 2120 and CEE 2210
Corequisite: CE 2511

Application of the physical, mechanical, and chemical properties of materials such as concrete, aggregate, ferrous metals, nonferrous metals, timber, plastics, and asphalt cements. Selection of materials and their behavior in civil engineering practice. Test principles and methods applied to construction materials and failure analysis in accordance to the ASTM.

CE 2511 - CONSTRUCTION MATERIALS LABORATORY

One credit-hour. Two-two hour lecture and laboratory periods per week. Prerequisites: ENGI 2120 and CEE 2210. Corequisite: CE 2510

Laboratory techniques and procedures to determine properties of concrete, coarse and fine aggregates, wood, and steel. Design and preparation of concrete mixes. Tests on concrete specimens.

CE 3110 - STRUCTURAL ANALYSIS I

Three credit-hours. Two two-hour lecture periods per week.

Prerequisites: ENGI 2120, CEE 2310, and CEE 2311

Analytical model of structural systems. Analysis of gravity load distribution. Determination of earthquake and wind loads according to actual code provisions. Stability and determinacy of structures. Approximate analysis of statically indeterminate structures. Analysis of statically indeterminate structures by the Force Method.

CE 3120 - STRUCTURAL ANALYSIS II

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CE 3110. Corequisite: CE 3121

Analysis of statically indeterminate structures by the Stiffness Method and by the Moment Distribution Method. Computer Assisted Structural Analysis. Stiffness. Center and shear force distribution.

CE 3121 - STRUCTURAL ENGINEERING LABORATORY

One credit-hour. Two two-hour lecture and laboratory periods per week.

Prerequisite: CE 3110. Corequisite: CE 3120

Verify theoretical results with simple laboratory experiences on bars under axial and torsional loads, beams, columns, trusses, and frames. Measurement of deflections, angle of twist, support reactions, internal forces, and strains as the structural response of interest under a specified applied loads.

CE 3130 - STEEL STRUCTURE DESIGN

Three credit-hours. Two two-hour lecture periods per week.

Prerequisite: CE 3110

Design of structural steel members. Structural steel properties. Tension and compression members. Design of beams with and without lateral support. Combined axial compression and bending. Bolted and welded connections for tension. Introduction to buildings design.

CE 3210 - GEOTECHNICAL ENGINEERING I

Three credit-hours. Two two-hour lecture periods per week.

Prerequisites: ENGI 2120, ENGI 2420, CEE 2110, CEE 2310, and CEE 2311. Corequisite: CE 3211

Soils as engineering materials. Local soil types. Description and identification of soils. Index properties. Mineralogical composition of clays. Compaction. The effect of water on soil behavior. Effective stress concept. Flow nets. Stresses in a soil mass. Elastic settlement of soils.

CE 3211 - GEOTECHNICAL ENGINEERING LABORATORY

One credit-hour. Two two-hour lecture and laboratory periods per week.

Prerequisites: ENGI 2120, ENGI 2420, CEE 2110, CEE 2310, and CEE 2311. Corequisite: CE 3210

Laboratory techniques to determine the basic properties of soils including soil sampling and description, relationships among soil phases, consistency limits, and grain size distribution. Soil classification systems, compaction, and field density. Coefficient of permeability.

CE 3220 - GEOTECHNICAL ENGINEERING II

Three credit-hours. Two two-hour lecture periods per week.

Prerequisites: CE 3210 and CE 3211.

Corequisite: CE 3221

Compressibility of soils, consolidation settlements, rate of consolidation. Subsoil exploration and sampling. Soil strength parameters and their use in the evaluation of pressure on retaining structures, soil bearing capacity, and slope stability. Basic concepts of deep foundations.

CE 3221 - GEOMECHANICS LABORATORY

One credit-hour. Two two-hour lecture and laboratory periods per week.

Prerequisites: CE 3210 and CE 3211.

Corequisite: CE 3220

Consolidation test of fine soil samples. Preparation of soil profile including physical properties. Determination of soil shear strength parameters for common geotechnical engineering applications. Unconfined compression, direct and triaxial shear tests performed on SPT-retrieved samples to obtain total stress parameters. Evaluation of soil stiffness. Application problems.

CE 3310 - ROUTE LOCATION AND GEOMETRIC DESIGN

Three credit-hours. Two two-hour lecture periods per week.

Prerequisites: SURV 2095, CEE 2310, and CEE 2311

Route study. Horizontal alignment and simple and compound circular curves. Profile alignment and vertical parabolic curves. Spiral curve and superelevation. Introduction to traffic engineering safety. Earthwork.

CE 3320 - HIGHWAY ENGINEERING

Three credit-hours. Two two-hour lecture periods per week.

Prerequisites: CE 2510, CE 3210, and CE 3310

Roadside design principles. Traffic control devices. Pavement design. Traffic flow theory principles. Capacity and level of service of two-lane highways. Capacity and level of service of multilane highways. Capacity and level of service of basic freeway segments. Freeway weaving analysis. Interchange design principles. At-grade intersection design principles.

CE 3330 - TRANSPORTATION ENGINEERING AND URBAN PLANNING

Three credit-hours. Two two-hour lecture periods per week.

Prerequisite: CE 3320**Corequisite: CE 3331**

Intersection capacity and level of service. Planning and design aspects of transportation systems. Urban transportation planning models. Development principles of transportation facilities. Design and operational analysis of pedestrian and bicycle facilities. Public transportation.

CE 3331 - HIGHWAY AND TRANSPORTATION ENGINEERING LABORATORY

One credit-hour. One four-hour lecture and laboratory periods per week.

Prerequisite: CE 3320

Data collection techniques and use of equipment associated with different types of transportation studies. Application of statistics and probability in transportation data presentation and analysis. Application of computer software.

CE 3420 - WATER SUPPLY ENGINEERING

Three credit-hours. Two two-hour lecture periods per week.

Prerequisites: SCIE 1210, SCIE 1211, and CEE 3410

Water supply sources. Demand and use of water. Physical, chemical, and biological characteristics of water. Safe Drinking Water Act and other water quality regulations. Water treatment: rapid mix, flocculation, sedimentation, filtration, disinfection, softening, and other processes. Design of a water distribution system: configuration and requirements, losses, analysis of flow, pipe materials, pumps, and pumping stations

CE 3520 - CONSTRUCTION PROJECT MANAGEMENT

Three credit-hours. Two two-hour lecture periods per week.

Prerequisites: ENGI 2260, CE 2510, and CE 2511

The course discusses management of construction projects from site investigation, planning, and design to construction and application of controls. Topics include project administration, organizations, project costs estimation, bidding of contracts and awards, planning and scheduling techniques, labor relations, claim and dispute resolution, safety, and risk management.

CE 4140 - CONCRETE STRUCTURES DESIGN

Three credit-hours. Two two-hour lecture periods per week.

Prerequisites: CE 3120, CE 3121, and CE 3130

Design of reinforced concrete structures using the Ultimate Strength Design Method. Design for flexure and shear. Continuous beams and one-way slab systems. Development of reinforcing bars. Introduction to column design.

CE 4150 - FOUNDATION ENGINEERING

Three credit-hours. Two two-hour lecture periods per week.

Prerequisites: CE 3220, CE 3221, and CE 4140

Evaluation of sub-soil conditions as they affect the behavior, proportions, and choice of type foundation. Combined and strap footing. Retaining walls. Sheet piling walls. Pile group and pile cap design. Mat foundations

CE 4430 - WASTEWATER ENGINEERING

Three credit-hours. Two two-hour lecture periods per week.

Prerequisite: CE 3420

Wastewater sources: domestic, industrial, and infiltration/inflow. Wastewater flow rates. Gravity and pressure sanitary sewer systems. Physical, chemical, and biological characteristics of wastewater. Wastewater treatment processes: a) preliminary treatment: screening, coarse solids reduction, grit removal, flow equalization, odor control, and coagulation/flocculation; b) primary treatment: sedimentation; c) secondary treatment: activated sludge and trickling filters; d) advanced treatment: filtration, adsorption, ion exchange, air stripping, nitrification-denitrification, reverse osmosis, microfiltration and ultrafiltration, chemical precipitation, and phosphorus removal. Disinfection. Post-aeration. Effluent disposal and reuse alternatives. Treatment and disposal of sludge. The Clean Water Act. Regulatory agencies and their requirements

CE 4440 - ENVIRONMENTAL ENGINEERING FOR CIVIL ENGINEERS

Three credit-hours. Two two-hour lecture periods per week.

Prerequisite: CE 4430

Overview to the field of environmental engineering. Environmental phenomena. Materials and energy balances. Ecosystems. Environmental fate and transport of contaminants. Impact of pollutants in aquatic, soil, and air environments. Surface water pollution and quality. Air

pollution control. Solid waste management. Construction and demolition debris management. Noise pollution. Environmental laws and regulations. Environmental impact assessment. Ethical perspective of environmental engineering.

CE 4441 - ENVIRONMENTAL ENGINEERING LABORATORY

One credit-hour. Two two-hour lecture and laboratory periods per week. Prerequisite: CE 4430

Corequisite: CE 4440

Laboratory techniques to determine the properties of water and wastewater. Sampling: collection, storage and preservation. Tests for physical characteristics: color, turbidity, temperature and solids content (total, settleable, suspended, volatile and fixed). Tests for chemical characteristics: pH, alkalinity, hardness, chlorine, conductivity, dissolved oxygen, BOD, COD, nitrogen, and phosphorus. Tests for biological characteristics: fecal and total coliform. Other tests such as meteorological factors measurements. Experiments focused on process monitoring and control as part of the water resources and environmental engineering design processes.

CE 4530 - CONSTRUCTION METHODS AND PRODUCTIVITY IMPROVEMENT

Three credit-hours. Two two-hour lecture period per week. Prerequisite: CE 3520

This course discusses technical aspects of the construction process, and how they can be improved. Construction methods for heavy and building construction will be studied. Also, organizing a project with productivity improvement as a goal will be studied. Students will learn how to calculate and measure worker productivity. In addition, various models and methods for improving productivity will be studied and applied to construction problems.

CE 4911 - CIVIL ENGINEERING SENIOR DESIGN PROJECT I

One credit hour. Two two-hour lecture and laboratory periods per week.

Prerequisites: CE 3330, CE 4140, CE 4430, and CE 4530

First part of a two-period open ended design project that involves most areas of Civil Engineering. The project allows correlating the different areas of Civil Engineering, to apply the principles of engineering design and science at a high level, and to develop awareness of social and economic effects of engineering projects. This first course will concentrate in the site analysis, in all the laboratory and field studies required by the specific project (i.e., topography, as-built, structure inventory, soil exploration, traffic study, among others), in the development of a project proposal, and in the site design and environmental evaluation of the proposal.

CE 4920 - CIVIL ENGINEERING SENIOR DESIGN PROJECT II

Three credit-hours. Two two-hour lecture periods per week.

Prerequisites: CE 4150, CE 4440, and CE 4911

A continuation of CE 4911. Second part of a two-period open ended design project that involves most areas of Civil Engineering. The project allows correlating the different areas of Civil Engineering, to apply the principles of engineering design and science at a high level, and to develop awareness of social and economic effects of engineering projects. This second course will concentrate in the detailed analyses and designs required by the specific project, with a clear identification of hypothesis and assumptions, limitations of the study, design criteria, methods and tools, costs, safety, feasibility, and design parameters adopted for each design. Oral presentations and written reports will be used to develop the objectives.

CE 5010 - PRINCIPLES OF ARCHITECTURE FOR CIVIL ENGINEERS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: CEE 1010 and CE 1011

Introduce civil engineering students to architectural concepts. It is a morphological study of the essentials elements of form, space, organization, circulation, proportion, scale, and ordering principles. The course emphasizes the element of form as the primary tool of the designer. The relationship between architecture, nature, urban context, culture, history, social, and political issues are included.

CE 5108 - PRESTRESSED CONCRETE STRUCTURES DESIGN

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CE 4140

General design principles of prestressed concrete members. Pretensioning vs. Postensioning. Prestressing materials: steel and concrete. Design for shear and torsion. Deflection computation and control. Prestress losses. Indeterminate structures and slabs. Construction methods.

CE 5116 - DESIGN OF WOOD STRUCTURES

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: CE 2510 and CE 3110

Wood buildings and design criteria. Properties of wood and lumber grades. Vertical design loads and lateral forces. Design of beams and columns for vertical loads. Design of horizontal diaphragms and shear walls for lateral forces. Connection design, including the overall tying together of the vertical and lateral force-resisting systems.

CE 5208 - SOIL IMPROVEMENT

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: CE 3220 and CE 3221

Current ground modification techniques to improve soil stability, reduce deformation, control seepage, and increase erosion resistance.

CE 5220 - PAVEMENT DESIGN

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: CE 3220, CE 3221, CE 3320, CE 4140, and CEE 3410

Stress and deformation of flexible and rigid pavements, traffic loading, material parameters, drainage design. Pavement performance and reliability concepts. Design of flexible and rigid pavements, overlay design, Superpave, new developments in pavement design. Computerized pavement design.

CE 5308 - URBAN TRANSPORTATION PLANNING

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CE 3330

Urban transportation planning modeling. Origin and destination trip assessment. Transportation mode use analysis. Traffic forecasting and assignment. Impact analysis.

CE 5312 - PUBLIC TRANSPORTATION

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CE 3330

Transit modes. Transit planning. Passenger demand, route choice, and assignment. Frequency and headway determination. Scheduling. Network analysis, level of service, and reliability control.

CE 5510 - PLANNING, SCHEDULING, AND COST ESTIMATES

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CE 3520

This course comprises the work plan development process and the use of several scheduling techniques such as precedence diagrams, progress schedules, the critical path method (CPM), program evaluation and review technique (PERT), crashing and delay analysis. Project cost controls, earned value principles, cost estimate studies for construction projects from conceptual and preliminary to detailed estimates are also studied.

CE 5522 - CONSTRUCTION DOCUMENTS FOR CIVIL ENGINEERING

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CE 3520

A comprehensive coverage of documents generated before and during the construction process, including the origin and format of construction documents, which ones are used and why. Globalization aspects on how documents are utilized and how they work together as a system. Contract forms, contract conditions, and specifications are the main core for study. Construction drawings and technical specifications are studied as a design and construction tool into the

process. Bidding requirements are discussed as part of the project manual.

ENVIRONMENTAL ENGINEERING COURSES

ENVE 1011 - INTRODUCTION TO ENVIRONMENTAL ENGINEERING

One credit-hour. Two two-hour lecture and laboratory periods per week. Prerequisites: MATH 1350, SCIE 1214, SCIE 1215, and CEE 1010

An introduction to the environmental engineering field, presenting to the students a historical background on the profession, as well as basic knowledge on environmental impacts on the atmosphere, soil, and water, and the mitigation technologies available for the environmental engineer. The course includes laboratory activities to illustrate distinct monitoring techniques for impact and compliance assessment, as well as field visits to water and wastewater treatment plants and to solid waste handling facilities.

ENVE 3010 - ENVIRONMENTAL ENGINEERING OPERATIONS AND PROCESSES

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1230, SCIE 2110, ENGI 2430, CEE 2210, and ENVE 1011

This course presents to the students an interface between the scientific knowledge acquired in previous courses and their applications in environmental unit processes and operations, specifically to physical and chemical operations and processes.

ENVE 3110 - ENVIRONMENTAL TOXICOLOGY

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1230, SCIE 2110, and ENGI 2430

Nature, sources, pathways of toxic substances in the environment and their impact on humans and other life forms. Biochemical Mechanisms of toxicity. Cellular mechanisms of environmental causes of disease. Dose-Response relationships. Xenobiotic metabolism. Phase I and Phase II Reactions. Biodegradation and Bioaccumulation. Quantitative toxicology.

ENVE 3210 - FUNDAMENTALS OF AIR POLLUTION

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENVE 3010 and ENVE 3110

Definition and general listing of air pollutants. Sources and effects of air pollutants. Federal legislation and regulatory trends. Meteorology. Dispersion of pollutants in the atmosphere. General control methods for particulate matter, gases, and vapors, sulfur oxides, nitrogen oxides and trace metals. Atmospheric photochemical reactions: ozone formation and smog. Emission standards for mobile sources. General odor control methods.

ENVE 3220 - AIR POLLUTION CONTROL DESIGN

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENVE 3210

Engineering principles applied to the solution of air pollution problems. Characteristics and design considerations: a) incinerators for control of VOC emissions, b) fixed bed absorbers, c) flue gas desulphurization systems, d) systems for the control of nitrogen oxides, e) cyclonic devices, f) electrostatic precipitators, and g) fabric filters. Cost estimation methodology in air pollution control.

ENVE 3310 - SOLID WASTE MANAGEMENT

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENVE 3010 and ENVE 3110

Sources, types, composition, and properties of municipal solid waste. Solid Waste generation and collection. Disposal of Solid Wastes; the landfill method. Design, operation, and closure of landfills. Control of gases and leachate in landfills. Materials separation and processing technologies. Thermal, biological, and chemical conversion technologies. Recycling of materials found in municipal solid wastes. Solid waste management and planning issues.

ENVE 3320 - HAZARDOUS WASTE MANAGEMENT

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENVE 3310

Definitions and characterization of hazardous wastes. Environmental legislation: TSCA, RCRA and CERCLA. Site Assessment. Partitioning, sorption, and exchange at surfaces. Dynamics of transport away from the source. Approaches to hazardous waste minimization, resources recovery, remediation, treatment and disposal. Design of selected pathway applications. Bioremediation technologies.

ENVE 3420 - DESIGN OF AQUEDUCTS AND SANITARY SEWER SYSTEMS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CEE 3410

Water demand calculations. Availability of water. Reservoirs. Distribution reservoirs and service storage. Wells. Types of aqueducts. Distribution systems. Analysis of flow in pipeline networks. Head loss. Design of piping networks. Fundamentals of open channel flow. Wastewater sources and flow rates. Design of sewers and sewer appurtenances. Prevention and control of infiltration and inflow. Occurrence and control of the biological transformations in sewers. Selection, analysis, and design of pumps and pumping stations.

ENVE 3430 - WATER QUALITY AND TREATMENT

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: CEE 3410 and ENVE 3010

Physical, chemical, and biological characteristics of water. Drinking Water Standards. Water sources. Characteristics and design of the water treatment processes. Rapid mixing, chemical feeding, flocculation, sedimentation, filtration, disinfection, and other operations and processes.

Processing and disposal of sludge generated at the water treatment plants.

ENVE 3440 - MUNICIPAL WASTEWATER TREATMENT AND DISPOSAL

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENVE 3430

Wastewater sources. Physical, chemical, and biological characteristics of wastewater. Design of wastewater treatment processes: a) preliminary treatment: screening, coarse solids reduction, grit removal, flow equalization, odor control and coagulation/flocculation; b) primary treatment: sedimentation; c) secondary treatment: activated sludge, trickling filters, stabilization ponds, aerated lagoons, and rotating biological contactors; d) advanced treatment: filtration, adsorption, ion exchange, air stripping, nitrification-denitrification, reverse osmosis, microfiltration and ultrafiltration, chemical precipitation, and phosphorus removal. Disinfection. Post-aeration. Effluent disposal and reuse alternatives. Dissolved oxygen sag analysis. Design of facilities for the treatment and disposal of sludge. The Clean Water Act. Regulatory agencies and their requirements.

ENVE 3450 - GROUNDWATER POLLUTION CONTROL

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: CEE 2110 and ENVE 3430

Overview of groundwater hydrology. Groundwater pollution sources. Pollutant transport and fate considerations. Flow and solute transport modeling. Pollutant source prioritization. Groundwater monitoring, planning and analysis. Groundwater pollution control: physical, chemical, biological and innovative treatment technologies. Groundwater quality management.

ENVE 4460 - INDUSTRIAL WASTEWATER TREATMENT, REUSE, AND DISPOSAL

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENVE 3440

Sources and characteristics of industrial wastewaters. Unit operations and processes used in the pre-treatment or treatment of industrial wastewaters: equalization, neutralization, sedimentation, oil separation, flotation, coagulation and chemical precipitation, aeration systems, air stripping, activated sludge, trickling filtration, rotating biological contactors, stabilization basins, anaerobic processes, nutrient removal processes, adsorption, ion exchange, chemical oxidation, filtration, membrane processes, and land treatment. Sludge handling and disposal. Effluent reuse and disposal alternatives. Regulatory agencies and their requirements.

ENVE 4511 - ENVIRONMENTAL ENGINEERING LABORATORY I

One credit-hour. Two two-hour lecture and laboratory periods per week.

Prerequisites: ENVE 3210 and ENVE 3440

Experiments focused on process monitoring and control as part of the environmental engineering design processes. 1. Laboratory techniques to determine the properties of water and wastewater. Sampling: collection, storage, and preservation. Tests for physical characteristics: color, turbidity, temperature, and solids content (total, settleable, suspended, volatile, and fixed). Tests for chemical characteristics: pH, alkalinity, hardness, chlorine, conductivity, dissolved oxygen, BOD, COD, nitrogen, and phosphorus. Tests for biological characteristics: fecal and total coliform. Jar tests. 2. Meteorological factors measurements. 3. Air quality measurements and analysis: CO₂, CO, NO_x, and SO_x. 4. Noise pollution tests.

ENVE 4513 - ENVIRONMENTAL ENGINEERING LABORATORY II

One credit-hour. Two two-hour lecture and laboratory periods per week.

Prerequisites: ENVE 3220, ENVE 3320, and ENVE 4511

This course introduces concepts of experimental design applied to environmental engineering. Experiments will include the characterization of dissolved solids in wastewater, the physical characterization of solid wastes, the measurement of chemical properties of soils, and monitoring of particulates in air, soil properties, and activated carbon adsorption. The analysis of experimental data and the preparation of reports will be emphasized.

ENVE 4610 - ENVIRONMENTAL IMPACT ASSESSMENT

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENVE 3220, ENVE 3320, ENVE 3440, and ENVE 3450

Analysis, evaluation, coordination, and preparation of environmental impact studies. Identification and description of the environmental setting, applicable environmental regulations, impact prediction, evaluation of the impacts, mitigation measures and environmental monitoring. Decision methods for the evaluation of alternatives. Public participation in environmental decision making processes and environmental justice principles.

ENVE 4710 - POLLUTION PREVENTION ENGINEERING

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENVE 3220, ENVE 3320, and ENVE 4460

An introduction to the theory, principles, and practices related to pollution prevention, environmental legislation, resources usage and conservation, and environmentally benign design for products, processes and manufacturing systems. Environmental impacts of waste from manufacturing operations, and life-cycle assessment that include post-use product disposal, environmental cycles of materials, sustainability, and principles of environmental economics will be thoroughly covered. Principles of process design and economic analysis are integrated in the solution of improved manufacturing processes, and technologies that can be used to minimize pollution. Environmental

Accounting and Financial Analysis of pollution prevention projects are presented to assess the effectiveness of proposed process modifications for capital budgeting considerations and managerial decision-making. Several computer projects involving numerical solutions for modification of process design, waste accountability, resource recovery, and financial accounting models are required.

ENVE 4810 - OCCUPATIONAL SAFETY AND HEALTH

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENVE 3220 and ENVE 3320

System safety. Safety management and regulations. Psychology. Industrial hygiene. Ergonomics. Workers compensation. Accident causation and investigation. Fire science. Hazardous materials. Workplace violence. Training.

ENVE 4911 - ENVIRONMENTAL ENGINEERING SENIOR DESIGN PROJECT I

One credit-hour. Two two-hour lecture and laboratory periods per week.

Prerequisites: ENGI 2260, ENVE 3420, and ENVE 4610

First part of a two-period open ended design project to correlate all areas of Environmental Engineering to apply, at a high level, the principles of engineering design and science studied in previous courses and to develop awareness of social and economic effects of engineering projects. Projects are equivalent to those normally experienced by a beginning professional. Computer laboratory sessions, oral presentations, and written reports will cover alternatives to be considered at the initial stage of the preliminary design.

ENVE 4920 – ENVIRONMENTAL ENGINEERING SENIOR DESIGN PROJECT II

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENVE 4911

A continuation of ENVE 4911. Second part of a two-period open ended design project that involves most areas of Environmental Engineering. The project allows correlating the different areas of Environmental Engineering, to apply the principles of engineering design and science at a high level, and to develop awareness of social and economic effects of engineering projects. This second course will concentrate in the detailed analyses and designs required by the specific project, with a clear identification of hypothesis and assumptions, limitations of the study, design criteria, methods and tools, costs, safety, feasibility, and design parameters adopted for each design. Oral presentations and written reports will be used to develop the objectives.

ENVE 5620 – ENVIRONMENTAL AUDITS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENVE 4610

This course is an introduction to the principles of environmental auditing and to give to the

students experience in the use of key methods and techniques. During the course, students will be able to understand the practice behind environmental management systems, gain experience of carrying out environmental management system techniques in the professional environment and conduct an environmental audit with a partner organization.

ENVE 5670 – ENVIRONMENTAL REMEDIATION

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENVE 4610

Environmental remediation, design and applications to emphasize the engineering aspects of using remediation process for the treatment of contaminated soils, sludge, and groundwater. Learn the fundamental techniques for the degradation of hazardous compounds, coupled with design and operational techniques for remediation process. Predict the basic hydrodynamic relationships of contaminant transport phenomena in subsurface environments. Identify the best treatment alternative for each contaminant. Interpret, calculate, and compare alternatives for remediation design.

DEPARTMENTAL FACULTY

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Area of Interest: Geotechnical Engineering

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CRUZADO VÉLEZ, HÉCTOR– Professor; Ph.D. in Wind Science and Engineering, Texas Tech University, 2007; M.S.C.E., Massachusetts Institute of Technology, 1998; B.S.C.E., University of Puerto Rico, Mayagüez Campus, 1996, P. E.

Area of Interest: Structural Engineering

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Area of Interest: Construction Engineering

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DESCHAPELLES DUQUE, BERNARDO– Professor; Ph.D. in Civil Engineering, California Western University, Santa Ana, 1983; M.S.C.E., California Western University, Santa Ana, 1981; B.S.C.E., University of Havana, Cuba, 1954, B.S.Ch.E., University of Havana, Cuba, 1952, P.E.

Area of Interest: Structural Engineering

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ECHÉANDÍA GONZÁLEZ, JORGE– Lecturer II; M.S.C.E., Polytechnic University of Puerto Rico, 2010; B.S.C.E., Polytechnic University of Puerto Rico, 2005, P.E.

Area of Interest: Structural Engineering

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GARCÍA URIARTE, JUAN– Lecturer II, M.S.C.E., Georgia Institute of Technology, 1980; B.S.C.E., University of Puerto Rico, Mayagüez Campus, 1978, P.E.

Area of Interest: Structural Engineering

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Area of Interest: Environmental Engineering

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Area of Interest: Structural Engineering

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MALAVÉ MUÑOZ, ROGER– Associate Professor, Ph.D. in Chemical Engineering, University of Sherbrooke, Canada, 1999; M.S.Ch.E., University of Puerto Rico, Mayagüez

Campus, 1993; B.S.Ch.E., National University of San Marcos, Perú, 1990; B.S. Food Technology Engineering, Villarreal University, Perú, 1987.
Area of Interest: Environmental Engineering
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Area of Interest: Structural Engineering
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MODESTO ORTIZ, PEDRO– Lecturer II; M.E.M., Polytechnic University of Puerto Rico, 1995; B.S.C.E., University of Puerto Rico, Mayagüez Campus, 1984, P.E.
Area of Interest: Environmental Engineering
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OCASIO ROSADO, EDILBERTO– Associate Professor; M. Arch., University of Puerto Rico, Río Piedras Campus, 1991; B. in Environmental Design, University of Puerto Rico, Río Piedras Campus, 1988.
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Area of Interest: Geotechnical Engineering
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Area of Interest: Environmental Engineering
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REYES PEGUERO, FRANCISCO– Lecturer II, M.S. in Urban Planning, University of Puerto Rico, Río Piedras

Campus, 1993; B.S.C.E., Autonomous University of Santo Domingo, Dominican Republic, 1986.
Area of Interest: Transportation Engineering
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Area of Interest: Transportation Engineering
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RODRÍGUEZ GOTAY, JORGE– Lecturer III; M. Arch., University of Puerto Rico, Río Piedras Campus, 1996; B. in Environmental Design, University of Puerto Rico, Río Piedras Campus, 1993.
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Area of Interest: Geology
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Area of Interest: Transportation Engineering
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Area of Interest: Structural Engineering
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Area of Interest: Environmental Engineering
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Electrical & Computer Engineering and Computer Science (ECECS) Department

Our society is increasingly dependent on the generation and distribution of energy in the form of electricity, and continues to develop at an accelerated pace electronic communication devices and computers designed to capture, create, process, transform, display, and distribute information. Electrical Engineering is one of the disciplines supporting the development and operation of this key infrastructure. It has evolved from the study of fundamental electrical principles to encompass sophisticated communication and computation techniques, thus helping spawn new disciplines in Computer Engineering and Computer Science. The ECECS Department offers students an opportunity to meet their learning goals and to be key contributors in our information society by pursuing any one of three different Bachelor of Science degrees. These are: Electrical Engineering, Computer Engineering, and Computer Science.

Students with interests in electricity and computer hardware and software will find a wide variety of subjects shared among these three programs when they want to choose a program that suits their specific area of interest. In addition, the department also offers Master's degree programs in Electrical Engineering, Computer Engineering and Computer Science which are described in the graduate catalog.

ELECTRICAL ENGINEERING PROGRAM

This four-year program develops the required knowledge and skills to face the dynamic technological environment of contemporary society. Throughout the program, theoretical and practical experiences are interwoven using a combination of socio-humanistic studies, mathematics, basic science, engineering science, and engineering design experience. The design experience begins during the first year with an introductory course to engineering design which is geared towards developing the student's creativity and problem-solving skills. This focus on design continues throughout the curriculum culminating in a significant design experience within a final Capstone Course. Real life engineering problems are defined and solved, integrating the fundamental elements of modern design theory and methodology.

The Electrical Engineering Program offers two areas of interest: a) Electric Power, and b) Communications, Signals and Controls. The Electric Power area of interest prepares students for planning, design and operation of generation, transmission, distribution, and end-user electrical systems. The Communications, Signals and Controls area of interest prepares students for the design of analog and digital

electronics, process control, and wireless communication systems.

Students in the Electric Power area of interest are required to take 25 credit-hours from the required area courses and 6 credit-hours from the elective area courses, for a total of 31 credit-hours. Students from the Communications, Signals and Controls area of interest have to take 7 credit-hours as required area courses and 24 credit-hours from the elective area courses, for a total of 31 credit-hours. The students set educational objectives in view of these main areas of Electrical Engineering subjects.

PROGRAM MISSION: “To educate graduates with a broad background in computers, mathematics, science, and electrical engineering capable of performing successfully as electrical engineers and pursuing graduate studies.”

PROGRAM EDUCATIONAL OBJECTIVES: Within a few years of graduation, the PUPR Electrical Engineering Program graduates are expected to attain the following:

1. Establish themselves as practicing professionals in an industry (i.e., manufacturing, service) or government agency within PR or the USA, adding value by a rapid integration to changing job demands, and gradually obtaining leadership positions.
2. Contribute to their organization by serving as a liaison in a bilingual (Spanish-English) environment, and being an active member of a professional team.
3. Demonstrate ethical behavior, responsibility and professional competence by holding positions of increasing responsibility in an electrical engineering field: Communications, Signals and Controls, or Electric Power.
4. Continue their professional development through independent learning, involvement in advanced professional studies in electrical engineering or enrolling in graduate school.

STUDENT OUTCOMES: The Graduates from the Electrical Engineering Program must have:

- a) an ability to apply knowledge of mathematics, science, and engineering;
- b) an ability to design and conduct experiments, as well as to analyze and interpret data;
- c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- d) an ability to function on multidisciplinary teams;
- e) an ability to identify, formulate, and solve engineering 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 engineering solutions in a global, economic, environmental, 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 engineering tools necessary for engineering practice.

ACADEMIC LOAD: The minimum full time load per trimester is twelve credit-hours. To register for sixteen (16) credit-hours or above the student must obtain the approval of the Department Head and Dean. Credits will not be awarded for courses in which the student is not properly registered.

DURATION: The program's format offers the professional, the unique opportunity to earn the Bachelor of Science in Electrical Engineering in four (4) years, while continuing to work in their current positions. It is also suitable for full-time students who have the desire to commit to a more demanding academic schedule. The program may be completed in 4 years by enrolling in about 12 credits per term.

ACADEMIC SCHEDULE: Registration for all students is held prior to the beginning of each term on designated registration days as stipulated on the Academic Calendar. Completion of registration for each term is required prior to class attendance. The academic year consists of three regular terms, and one summer session for engineering courses, but two summer sessions for arts and sciences courses. Fall, Winter and Spring classes are scheduled from 8:00 AM to 10:30 PM, Monday through Thursday, and from 8:00 AM to 5:00 PM on Fridays and Saturdays. Students are required to make-up class contact hours lost because of holidays.

CAREER OPPORTUNITIES: Electrical Engineers remain in high demand in the modern global economy. The electric power industry now faces challenges for an efficient and economic energy supply to satisfy increasing demands both applying traditional schemes as well as by using new alternative energy technologies. The communication industry has gone through sweeping changes (i.e. wireless technology, cellular, optic fiber, etc.) forever changing people lives and culture. The constant demand for productivity and economy in modern industry requires the application of automated analytical and processing methods. The demand from these and related fields of human endeavor assure our well-equipped graduates the availability of good jobs in the foreseeable future.

DEVELOPMENTAL STUDIES: All students that request admission and are admitted to the Electrical Engineering Program must show evidence that they have acquired the academic abilities and skills necessary to progress through this major. Those not demonstrating the complete

acquisition of these abilities will be required to take developmental courses. Abilities and skills are demonstrated through the results of the College Entrance Examination Board Test, results of PUPR's placement test, previous university experience, and other tests or criteria. The courses are designed to help students overcome deficiencies in languages, mathematics, and science. These developmental courses are in addition to the 144 credits of the Electrical Engineering Program. The courses are awarded their corresponding credits according to contact hours. The courses are the following:

DEVELOPMENTAL STUDIES COMPONENT
(MAXIMUM OF 33 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
MATH 1330	Precalculus I	3
MATH 1340	Precalculus II	3
SCIE 0110	Introduction to Physics	3
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

LABORATORIES: The ECECS Department provides undergraduate teaching and/or research laboratories in the following subjects: Electrical Measurements, Electronics, Power Electronics, Communications, Logic Circuits, Process Control & Instrumentation, Electromechanical Energy Conversion, Power System Analysis, Power System Protection, Computer Programming, Computer Interfacing, Computer Architecture, Computer Networks, Real Time Digital Signal Processing, Fundamentals of Digital Signal Processing, Automation Engineering, Robotic Engineering, and Plasma Engineering.

STUDENT ORGANIZATIONS: The Students enrolled in the department may become members of any of the following organizations:

- Electrical Engineering Student chapter of the board that locally enrolls licensed engineers.
- IEEE Student Branch- This is an organization for undergraduates currently enrolled in electrical engineering programs. Branches are organized under the Institute of Electrical and Electronics Engineers, Inc., the world's largest professional engineering society.

DEGREE OFFERED: PUPR offers a Bachelor of Science in Electrical Engineering (BSEE) degree. In order to earn the BSEE degree, the student must complete the following requirements:

MINIMUM GRADUATION REQUIREMENTS

15	Credit-hours in Mathematics
14	Credit-hours in Basic Sciences
21	Credit-hours in Socio-Humanistic Studies and Languages
12	Credit-hours in Engineering Sciences
48	Credit-hours in Basic Electrical Engineering Component
31	Credit-hours in Electric Power or Communications, Signals & Controls Interest Areas
03	Credit-hours in Free Electives

144 Total Credit-Hours

ELECTRICAL ENGINEERING CURRICULUM
(144 CREDIT-HOURS)

MATHEMATICS COMPONENT
(15 CREDIT- HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
MATH 1360	Calculus II	4
MATH 1370	Calculus III	4
MATH 2350	Differential Equations	3

BASIC SCIENCES COMPONENT
(14 CREDIT- HOURS)

COURSE	TITLE	CREDIT-HOURS
SCIE 1210	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory	0
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
SCIE 1440	Physics II	4
SCIE 1441	Physics II Laboratory	1

SOCIO-HUMANISTIC STUDIES AND LANGUAGES COMPONENT
(21 CREDIT- HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English and Letter	3
SOHU 2010	Socio-Humanistic Studies	3

SOHU	2040	Socio-Humanistic Studies II (Ethics, Global and Contemporary Issues)	3
SOHU	XXXX	Socio-Humanistic Elective	3
SPAN	1010	Basic Spanish	3
SPAN	2020	Business Spanish	3

ENGINEERING SCIENCES COMPONENT
(12 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGI 2260	Engineering Economics	3
ENGI 2270	Engineering Probability & Statistics	3
ENGI 2910	Engineering Mechanics, Statics & Dynamics	3
ENGI 3440	Thermo-Fluids	3

ELECTRICAL ENGINEERING BASIC CORE COMPONENT
(48 CREDIT- HOURS)

COURSE	TITLE	CREDIT-HOURS
CECS 2200	Computer Programming Fundamentals	1
CECS 2202	Computer Programming I	4
CECS 2203	Computer Programming I Laboratory	0
COE 2300	Logic Circuits	3
COE 2301	Logic Circuits Laboratory	1
EE 1130	Freshman Design for Electrical & Computer Engineers	3
EE 2000	Circuit Analysis I	3
EE 2001	Electrical Measurements Laboratory	1
EE 2010	Computational Methods in Electrical & Computer Engineering	3
EE 2020	Circuit Analysis II	3
EE 2030	Electromagnetics Theory	3
EE 2400	Electromechanical Energy Conversion I	3
EE 2401	Electromechanical Energy Conv. I Laboratory	1
EE 2500	Electronics I	3
EE 3002	Signals & Systems	3
EE 3520	Electronics II	3
EE 3521	Electronics Laboratory	1
EE 3600	Automatic Controls	3
EE 4002	Capstone Design Course I	3
EE 4022	Capstone Design Course II	3

FREE ELECTIVES
(3 CREDIT- HOURS)

Select any 3 credit-hours except electrical engineering courses offered as service courses for non-electrical engineering students.

PROGRAM TECHNICAL ELECTIVES COMPONENT COMMUNICATIONS, SIGNALS & CONTROLS ENGINEERING
(31 CREDIT-HOURS)

Must select 7 credit-hours in required courses in this area of interest of "Communications, Signals, & Control", and other 24 credit-hours in elective area courses. CECS courses will also be available as department electives. Of the program electives, a total of 15 credit-hours must be in EE or COE 4th year level, or CECS 3rd year level. No CS courses will be accepted. At least two credit-hours, or their equivalent in laboratory experience must be included. Elective courses must amount to at least 8 credit-hours of design.

PROGRAM TECHNICAL ELECTIVES COMPONENT ELECTRIC POWER ENGINEERING
(31 CREDIT-HOURS)

Must select all 25 credit-hours of required courses in this area of interest "Electric Power Courses", and other 6 credit-hours in elective area courses. CECS courses will also be available as department electives. Of the program electives area courses, a total of 15 credit-hours must be in courses EE or COE 4th year level. No CS courses will be accepted. At least two credit-hours, or their equivalent in laboratory experience must be included. Elective courses must include at least 8 credit-hours of design.

Only one of these courses will be accepted as a 4th year level course for graduating requirements: EE 4902, COE 4902, EE 4990, or COE 4990.

PROGRAM TECHNICAL ELECTIVE COURSES COMMUNICATIONS, SIGNALS & CONTROLS
(MUST SELECT 31 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
Required Area Courses (7 credits)		
COE 3320	Microprocessors	3
COE 3321	Microprocessors Laboratory	1
EE 3700	Communication & Wireless Systems I	3
Elective Area Courses (Must take 24 credits, at least 15 credits in 4XXX level courses)		
CECS 3302	Data Communications	3
COE 3302	Digital System Design with VHDL	3
COE 4320	Computer Architecture	3

COE	4321	Computer Architecture Laboratory	1
COE	4340	Microcomputer Interfacing	4
COE	4341	Microcomputer Interfacing Laboratory	0
COOP	3010	Professional Practice	3
EE	3220	Software Applications for Electrical Engineering	3
EE	3610	Automation Engineering	3
EE	3611	Automation Engineering Laboratory	1
EE	3710	Random Processes	3
EE	4502	Power Electronics	3
EE	4503	Power Electronics Laboratory	1
EE	4520	Advanced Electronics	3
EE	4602	Process Control & Instrumentation	3
EE	4603	Process Control & Instrumentation Laboratory	1
EE	4612	Control System Design	3
EE	4620	Robotic Engineering Design	4
EE	4621	Robotic Engineering Design Laboratory	0
EE	4630	Selected Topics in Control	3
EE	4706	Fiber Optics Systems Design	3
EE	4716	Communication & Wireless Systems II	3
EE	4718	Communication Systems, Simulation & Design	3
EE	4720	Digital Signal Processing	3
EE	4722	Real Time Digital Signal Processing	3
EE	4730	Radio Frequency Circuit Design	3
EE	4740	Communication & Wireless Syst. III	3
EE	4902	Undergraduate Research in Elect. Eng.	3
EE	4990	Special Topics in Elect. Engineering	3
MATH	2360	Linear Algebra	3

*Note: Availability of courses EE 4902 and EE 4990, as well as CS and COE 4902, CS 4990, and COE 4990 for the Electrical Engineering Program students, will be determined by the Department Chairman, depending on the specific teaching or research topic.

**PROGRAM TECHNICAL ELECTIVE COURSES
IN ELECTRIC POWER
(MUST SELECT 31 CREDIT-HOURS)**

COURSE	TITLE	CREDIT-HOURS	
Required Area Courses (25 Credits)			
EE	2410	Electromechanical Energy Conversion II	3
EE	2411	Electromechanical Energy Conversion II Laboratory	1
EE	3420	Power System Analysis I	3
EE	3440	Electric System Design I	3
EE	3610	Automation Engineering	3
EE	3611	Automation Engineering Laboratory	1
EE	4400	Power System Analysis II	3
EE	4401	Power System Analysis Laboratory	1
EE	4432	Power System Protection	3
EE	4433	Power System Protection Laboratory	1
EE	4436	Distribution System Design	3
Elective Area Courses (Must take 6 credits, at least 3 credits in 4XXX level courses)			
COOP	3010	Professional Practice	3
EE	3220	Software Applications for Electrical Engineering	3
EE	4422	Electric Power Quality	3
EE	4444	Electric System Design II	3
EE	4450	Wind Power Systems	3
EE	4460	Photovoltaic Systems	3
EE	4462	Electrical Construction Project Management	3
EE	4464	Generation Control Systems	3
EE	4502	Power Electronics	3
EE	4503	Power Electronics Laboratory	1
EE	4902	Undergraduate Research in Electrical Engineering	3
EE	4990	Special Topics in Electrical Engineering	3

*Note: Availability of courses EE 4902 and EE 4990, as well as CS and COE 4902, CS 4990, and COE 4990 for the Electrical Engineering Program students, will be determined by the Department Chairman, depending on the specific teaching or research topic.

ELECTRICAL ENGINEERING PROGRAM CURRICULUM SEQUENCE

FIRST YEAR

FIRST QUARTER		
COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
SPAN 1010	Basic Spanish	3
ENGL 1010	The Study of Essay as a Literature Genre	3
EE 1130	Freshman Design for EE & CpE	3
		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1360	Calculus II	4
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
SCIE 1210	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory	0
		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1370	Calculus III	4
SCIE 1440	Physics II	4
SCIE 1441	Physics II Laboratory	1
CECS 2200	Computer Programming Fundamentals	1
SOHU 2010	Socio-Humanistic Studies	3
		13

SECOND YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 2350	Differential Equations	3
EE 2000	Circuit Analysis I	3
CECS 2202	Computer Programming I	4
CECS 2203	Computer Programming Laboratory	0
SPAN 2020	Business Spanish	3
		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGI 2270	Engineering Probability & Statistics	3
EE 2020	Circuit Analysis II	3
EE 2010	Computational Methods in Electrical & Computer Engineering	3
EE 2030	Electromagnetics Theory	3
		12

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
EE 2001	Electrical Measurements Laboratory	1
EE 2400	Electromechanical Energy Conv. I	3
EE 2500	Electronics I	3
SOHU 2040	Socio-Humanistic Studies II (Ethics, Global and Contemporary Issues)	3
ENGL 2020	Business English and Letter	3
		13

(Only For Students in Electric Power Interest Area)

THIRD YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
EE 3520	Electronics II	3
EE 2401	Electromechanical Energy Conv. I Laboratory	1
EE 3420	Power System Analysis I	3
EE 2410	Electromechanical Energy Conv. II	3
EE 3002	Signals & Systems	3
		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGI 2910	Engineering Mechanics, Statics & Dynamics	3
EE 2411	Electromechanical Energy Conv. II Laboratory	1
EE 3521	Electronics Laboratory	1
EE 3440	Electric System Design I	3
EE 3600	Automatic Controls	3
		11

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGI 3440	Thermo-fluids	3
EE 4400	Power System Analysis II	3
EE 4401	Power System Analysis Laboratory	1
COE 2300	Logic Circuits	3
COE 2301	Logic Circuits Laboratory	1
		11

FOURTH YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGI 2260	Engineering Economics	3
EE 4436	Distribution System Design	3
EE 3610	Automation Engineering	3
EE 3611	Automation Engineering Laboratory	1
EE 4432	Power System Protection	3
		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
EE 4002	Capstone Design I	3
EE 4433	Power System Protection Laboratory	1
XXXX	Free Elective	3
EE XXXX	EE Electric Power Technical Elective	3
SOHU XXXX	Socio-Humanistic Elective	3
		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
EE 4022	Capstone Design II	3
EE XXXX	EE Electric Power Technical Elective	3
		6

(Only For Students in Communications, Signals & Controls Interest Area)

THIRD YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
EE 3520	Electronics II	3
EE 2401	Electromechanical Energy Conv. I Laboratory	1
COE 2300	Logic Circuits	3

COE 2301	Logic Circuits Laboratory	1
EE 3002	Signals & Systems	3
		11

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGI 2910	Engineering Mechanics, Statics & Dynamics	3
COE 3320	Microprocessors	3
COE 3321	Microprocessors Laboratory	1
SOHU XXXX	Socio-Humanistic Elective	3
EE 3600	Automatic Controls	3
		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGI 3440	Thermo-fluids	3
ENGI 2260	Engineering Economics	3
EE 3521	Electronics Laboratory	1
EE 3700	Communications & Wireless Systems I	3
EE XXXX	EE Communications, Signals & Controls Technical Elective	3
		13

FOURTH YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
XXXX	Free Elective	3
EE XXXX	EE Communications, Signals & Controls Technical Elective	9
		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
EE 4002	Capstone Design I	3
EE XXXX	EE Communications, Signals & Controls Technical Elective	9
		12

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
EE 4022	Capstone Design II	3
EE XXXX	EE Communications, Signals & Controls Technical Elective	3
		6

PROGRAM COURSES

COMPUTER ENGINEERING AND COMPUTER SCIENCE COURSES

(Go to the ECECS Department Courses for the description)

CECS 2200	Computer Programming Fundamentals
CECS 2202	Computer Programming I
CECS 2203	Computer Programming I Laboratory
CECS 3302	Data Communications

COMPUTER ENGINEERING COURSES

(Go to the ECECS Department Courses for the description)

COE 2300	Logic Circuits
COE 2301	Logic Circuits Laboratory
COE 3302	Digital System Design w. VHDL
COE 3320	Microprocessors
COE 3321	Microprocessors Laboratory
COE 4320	Computer Architecture
COE 4321	Computer Architecture Lab.
COE 4340	Microcomputer Interfacing
COE 4341	Microcomputer Interfacing Laboratory

ELECTRICAL ENGINEERING COURSES

(Go to the ECECS Department Courses for the description)

EE 1130	Freshman Design for EE & CpE
EE 2000	Circuit Analysis I
EE 2001	Electrical Measurements Laboratory
EE 2010	Computational Methods in Electrical & Comp. Engineering
EE 2020	Circuit Analysis II
EE 2030	Electromagnetics Theory
EE 2400	Electromechanical Energy Conversion I
EE 2401	Electromechanical Energy Conversion I Laboratory
EE 2410	Electromechanical Energy Conversion II
EE 2411	Electromechanical Energy Conversion II Laboratory
EE 2500	Electronics I
EE 3002	Signals & Systems
EE 3220	Software Applications for Electrical Engineering
EE 3420	Power Systems Analysis I
EE 3440	Electric System Design I
EE 3520	Electronics II
EE 3521	Electronics Laboratory
EE 3600	Automatic Controls
EE 3610	Automation Engineering
EE 3611	Automation Engineering Laboratory
EE 3700	Communications & Wireless Systems I
EE 3710	Random Processes
EE 4002	Capstone Design Course I
EE 4022	Capstone Design Course II
EE 4400	Power Systems Analysis II
EE 4401	Power Systems Analysis Laboratory
EE 4422	Electric Power Quality

EE 4432	Power System Protection
EE 4433	Power System Protection Laboratory
EE 4436	Distribution System Design
EE 4444	Electric System Design II
EE 4450	Wind Power Systems
EE 4460	Photovoltaic Systems
EE 4462	Electrical Construction Project Management
EE 4464	Generation Control Systems
EE 4502	Power Electronics
EE 4503	Power Electronics Laboratory
EE 4520	Advanced Electronics
EE 4602	Process Control & Instrumentation
EE 4603	Process Control & Instrumentation Laboratory
EE 4612	Control System Design
EE 4620	Robotic Engineering Design
EE 4621	Robotic Eng. Design Laboratory
EE 4630	Selected Topics in Control
EE 4706	Fiber Optics System Design
EE 4716	Communication & Wireless Systems II
EE 4718	Communication Systems, Simulation & Design
EE 4720	Digital Signal Processing
EE 4722	Real Time DSP
EE 4730	Radio Frequency Circuit Design
EE 4740	Communication & Wireless Systems III
EE 4902	Undergraduate Research in Electrical Engineering
EE 4990	Special Topics in Electrical Engineering

OTHER DEPARTMENT COURSES

(Go to the Mathematics and Sciences Department Courses for the description)

MATH 2360	Linear Algebra
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COMPUTER ENGINEERING PROGRAM

Computer Engineering is a rapidly changing field that spans a wide range of topics concerned with the design, implementation, and programming of computers and digital systems. Computer engineers develop integrated hardware and software systems and apply these to the creative solution of problems in government and business. These solutions are key enablers to global economic development and social welfare. A sample of the range of solutions created by computer engineers include: industrial and military control systems, database management systems, health care information systems, networked systems, end-user embedded computer controlled products, and computer-aided design tools to automate and leverage human performance in many other disciplines.

The Bachelor of Science in Computer Engineering provides both breadth and depth in the discipline by incorporating physical and mathematical sciences, core engineering subjects, fundamental computer science topics, and a wide

array of specialized courses in areas of long range relevance to computer engineering. It has been designed as a flexible program that is able to accommodate particular student interests through electives.

Topics covered include: algorithms and languages, digital system design, networks and communications, computer organization and architecture, microprocessor-based systems, database systems, software engineering, operating systems, and capstone design courses.

PROGRAM MISSION: "To educate graduates with broad background in mathematics, science, software, and hardware capable of performing successfully as computer engineers and/or pursuing graduates studies."

PROGRAM EDUCATIONAL OBJECTIVES for the Computer Engineering graduates are:

1. Establish themselves as practicing professionals and continuously evolve to meet the needs of a changing information and industry-based society, maintaining an ethical and socially responsible perspective.
2. Develop successfully as team members, leaders, and managers or entrepreneurs in the Computer Engineering arena.
3. Provide comprehensive solutions to Computer Engineering problems that leverage technological advancements.
4. Engage in professional development through a lifetime of continuing education, research, and graduate studies.

STUDENT OUTCOMES: Computer Engineering Graduates must have:

- a) an ability to apply knowledge of mathematics, science, and engineering;
- b) an ability to design and conduct experiments, as well as to analyze and interpret data;
- c) an ability to design a system, component, or process, to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability;
- d) an ability to function on multidisciplinary teams;
- e) an ability to identify, formulate, and solve engineering 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 engineering solutions in a global, economic, environmental and societal context;
- i) a recognition of need for and ability to engage in life-long learning;
- j) a Knowledge of contemporary issues.
- k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CAREER OPPORTUNITIES: The demand for Computer Engineers continues to expand in parallel to the computer and informatics revolution that has characterized the turn of the century. This trend is expected to continue well into the twenty-first century as computers continue to impact human development in all disciplines and industries, including business, research and entertainment. Job opportunities exist within all kinds of businesses, given their need and reliance on computational infrastructure, as well as in organizations specifically devoted to research and development of computer technologies.

ACADEMIC LOAD: The minimum full time load per trimester is twelve credit-hours. To register for sixteen (16) credit-hours or above the student must obtain the approval of the Department Head and Dean. Credits will not be awarded for courses in which the student is not properly registered.

DURATION: The program's curriculum format offers the professional the unique opportunity to earn the Bachelor of Science in Computer Engineering in four (4) years, while continuing to work in their current positions. It is also suitable for full-time students who have the desire to focus their entire effort on pursuing this degree. The program may be completed in four (4) years by enrolling in about 12 to 13 credits per trimester.

ACADEMIC SCHEDULE: Registration for all students is held prior to the beginning of each term on designated registration days as stipulated on the Academic Calendar. Completion of registration for each term is required prior to class attendance. The academic year consists of three regular terms, and one summer session. Fall, winter and spring classes are scheduled from 8:00 AM to 10:30 PM, Monday through Thursday, and from 8:00 AM to 5:00 PM on Fridays and Saturdays. Students are required to make up class contact hours lost because of holidays or weather conditions.

DEVELOPMENTAL STUDIES: All students that request admission and are admitted to the Computer Engineering Program must show evidence that they have acquired the academic abilities and skills necessary to progress through this major. Those not demonstrating the complete acquisition of these abilities will be required to take developmental courses. Abilities and skills are demonstrated through the results of the College Entrance Examination Board Test, results in PUPR's placement test, previous university experience, other tests, or criteria. The courses are designed to help students overcome deficiencies in languages, mathematics, and science. These developmental courses are in addition to the 149 credits of the Computer Engineering Program.

The courses are awarded their corresponding credits according to contact hours. The courses are the following:

DEVELOPMENTAL STUDIES COMPONENT
(MAXIMUM OF 33 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
MATH 1330	Precalculus I	3
MATH 1340	Precalculus II	3
SCIE 0110	Introduction to Physics	3
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

LABORATORIES: The ECECS Department provides undergraduate laboratory and research in the following topics: Electrical Measurements, Electronics, Power Electronics, Communications, Logic Circuits, Process Control & Instrumentation, Electromechanical Energy Conversion, Power System Analysis, Power System Protection, Computer Programming, Computer Interfacing, Computer Architecture, Computer Networks, Real Time Digital Signal Processing, Fundamentals of Digital Signal Processing, Automation Engineering, Robotic Engineering, and Plasma Engineering.

STUDENT ORGANIZATIONS: The Students enrolled in the department may become members of the following student organizations:

a. Computer Engineering Student chapter of the board that locally enrolls licensed engineers.

b. IEEE Student Branch- This is an organization for registered undergraduates currently enrolled in departmental engineering programs. Branches are organized under the Institute of electrical and Electronics Engineers, Inc., the world's largest professional engineering society.

DEGREE OFFERED: PUPR offers a Bachelor of Science in Computer Engineering (BSCpE) degree. In order to earn the BSCpE degree, the student must complete the following requirements:

MINIMUM GRADUATION REQUIREMENTS

15 Credit-hours in Mathematics

14	Credit-hours in Basic Sciences
21	Credit-hours in Socio-Humanistic Studies and Languages
09	Credit-hours in Engineering Sciences
81	Credit-hours in Basic Computer Engineering
03	Credit-hours in Free Electives
06	Credit-hours in Computer Engineering Program Electives
149	Total Credit-Hours

COMPUTER ENGINEERING CURRICULUM
(149 CREDIT-HOURS)

MATHEMATICS COMPONENT
(15 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
MATH 1360	Calculus II	4
MATH 1370	Calculus III	4
MATH 2350	Differential Equations	3

BASIC SCIENCES COMPONENT
(14 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SCIE 1210	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory	0
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
SCIE 1440	Physics II	4
SCIE 1441	Physics II Laboratory	1

SOCIO HUMANISTIC STUDIES AND LANGUAGES COMPONENT
(21 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English and Letter	3
SOHU 2010	Socio-Humanistic Studies	3
SOHU 2040	Socio-Humanistic Studies II (Ethics, Global and Contemporary Issues)	3
SOHU XXXX	Socio-Humanistic Elective	3
SPAN 1010	Basic Spanish	3
SPAN 2020	Business Spanish	3

ENGINEERING SCIENCES COMPONENT
(9 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGI 2260	Engineering Economics	3
ENGI 2270	Engineering Probability and Statistics	3
ENGI 2910	Eng. Mechanics Statics & Dynamics	3

COMPUTER ENGINEERING CORE COURSES
(81 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
CECS 2004	Discrete Structures	3
CECS 2200	Computer Programming Fundamentals	1
CECS 2202	Computer Programming I	4
CECS 2203	Computer Programming I Laboratory	0
CECS 2222	Computer Programming II	4
CECS 2223	Computer Programming II Laboratory	0
CECS 3210	Advanced Programming	3
CECS 3212	Data Structures	3
CECS 3302	Data Communications	3
CECS 4202	Database Systems	3
CECS 4204	Software Engineering	3
CECS 4230	Operating Systems	3
COE 2300	Logic Circuits	3
COE 2301	Logic Circuits Laboratory	1
COE 3302	Digital Systems Design with VHDL	3
COE 3320	Microprocessors	3
COE 3321	Microprocessors Laboratory	1
COE 4002	Capstone Design I	3
COE 4022	Capstone Design II	3
COE 4320	Computer Architecture	3
COE 4321	Computer Architecture Laboratory	1
COE 4330	Computer Networks	3
COE 4331	Computer Networks Laboratory	1
COE 4340	Microcomputer Interfacing	4
COE 4341	Microcomputer Interfacing Laboratory	0
EE 1130	Freshman Design for Electrical & Computer Engineers	3
EE 2000	Circuit Analysis I	3
EE 2001	Electrical Measurements Lab.	1
EE 2010	Computational Methods in Elec. & Comp. Engineering	3
EE 2020	Circuit Analysis II	3
EE 2500	Electronics I	3
EE 3002	Signals & Systems	3

EE 4720	Digital Signal Processing	3
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COMPUTER ENGINEERING TECHNICAL ELECTIVES
(Must take 6 credits in technical electives to complete graduation requirements)

COURSE	TITLE	CREDIT-HOURS
CECS 3200	Assembly Language Programming	3
CECS 3202	Visual-Oriented Programming	3
CECS 3214	Internet Programming I	3
CECS 3220	Human-Computer Interaction	3
CECS 3234	UNIX Operating System	3
CECS 4200	Programming Languages	3
CECS 4206	Design and Analysis of Algorithms	3
CECS 4208	Computer Forensics	3
CECS 4210	Ethical Hacking	3
CECS 4212	Artificial Intelligence (AI)	3
CECS 4214	Network Security	3
CECS 4216	Reverse Engineering	3
CECS 4218	Introduction to Game Design	3
CECS 4220	E-Commerce	3
CECS 4222	Game Programming Fundamentals	3
CECS 4226	Computer Graphics	3
CECS 4228	Computational Theory	3
CECS 4234	UNIX Administration	3
CECS 4256	Internet Programming II	3
COE 4902	Undergraduate Research in Computer Engineering	3
COE 4990	Special Topics in Comp. Engineering	3
COOP 3010	Professional Practice	3
EE 3520	Electronics II	3
EE 3600	Automatic Controls	3
EE 3610	Automation Engineering	3
EE 3611	Automation Engineering Laboratory	1
EE 3710	Random Processes	3
EE 4620	Robotic Engineering Design	4
EE 4621	Robotic Engineering Design Laboratory	0
EE 4722	Real Time DSP	3
MGMT 4660	Entrepreneurship	3

*Notes: A student is required to select nine (9) credit-hours of available technical electives in order to acquire additional skills that reinforce the student's knowledge in a specific area of interest. Availability of courses COE 4902 and COE 4990, as well as CS and EE 4902, CS 4990, and EE 4990 for the Computer Engineering Program students will be determined by the Program Director, depending on the specific teaching or research topic.

FREE ELECTIVES

(3 CREDIT-HOURS)

Three credit hours of free electives, in any area, are chosen by the student.

**COMPUTER ENGINEERING PROGRAM
CURRICULUM SEQUENCE (149 CREDIT-HOURS)**

FIRST YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
SPAN 1010	Basic Spanish	3
ENGL 1010	The Study of the Essay as a Lit. Genre	3
EE 1130	Freshman Design for EE & CpE	3
		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1360	Calculus II	4
SCIE 1210	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory	0
CECS 2004	Discrete Structures	3
		11

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1370	Calculus III	4
CECS 2200	Computer Programming Fundamentals	1
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
SOHU 2010	Socio Humanistic Studies	3
		13

SECOND YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
SCIE 1440	Physics II	4
SCIE 1441	Physics II Laboratory	1
CECS 2202	Computer Programming I	4
CECS 2203	Computer Programming I Laboratory	0
MATH 2350	Differential Equations	3
		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
EE 2000	Circuit Analysis I	3
ENGI 2270	Engineering Probability & Statistics	3

CECS 2222	Computer Programming II	4
CECS 2223	Computer Programming II Laboratory	0
ENGI 2910	Eng. Mechanics, Statics & Dynamics	3
		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
SOHU 2040	Socio-Humanistic Studies II (Ethics, Global and Contemporary Issues)	3
EE 2020	Circuits Analysis II	3
EE 2001	Electrical Measurements Lab.	1
CECS 3212	Data Structures	3
EE 2500	Electronics I	3
		13

THIRD YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
CECS 3210	Advanced Programming	3
COE 2300	Logic Circuits	3
COE 2301	Logic Circuits Laboratory	1
CECS 4202	Database Systems	3
SPAN 2020	Business Spanish	3
		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
CECS 3302	Data Communications	3
COE 3320	Microprocessors	3
COE 3321	Microprocessors Laboratory	1
COE 3302	Digital Systems Design with VHDL	3
ENGL 2020	Business English & Letter	3
		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
CECS 4204	Software Engineering	3
COE 4320	Computer Architecture	3
COE 4321	Computer Architecture Laboratory	1
ENGI 2260	Engineering Economics	3
EE 2010	Computational Methods in Elec. & Comp. Engineering	3
		13

FOURTH YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
CECS 4230	Operating Systems	3
COE 4340	Microcomputer Interfacing	4

COE	4341	Microcomputer Interfacing Lab.	0
SOHU	XXXX	Socio-Humanistic Elective	3
EE	3002	Signals & Systems	3
			13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS	
COE	4002	Capstone Design I	3
EE	4720	Digital Signal Processing	3
CECS/ COE	XXXX	Computer Engineering Technical Elective	3
COE	4330	Computer Networks	3
COE	4331	Computer Networks Laboratory	1
			13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS	
COE	4022	Capstone Design II	3
CECS/ COE	XXXX	Computer Engineering Technical Elective	3
XXXX		Free Elective	3
			9

PROGRAM COURSES

COMPUTER ENGINEERING AND COMPUTER SCIENCE COURSES

(Go to the ECECS Department Courses for the description)

CECS 2004	Discrete Structures
CECS 2200	Computer Programming Fundamentals
CECS 2202	Computer Programming I
CECS 2203	Computer Programming I Laboratory
CECS 2222	Computer Programming II
CECS 2223	Computer Programming II Laboratory
CECS 3200	Assembly Programming Language
CECS 3202	Visual-Oriented Programming
CECS 3210	Advanced Programming
CECS 3212	Data Structures
CECS 3214	Internet Programming I
CECS 3220	Human-Computer Interaction
CECS 3234	UNIX Operating System
CECS 3302	Data Communications
CECS 4200	Programming Languages
CECS 4202	Database Systems
CECS 4204	Software Engineering
CECS 4206	Design and Analysis of Algorithms
CECS 4208	Computer Forensics
CECS 4210	Ethical Hacking
CECS 4212	Artificial Intelligence (AI)
CECS 4214	Network Security
CECS 4216	Reverse Engineering
CECS 4218	Introduction to Game Design
CECS 4220	E-Commerce
CECS 4222	Game Programming Fundamentals
CECS 4226	Computer Graphics
CECS 4228	Computational Theory
CECS 4230	Operating Systems

CECS 4234	UNIX Administration
CECS 4256	Internet Programming II

COMPUTER SCIENCE COURSES*

(Go to the ECECS Department Courses for the description)
 *Note: Courses CS 2302, CS 3010, and CS 3300, are not acceptable as valid requirements for the BScPE degree.

COMPUTER ENGINEERING COURSES

(Go to the ECECS Department Courses for the description)

COE 2300	Logic Circuits
COE 2301	Logic Circuits Laboratory
COE 3302	Digital Systems Design with VHDL
COE 3320	Microprocessors
COE 3321	Microprocessors Laboratory
COE 4002	Capstone Design I
COE 4022	Capstone Design II
COE 4320	Computer Architecture
COE 4321	Computer Architecture Laboratory
COE 4330	Computer Networks
COE 4331	Computer Networks Laboratory
COE 4340	Microcomputer Interfacing
COE 4341	Microcomputer Interfacing Laboratory
COE 4902	Undergraduate Research in Comp. Eng.
COE 4990	Special Topics in Computer Engineering

ELECTRICAL ENGINEERING COURSES

(Go to the ECECS Department Courses for the description)

EE 1130	Freshman Design for EE & CpE
EE 2000	Circuit Analysis I
EE 2001	Electrical Measurements Laboratory
EE 2010	Comp. Methods in Elect. & Comp. Eng.
EE 2020	Circuit Analysis II
EE 2500	Electronics I
EE 3002	Signals & Systems
EE 3520	Electronics II
EE 3600	Automatic Controls
EE 3610	Automation Engineering
EE 3611	Automation Engineering Laboratory
EE 3710	Random Processes
EE 4620	Robotic Engineering Design
EE 4621	Robotic Eng. Design Laboratory
EE 4720	Digital Signal Processing
EE 4722	Real Time DSP

OTHER DEPARTMENT COURSES

(Go to the Business Administration Department Courses for the description)

MGMT 4660	Entrepreneurship
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COMPUTER SCIENCE PROGRAM

The field of computer science is one of the most popular academic disciplines within our information society. Computer Scientists build computer-aided design tools, manage information technology enterprises, develop business information systems for various industries, including finance and healthcare, support wide-area, local, and cellular networks, and design embedded computer-controlled products.

The computer science program is a flexible program that can be tailored to the student's interests and adjusted to the rapid changes in the industry. The computer science curriculum was designed to satisfy the following criteria:

1. University general education requirements.
2. A common core of computer science courses to ensure a good level of understanding of computer science.
3. A breadth requirement to provide the students with a broad knowledge of the computer science field.
4. A depth requirement to ensure that the students have substantial competence in a concentration area.
5. A senior project experience under the supervision of a faculty member.
6. Elective courses to permit further breadth/depth customization of the student's program.

PROGRAM MISSION: "To prepare students with a holistic formation in mathematics, science, computation fundamentals, computers, ethical and legal aspects of computing, languages, design and analysis of algorithms, interface design, database systems and software engineering, capable of joining the workforce as computer scientists and/or pursuing graduate studies."

PROGRAM EDUCATIONAL OBJECTIVES: Graduates from the Computer Science Program will be able to:

1. Be innovators able to apply a multiple-viewpoint understanding of an application domain for the creation of integrated and usable solutions.
2. Develop successfully as team members, leaders, and managers or entrepreneurs, with the proper communication skills and ethical standards to excel as computer science professionals.
3. Be able to develop a business as a computer consultant and/or a provider of computer services and solutions within industrial and governmental organizations.
4. Engage in the lifelong learning of the theoretical and practical areas of computer science in order to keep up with the rapid technological changes and innovation, and/or pursue graduate studies.
5. Apply Computer Science knowledge to other disciplines.

STUDENT OUTCOMES: Computer Science Graduates must have:

- a) an ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline;
- b) an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution;
- c) an ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs;
- d) an ability to function effectively on teams to accomplish a common goal;
- e) an understanding of professional, ethical, legal, security and social issues and responsibilities;
- f) an ability to communicate effectively with a range of audiences;
- g) an ability to analyze the local and global impact of computing on individuals, organizations, and society;
- h) a recognition of the need for and an ability to engage in continuing professional development;
- i) an ability to use current techniques, skills, and tools necessary for computing practice.

CAREER OPPORTUNITIES: The Bachelor's Degree in Computer Science is one of the most popular programs in today's high-tech, computer oriented academic curriculums. It is ideal for undergraduates that want to obtain professional knowledge and skills that will eventually lead to a career in computer programming or a related field. The Bachelor's Degree in Computer Science (CS) will prepare the student with skills that are already of great demand in today's fast-paced, highly competitive work areas. Related positions are well paid because companies are in need of resources that know how to develop and/or maintain software and hardware components and computer systems. This program is an excellent choice for students who want to continue careers in application development, software engineering, appropriate analysis and design methods, and the development of hardware and software components.

DEVELOPMENTAL STUDIES: All students that request admission and are admitted to the Computer Science Program must show evidence that they have acquired the academic abilities and skills necessary to progress through this major. Those not demonstrating the complete acquisition of these abilities will be required to take developmental courses. Abilities and skills are demonstrated through the results of the College Entrance Examination Board Test, results in PUPR's placement test, previous university experience, other tests, or criteria. The courses are designed to help students overcome deficiencies in languages, mathematics, and science. These developmental courses are in addition to the 122 credits of the Computer Science Program. The courses are awarded their corresponding credits according to contact hours. The courses are the following:

DEVELOPMENTAL STUDIES COMPONENT
(MAXIMUM OF 27 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
SCIE 0110	Introduction to Physics	3
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

LABORATORIES: The ECECS Department provides undergraduate laboratory and research in the following topics: Electrical Measurements, Electronics, Power Electronics, Communications, Logic Circuits, Process Control & Instrumentation, Electromechanical Energy Conversion, Power System Analysis, Power System Protection, Computer Programming, Computer Interface, Computer Architecture, Computer Networks, Real Time Digital Signal Processing, and Fundamentals of Digital Signal Processing laboratories.

STUDENT ORGANIZATIONS: Students enrolled in the department may become members of the following professional and student organization: ACM (Association for Computing Machinery) - is the world's first educational and scientific computing society. Founded in 1947, ACM is a major force in advancing the skills of information technology professionals and students worldwide.

DEGREE OFFERED: PUPR offers a Bachelor of Science in Computer Science (BSCS) degree. In order to earn the BSCS degree, the student must complete the following requirements:

MINIMUM GRADUATION REQUIREMENTS

58	Credit-hours in Computer Science Core
06	Credit-hours in Computer Science Electives
14	Credit-hours in Mathematics
14	Credit-hours in Basic Sciences
18	Credit-hours in Socio Humanistic and Languages Studies
06	Credit-hours in Free Electives
03	Credit-hours in Engineering Sciences
03	Credit-hours in Management
122	Total Credit-Hours

COMPUTER SCIENCE CURRICULUM
(122 CREDIT-HOURS)

COMPUTER SCIENCE CORE COURSES
(58 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
CECS 2004	Discrete Structures	3
CECS 2200	Computer Program Fundamentals	1
CECS 2202	Computer Programming I	4
CECS 2203	Comp. Programming I Lab.	0
CECS 2222	Computer Programming II	4
CECS 2223	Comp. Programming II Lab.	0
CECS 3200	Assembly Language Programming	3
CECS 3210	Advanced Programming	3
CECS 3212	Data Structures	3
CECS 4200	Programming Languages	3
CECS 4202	Database Systems	3
CECS 4204	Software Engineering	3
CECS 4206	Design and Analysis of Algorithms	3
CECS 4228	Computational Theory	3
CECS 4230	Operating Systems	3
COE 4330	Computer Networks	3
COE 4331	Computer Networks Lab.	1
CS 2302	Digital Logic for CS Majors	3
CS 3010	Num. Analysis for CS Majors	3
CS 3300	Comp. Arch. for CS Majors	3
CS 4002	Computer Science Project I	3
CS 4022	Computer Science Project II	3

CECS TECHNICAL ELECTIVE COURSES *
(6 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
CECS 3202	Visual-Oriented Programming	3
CECS 3214	Internet Programming I	3
CECS 3220	Human-Comp. Interaction	3
CECS 3234	UNIX Operating Systems	3
CECS 3302	Data Communications	3
CECS 4208	Computer Forensics	3
CECS 4210	Ethical Hacking	3
CECS 4212	Artificial Intelligence (AI)	3
CECS 4214	Network Security	3
CECS 4216	Reverse Engineering	3
CECS 4218	Introduction to Game Design	3
CECS 4220	E-Commerce	3
CECS 4222	Game Programming Fundamentals	3

CECS	4226	Computer Graphics	3
CECS	4234	UNIX Administration	3
CECS	4256	Internet Programming II	3
COOP	3010	Professional Practice	3
CS	4902	Undergraduate Research in Computer Science*	3
CS	4990	Special Topics in Computer Science*	3
MGMT	1010	Introduction to Management	3

*Notes:

- Student is required to select twelve (12) credit-hours of available technical electives in order to acquire additional skills that reinforce the student's knowledge in a specific area of interest.
- Availability of courses CS 4902 and CS 4990, as well as COE 4902, and COE 4990 for Computer Science Program students will be determined by the Department Chairman, depending on the specific teaching or research topic.

MATHEMATICAL COMPONENT
(14 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
MATH	1330	Pre-Calculus I	3
MATH	1340	Pre-Calculus II	3
MATH	1350	Calculus I	4
MATH	1360	Calculus II	4

BASIC SCIENCE COMPONENT
(14 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
SCIE	1110	General Biology	4
SCIE	1111	General Biology Lab.	0
SCIE	1430	Physics I	4
SCIE	1431	Physics I Lab.	1
SCIE	1440	Physics II	4
SCIE	1441	Physics II Lab.	1

SOCIO-HUMANISTIC AND LANGUAGE STUDIES COMPONENT
(18 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
ENGL	1010	The Study of the Essay as a Literary Genre	3
ENGL	2020	Business English and Communication	3
SOHU	2010	Socio-Humanistic Studies I	3
SOHU	2040	Ethics, Global & Contemporary Issues	3
SPAN	1010	Linguistic Analysis of Literary Genres	3
SPAN	2020	Business Spanish	3

FREE ELECTIVES

(6 CREDIT-HOURS)

Six credit-hours of free electives in any area are to be chosen by the student.

ENGINEERING SCIENCE COMPONENT
(3 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
ENGI	2270	Engineering Probability and Statistics	3

MANAGEMENT COURSES
(3 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
MGMT	4660	Introduction to Entrepreneurship	3

COMPUTER SCIENCE PROGRAM CURRICULUM SEQUENCE

FIRST YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS	
MATH	1330	Pre-Calculus I	3
ENGL	1010	The Study of the Essay as a Literary Genre	3
SPAN	1010	Linguistic Analysis of Literary Genres	3
SOHU	2010	Socio-Humanistic Studies	3
CECS	2200	Computer Programming Fundamentals	1
			13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS	
MATH	1340	Pre-Calculus II	3
CECS	2202	Computer Programming I	4
CECS	2203	Computer Programming I Laboratory	0
CS	2302	Digital Logic for CS Majors	3
CECS	2004	Discrete Structures	3
			13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS	
MATH	1350	Calculus I	4
SCIE	1110	General Biology	4
SCIE	1111	General Biology Lab.	0
CECS	2222	Computer Programming II	4
CECS	2223	Computer Programming II Lab.	0
			12

SUMMER - FIRST YEAR		
COURSE	TITLE	CREDIT-HOURS
ENGL 2020	Business English and Communication	3
XXXX	Free Elective	3
		06

SECOND YEAR FIRST QUARTER		
COURSE	TITLE	CREDIT-HOURS
MATH 1360	Calculus II	4
CECS 3200	Assembly Language Programming	3
CECS 3212	Data Structures	3
MGMT 4660	Introduction to Entrepreneurship	3
		13

SECOND QUARTER		
COURSE	TITLE	CREDIT-HOURS
SCIE 1430	Physics I	4
SCIE 1431	Physics I Lab.	1
CECS 3210	Advanced Programming	3
CECS 4200	Programming Languages	3
		11

THIRD QUARTER		
COURSE	TITLE	CREDIT-HOURS
CS 3300	Computer Architecture for CS Majors	3
CECS 4206	Design and Analysis of Algorithms	3
SCIE 1440	Physics II	4
SCIE 1441	Physics II Lab.	1
		11

SUMMER - SECOND YEAR		
COURSE	TITLE	CREDIT-HOURS
SPAN 2020	Business Spanish	3
XXXX	Free Elective	3
		06

THIRD YEAR FIRST QUARTER		
COURSE	TITLE	CREDIT-HOURS
SOHU 2040	Ethics, Global & Contemporary Issues	3
ENGI 2270	Engineering Probability and Statistics	3
CECS 4202	Database Systems	3
CECS 4204	Software Engineering	3
		12

SECOND QUARTER		
COURSE	TITLE	CREDIT-HOURS
CS 3010	Num. Analysis for CS Majors	3
CS 4002	Computer Science Project I	3
CECS 4230	Operating Systems	3
CECS XXXX	CS Technical Elective	3
		12

THIRD QUARTER		
COURSE	TITLE	CREDIT-HOURS
CS 4022	Computer Science Project II	3
CECS 4228	Computational Theory	3
COE 4330	Computer Networks	3
COE 4331	Computer Networks Lab.	1
CECS XXXX	CS Technical Elective	3
		13

PROGRAM COURSES

COMPUTER ENGINEERING COURSES

(Go to the ECECS Department Courses for the description)

- COE 3321 Microprocessors Laboratory
- COE 4321 Computer Architecture Laboratory
- COE 4330 Computer Networks
- COE 4331 Computer Networks Laboratory

COMPUTER ENGINEERING AND COMPUTER SCIENCE COURSES

(Go to the ECECS Department Courses for the description)

- CECS 2004 Discrete Structures
- CECS 2200 Computer Science Fundamentals
- CECS 2202 Computer Programming I
- CECS 2203 Computer Programming I Laboratory
- CECS 2222 Computer Programming II
- CECS 2223 Computer Programming II Laboratory
- CECS 3200 Assembly Language Programming
- CECS 3202 Visual-Oriented Programming
- CECS 3210 Advanced Programming
- CECS 3212 Data Structures
- CECS 3214 Internet Programming I
- CECS 3220 Human-Computer Interaction
- CECS 3234 UNIX Operating System
- CECS 3302 Data Communications
- CECS 4200 Programming Languages
- CECS 4202 Database Systems
- CECS 4204 Software Engineering
- CECS 4206 Design and Analysis of Algorithms
- CECS 4208 Computer Forensics
- CECS 4210 Ethical Hacking

CECS 4212	Artificial Intelligence (AI)
CECS 4214	Network Security
CECS 4216	Reverse Engineering
CECS 4218	Introduction to Game Design
CECS 4220	E-Commerce
CECS 4222	Game Programming Fundamentals
CECS 4226	Computer Graphics
CECS 4228	Computational Theory
CECS 4230	Operating Systems
CECS 4234	UNIX Administration
CECS 4256	Internet Programming II

COMPUTER SCIENCE COURSES

(Go to the ECECS Department Courses for the description)

CS 2302	Digital Logic for Computer Science Majors
CS 3010	Numerical Analysis for Computer Science Majors
CS 3300	Computer Architecture for Computer Science Majors
CS 4002	Computer Science Project I
CS 4022	Computer Science Project II
CS 4902	Undergraduate Research in Computer Science
CS 4990	Special Topics in Computer Science

OTHER DEPARTMENT COURSES

(Go to the Business Administration Department Courses for the description)

MGMT 1010	Introduction to Management
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ECECS DEPARTMENT

ELECTRICAL ENGINEERING COURSES

EE 1130 Freshman Design for Electrical & Computer Engineers

Three credit-hours. Two two-hour lectures per week.
Prerequisites: MATH 0110 or Equivalent

An introduction to the engineering design philosophy, techniques, methodology, and graphical tools, with emphasis on teamwork. The course seeks to develop creativity and imagination skills in the solution of engineering problems, including critical thinking and logical presentation of an engineering analysis.

EE 2000 Circuit Analysis I

Three credit-hours. Two two-hour lectures per week.

Pre-requisites: SCIE 1440, MATH 1360

For EE & CpE Students Only: CECS 2200

For ME Students Only: ME 2010

Corequisites: MATH 2350

Elements in a circuit and electrical quantities. Techniques for the DC circuit analysis. Natural and forced response of

RL, RC, and RLC circuits. Introduction to AC circuits analysis.

EE 2001 Electrical Measurements Laboratory

One credit-hour. One four-hour or two two-hour lectures per week.

Prerequisites: SCIE 1441, ENGI 2270, EE 2000

Modern electronics measurement methods. Instrument calibration and use. Experimental verification of fundamental laws of electric circuits and magnetism. Experimental study of capacitive and inductive circuits. Use computer programs to analyze circuits. Safety consideration in the laboratory.

EE 2010 Computational Methods in Electrical & Computer Engineering

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2202, MATH 1360

Corequisites: SCIE 1440

Introduces and motivates some of the most important and time-tested methods and techniques for obtaining solutions to mathematical formulations by using numerical approaches amenable to their automation in the form of computer algorithms, while taking into consideration the issues resulting from the finite precision representation of numbers and limited memory available within computer systems. Main topics included are: "Gaussian Elimination, Linear Equations, Orthogonal Projections, Least-Squares & Eigenvalue Problems, and Applied Numerical Analysis. Approximations and Errors. Numerical Solution of Linear and Nonlinear Algebraic Equations, ODE, PDE, Numerical solution of RC, RL, and RLC Circuits. "Curve-Fitting".

EE 2020 Circuit Analysis II

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 2000, MATH 2350

Sinusoidal steady state analysis. AC circuit power calculation. Three phase circuits. Coupled inductors and transformers. Laplace transform in circuit analysis. Resonance and frequency response in a circuit Transfer function and passive filters.

EE 2030 Electromagnetics Theory

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 2000, MATH 1370

Study of time-varying electric and magnetic fields and Maxwell's equations describing time-varying fields. Use of Maxwell's equations to describe the propagation of electromagnetic plane waves. Reflection and transmission of waves at discontinues boundaries.

EE 2400 Electromechanical Energy Conversion I

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 2000, EE 2030

Corequisites: EE 2020

The study of the transformers, rotating machinery basics and DC machines under steady state. Safety considerations with the electric machines

EE 2401 Electromechanical Energy Conversion I Laboratory

One credit-hour. One four-hour or two two-hour lectures per week.

Prerequisites: EE 2001, EE 2400

Experimental study of electrical machines. Safety considerations with electric machines. This course is designed to give electrical engineering students a one trimester course in laboratory work on: electrical and mechanical measurements and basic operation characteristics of transformers (single and three phases) and DC machines used as motor and as generators.

EE 2410 Electromechanical Energy Conversion II

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 2400

The study of the three phase transformers and one phase/three phase ac induction motor.

EE 2411 Electromechanical Energy Conversion II Laboratory

One credit-hour. One four-hour or two two-hour lectures per week.

Prerequisites: EE 2401, EE 2410

Experimental study of induction (single and three phase), universal and synchronous motors. Safety considerations with electric machines. This course is designed to give electrical engineering students a one-trimester course in laboratory work on: electrical and mechanical measurements and basic operation characteristics of AC machines (single and three phase).

EE 2500 Electronics I

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 1130, EE 2000

Corequisites: EE 2001

This course is the first of a three-course series in electronics. Subjects include operational amplifiers, semiconductor devices, diodes, rectification, bipolar transistors, amplification, switching, and an introduction to field-effect transistors. Design and analysis techniques are presented for each subject.

EE 3002 Signals & Systems

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 2010, EE 2020

Continuous and discrete-time signals. Continuous-time system representation. Fourier series. Fourier transform. Z-transform. Discrete-time system representation. State-variable analysis.

EE 3220 Software Applications for Electrical Engineering

Three credit-hours. Two two-hour lectures per week.

Pre-requisites: CECS 2202

Basic knowledge of various engineering software applications that have proven to be very intensively used in

the industry and academic environments. Introduction to Microsoft Office, MATLAB, SIMULINK, MathCAD and Pspice Family Design Center.

EE 3420 Power System Analysis I

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 2400

Corequisites: EE 2410

The study of the power concepts in a process of generation, transmission and distribution of an electric system.

EE 3440 Electric System Design I

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 2020, EE 2400

General Design of electrical systems based in the National Electrical Code and the Puerto Rico Electric Power Authority Code.

EE 3520 Electronics II

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 2020, EE 2500

This is the second course in a three-course series in electronics. More advanced topics of semiconductor devices are introduced. Discussion topics include differential amplifiers, multistage amplifiers, frequency response, and design and analysis of other common amplifier configurations using MOSFETs and bipolar transistors and bipolar junction transistors (BJTs).

EE 3521 Electronics Laboratory

One credit-hour. One four-hour or two two-hour lectures per week.

Prerequisites: EE 2001, EE 3520

Review of laboratory measurement equipment. Perform several design experiments according with topics on electronic theory: diodes and power supplies. Behavior of BJT as amplifier, timers, OP-amp and some design applications; MOSFET as an amplifier.

EE 3600 Automatic Controls

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 3002, EE 3520

Study of linear control systems. Transfer functions. Stability criteria. Compensation techniques. Analysis of a particular system and determination of an optimal design complying with given specifications. A design project will be required.

EE 3610 Automation Engineering

Three credit-hours. Two two-hour lectures per week.

Prerequisites: COE 2300, COE 2301

Corequisites: EE 3611

Study of the theory and practices of the technologies used for industrial automation. The PLC is used as the main micro-controller device to interface with sensors, relays, electro-pneumatics, and motors. Different problems and situations are presented to the students and they prepare

and design the solution. A final project is presented at the end of the class.

EE 3611 Automation Engineering Laboratory

One credit-hour. One four-hour or two two-hour lectures per week.

Prerequisites: COE 2300, COE 2301

Corequisites: EE 3610

Experimental exercises with sub-systems used on industrial control applications. The PLC is used as the main micro-controller. Design and programming of PLC based systems are performed. A field trip to the industry is made as part of the laboratory.

EE 3700 Communication & Wireless Systems I

Three credit-hours. Two two-hour lectures per week.

Prerequisites: ENGI 2270, EE 2030, EE 3002

Analysis and Transmission of Signals. Amplitude modulation (AM) and Angle modulation (FM, PM). Introduction to Random Processes Concepts. Introduction to Wireless Systems. Propagation Characteristic of Wireless Channels. Fading.

EE 3710 Random Processes

Three credit-hours. Two two-hour lectures per week.

Prerequisites: ENGI 2270, EE 3002

After completing this course the students should master the theoretical principles regarding Probability and Random Processes and be familiar with some of its basic applications to electrical engineering. Topics include Probability, Random Variables, Operations in Single and Multiple Random Variables, Random Processes, Spectral Characteristics of Random Processes, Linear System with Random Inputs.

EE 4002 Capstone Design Course I

Three credit-hours. Two two-hour meetings per week.

Prerequisites: Departmental Permit. Must have approved all Basic Electrical Engineering Core courses plus ENGI 2260, plus 15 credits of EE Department Technical Electives.

First part of a two-term course on the design of projects based on open-ended requirements. Projects will be selected in accordance with the student's area of interest (i.e., Electric Power, Electronics, Communications, Automatic Controls, etc.). Students must approve both Capstone Design Courses in sequence and without interruptions. Students that approve the first course and miss the second course will be required to repeat the first course again.

EE 4022 Capstone Design Course II

Three credit-hours. Two two-hour meetings per week.

Prerequisites: EE 4002

Second part of a two-term course on the design of projects based on open-ended requirements. Students must approve both Capstone Design Courses in sequence and

without interruptions. Students that approve the first course and miss the second course will be required to repeat the first course again.

EE 4400 Power System Analysis II

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 3420

Corequisites: EE 2411, EE 4401

Review of impedance and admittance matrix construction and reduction. Review of transformer line and machine models suitable for short circuit and steady state analysis. Power flow analysis using the Gauss Seidel method. Case studies of power flow analysis. Short circuit analysis of three phase, single phase and phase to phase faults. Breaker selection.

EE 4401 Power System Analysis Laboratory

One credit-hour. One four-hour or two two-hour lectures per week.

Prerequisites: EE 3420

Corequisites: EE 4400

Experiments with electric power transmission systems, three phase generation, power lines, and synchronous motors.

EE 4422 Electric Power Quality

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 2410, EE 4400

Measurements and Industry Standards for Power Quality. Component modeling and network analysis under non-sinusoidal conditions. Effects of nonlinear loads. Harmonics and flicker distortion in power systems. Sags, swells, impulses and other transient events. Improvement practices.

EE 4432 Power System Protection

Three credit-hours. Two two-hour lectures per week.

Prerequisites: EE 4400

Introduction and general philosophies of protection for power systems. Analysis of power system during faults and abnormal conditions. Application of protective relays in electric power systems. Study of protection schemes for Transmission and Distribution lines, Substations, Transformers and Generators.

EE 4433 Power System Protection Laboratory

One credit-hour. One four-hour or two two-hour lectures per week.

Prerequisites: EE 4432

Experimental works with protective relays and auxiliary equipment. Calibration, testing and setting of protective relays. Discussions topics include transient effects in power system networks, short circuit analysis using symmetrical components, instruments transformer PT's and CT's test, moderates protective relaying coordination studies, overcurrent relays, directional overcurrent relays, bus and transformer differential relays test and simulation. Protection and control drawing interpretation containing ANSI and IEEE guides and standard.

EE 4436 Distribution System Design**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 4400**

Distribution System Planning. Load Characteristics. Distribution Transformers. Substation Components. Design of Primary and Secondary Systems. Voltage drop and Power loss considerations. Capacitors Applications. Voltage Regulation.

EE 4444 Electric System Design II**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 3420, EE 3440**

General Design of electrical systems based in the National Electrical Code and the Puerto Rico Electric Power Authority Code.

EE 4450 Wind Power Systems**Three credit-hours. Two two-hour lectures per week.****Prerequisites: ENGI 2260, ENGI 2910, EE 1130, EE 3440****Corequisites: EE 3420**

Study of the wind properties for its conversion into a useful form of energy. Wind measurement using the International Standard Atmosphere Model (ISA) in wind. Operation and design of electrical generation systems using wind power systems. Consideration of standard methods to estimate the wind Annual Energy Output (AEO). Treatment of the power quality and safety regulations, according with the National Electrical Code, Small Wind Electric System, Article 694. Wind power component configuration analysis in stand-alone application. Wind power component configuration analysis in grid tie & net metering application.

EE 4460 Photovoltaic Systems**Three credit-hours. Two two-hour lectures per week.****Prerequisites: ENGI 2260, EE 3440, EE 3520****Corequisites: EE 3420**

Operation and design of electrical generation systems using photovoltaic (PV) solar panels. Study of the codes rules, standards, and calculations that apply to these systems, as well as the procedures required to obtain the necessary approvals of the government agencies for the designs. Considerations in how to incorporate a PV System into a stand-alone or grid connected way. Other concerns like throw site evaluation, energy evaluation, component operation, system design and sizing, and installation requirements are treated.

EE 4462 Electrical Construction Project Management**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 4444**

Principles of Project Management applied to case studies of the Electrical Construction Industry, and conforming with NECA, MCAA, & SMAGNA techniques.

EE 4464 Generation Control Systems**Three credit-hours. Two two-hour lectures per week.****Pre-requisites: EE 4400**

Power Plant components. Generating Plants Types. Characteristics of power generating units. Economic dispatch of thermal units and methods of solution. Unit Commitment. Automatic Generation Control. Introduction to Power System Stability.

EE 4502 Power Electronics**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 3600****Corequisites: EE 4503**

Electrical rating and characteristics of power semiconductor switching devices. Phase controlled rectifiers. Fundamental switching regulators. DC choppers. Static power inverters. Load considerations. Design projects will be required.

EE 4503 Power Electronics Laboratory**One credit-hour. One four-hour or two two-hour lectures per week.****Prerequisites: EE 3521****Corequisites: EE 4502**

Experiments with the Power Electronics Converters: AC-DC, DC-DC, and DC-AC. Closed-loop control of DC drives and Closed-loop control of induction motors. Use of computer programs to analyze circuits. Safety consideration in the laboratory.

EE 4520 Advanced Electronics**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 3520**

Advanced theory, design, and simulation techniques for linear, analog integrated circuit building blocks. Topics include feedback, output stages, power amplifiers, and a thorough analysis of the 741 operational amplifiers.

EE 4602 Process Control & Instrumentation**Three credit-hours. Two two-hour lectures per week.****Prerequisites: ENGI 3440, EE 3600**

Study of process control strategies. Electronic and pneumatic instrumentation. Linearization of nonlinear continuous systems. Application of linear control theory to nonlinear continuous process. Study of a particular process and determination of the necessary instrumentation and control strategy to be used. Study of ladder logic networks and its implementation with PLC controllers. Design projects will be required.

EE 4603 Process Control & Instrumentation Laboratory**One credit-hour. One four-hour or two two-hour lectures per week.****Prerequisites: EE 4602**

Experiments for process control and instrumentation. Transducers, transmitters, analog and digital controllers, controls valves, switches, and indicators. Experiments with a process control trainer and programmable logic controllers.

EE 4612 Control System Design**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 3600**

Principles of analog and digital control. Analog and digital control using the PID controller. Design strategies with time specifications. Design strategies with frequency specifications. Special topics. Design projects will be required.

EE 4620 Robotic Engineering Design**Four credit-hours. Two two-hour lectures per week.****Prerequisites: EE 3600****Corequisites: EE 4621**

Study of the technology, programming, applications, theory and practices of robotic systems. All the basic systems of the robots are covered including manipulators, hardware components, sensors and programming. The course covers design, and applications.

EE 4621 Robotic Engineering Design Laboratory**Zero credit-hour. One four-hour or two two-hour lectures per week.****Prerequisites: EE 3600****Corequisites: EE 4620**

Experimental exercises with sub-systems used in robotic applications. Design and programming of PLC based systems are performed. A field trip to the industry is made as part of the laboratory.

EE 4630 Selected Topics in Control**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 2010, EE 3600**

Introduction to the use of soft computing techniques like fuzzy logic, neural networks (NN) and genetic algorithms (GA) for control systems design. State-space representation of dynamic systems. Discretization of continuous-time state-space. Controllability and Observability. Pole-placement and estimator design techniques. Use of the MATLAB Fuzzy Logic, Neural Networks and Control System toolboxes. Additional topics may be included.

EE 4706 Fiber Optics Systems Design**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 2030. Departmental Permit with 107 credits.**

Application of electromagnetic and optical physics theory, digital communication theory, and modulation techniques to the design of fiber optic transmission systems. A design project is required.

EE 4716 Communication & Wireless Systems II**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 3700**

Introduction to Random Processes and review of the Sampling Theorem. Pulse amplitude modulation. Baseband digital transmission with PCM, DPCM, DM, ADM. Line coding. Passband binary digital transmission including ASK,

FSK, PSK, and DPSK. M-ary modulation techniques. Advanced digital communication systems including spread spectrum systems and orthogonal frequency division multiplexing. Overview of the Behavior of digital communication systems in presence of AWGN. Cells and Cellular Traffic. Large scale path loss models.

EE 4718 Communication Systems, Simulation & Design**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 4716**

Students in this class consider simulation and design of analog and digital communications systems. Design procedure includes two parts 1) theoretical design, and 2) modeling of the designed system by simulation. It is used MATLAB, SIMULINK, the COMMUNICATION and the DSP block-sets to verify and test the designed models. The simulating models help to apply theory to practice. The students simulate the various models of the analog and digital communication systems like DSB-SC AM, DSB-AM, SSB-AM inside the Amplitude modulations schemes, Frequency and Phase modulations, Binary and M-ary baseband and passband modulations, Time division and frequency division multiple access.

EE 4720 Digital Signal Processing**Three credit-hours. Two two-hour lectures per week.****Prerequisites: ENGI 2270, EE 3002**

Topics include LSI systems, the DTFT, the DFT, and the FFT. Study of linear and cyclic convolution. The Z-transform. Filter structures. Introduction to FIR and IIR digital filter design. Several DSP applications are discussed and demonstrated. MATLAB simulations and a final project are required.

EE 4722 Real Time Digital Signal Processing**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 4720, COE 3320**

This course provides theoretical and hands on experience regarding the implementation of DSP algorithms in fixed point or floating point DSP Processors and FPGAs. Includes the implementation of digital filters (FIR and IIR) for real time processing of audio signals.

EE 4730 Radio Frequency Circuit Design**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 2030, EE 3520****Corequisites: EE 3700**

Introduction to high-frequency analog circuit design. This course provides a solid background for continued studies of wireless communications. Topics include RF concepts, lumped component models, transmission line fundamentals, the Smith Chart and its applications, resonant circuits and filters and small signal amplifiers with s-parameters.

EE 4740 Communication & Wireless Systems III**Three credit-hours. Two two-hour lectures per week.****Prerequisites: EE 4716**

Corequisites: EE 3710

Behavior of analog and digital communication systems in presence of AWGN. Performance of various modulation / demodulation schemes in fading channels. Review of Propagation Models, Fading. Fading Mitigation. Modems for Wireless Communication. Multiple-Access Techniques in Wireless Communications.

EE 4902 Undergraduate Research in Electrical Engineering

Three credit-hours Pre-requisites: Fourth-year Electrical Engineering student with 3.00 or higher GPA. Departmental Permit.

Research study in advanced topics in areas of electrical engineering like electric power systems, solid state electronics, communication systems, industrial control, robotics, digital signal processing, among others. The research can be conducted in two ways: a research paper or the implementation of a project. Each project will be evaluated observing the use of the recommended guidelines required to develop the project.

EE 4990 Special Topics in Electrical Engineering

Three credit-hours. One four-hour or two two-hour lectures per week.

Prerequisites: Departmental permit according to topics to be addressed.

Advanced topics (4th year level) in areas of current research in electrical engineering. Many include topics in advanced electric power systems, solid-state electronics, communication systems, industrial control, and robotics, among others.

COMPUTER ENGINEERING COURSES

COE 2300 Logic Circuits

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2200

Corequisites: COE 2301

This course covers a full range of topics such as number systems and codes, digital circuits, Boolean algebra, minimization of logic functions, combinational logic design and practices, introduction to combinational logic design with PLDs, sequential logic design principles and practices. A general exposure to the combinational design of an Arithmetic-Logic Unit (ALU) and the sequential design with PLDs. ROM and RAM system-level design is given. Design Projects will be required.

COE 2301 Logic Circuits Laboratory

One credit-hour. One four-hour or two two-hour lectures per week.

Prerequisites: EE 2001

Corequisites: COE 2300

This laboratory provides an experimental study using the TTL digital logic circuits. Two levels of integration are used: small-scale integration (SSI) and medium-scale integration

(MSI). These logic circuits are then used in such applications like: combinational logic analysis and design, multiplexing, decoding, arithmetic and comparison operations, memory devices, counting, and sequential logic analysis and design. Computer simulation will also be required.

COE 3302 Digital Systems Design with VHDL

Three credit-hours. Two two-hour lectures per week.

Prerequisites: COE 2300

Study of the modern methodology for digital system design using CAD tools and VHDL/Verilog as design language. Design of components toward integration into a system to be used for particular purposes.

COE 3320 Microprocessors

Three credit-hours. Two two-hour lectures per week.

Prerequisites: COE 2300

Corequisites: COE 3321

This course covers a full range of topics such as: numerical base, basic computer architecture and organization, microprocessor and microcontroller architecture, programmer models, microprocessor addressing modes, instruction set, and assembly language. A design project will be required.

COE 3321 Microprocessors Laboratory

One credit-hour. One four-hour or two two-hour lectures per week.

Prerequisites: COE 2301 or CS 2302 for CS Majors

Corequisites: COE 3320 or CECS 3200 for CS Majors

The laboratory provides an introduction to microprocessor systems programming, including both hardware interfacing and software fundamentals.

COE 4002 Capstone Design Course I

Three credit-hours. Two two-hour meetings per week.

Prerequisites: All Computer Engineering core courses before 4th year. Senior standing. Departmental permit.

First part of a two-term course on the design of projects based on open-ended requirements. Projects will be selected in accordance with the student's area of interest (i.e., digital circuits, VLSI testing, software engineering, parallel processing, computer graphics, visualization, artificial intelligence, data base, HCI, computer Hardware, computer Software, data mining, etc.). Students must approve both Capstone Design Courses in sequence and without interruptions. Students that approve the first course and miss the second course will be required to repeat the first course again.

COE 4022 Capstone Design Course II

Three credit-hours. Two two-hour meetings per week.

Prerequisites: COE 4002

Second part of a two-term course on the design of projects based on open-ended requirements. Students must approve both Capstone Design Courses in sequence and

without interruptions. Students that approve the first course and miss the second course will be required to repeat the first course again.

COE 4320 Computer Architecture

Four credit-hours. Two two-hour lectures per week.

Prerequisites: COE 3320

Corequisites: COE 4321

Instruction set architecture, functional organization, and implementation of a computer are studied from the performance point of view, to provide the students with the principles and techniques used in the design of modern computer systems.

COE 4321 Computer Architecture Laboratory

Zero credit-hour. One four-hour or two two-hour lectures per week.

Corequisites: COE 4320

A practical experience on design, organization, performance measurement, benchmarks, and implementation of a computer system.

COE 4330 Computer Networks

Three credit-hours. Two two-hour lectures per week.

Corequisites: CECS 4230, COE 4331

Focuses on the ISO-layers above the Data link layer. Problems solved by each layer are discussed and the entities, techniques and protocols used as solutions are presented and discussed in detail. Algorithms for routing, spanning tree, and others are presented. Techniques for improving flow control, their impact on performance, and criteria for their adoption are discussed. IP addressing schemes and address translation between addressing levels are discussed. The course closes with the discussion of various application-level protocols; file transfer, network management and others.

COE 4331 Computer Networks Laboratory

One credit-hour. One four-hour or two two-hour lectures per week.

Corequisites: CECS 4230, COE 4330

The laboratory exemplifies the techniques and devices that implement the solutions to communication problems discussed in class. Covers structured wiring schemes and their combination with wireless access schemes. Configures communication protocol stacks within various operating systems. Simulation and analysis of techniques that solve important communication problems. Covers various communication applications and issues of security and reliability related to different network topologies and configurations.

COE 4340 Microcomputer Interfacing

Four credit-hours. Two two-hour lectures per week.

Prerequisites: COE 3320

Corequisites: COE 4341

Practical architectural view of microprocessor and detailed description of its interfacing elements. Laboratory assignments place emphasis on the MC68HC12 and MC9S12DP256B microcontrollers, their I/O capabilities; peripheral interfacing chips for memory and devices, and counter-timers and interrupts. Interrupts and interrupt handlers are discussed in detail. Weekly interfacing problems and a design project are required.

COE 4341 Microcomputer Interfacing Laboratory

Zero credit-hour. One four-hour or two two-hour lecture periods per week.

Corequisites: COE 4340

The laboratory emphasizes in the I/O capabilities, peripheral interfacing chips for memory and devices, counter-timers and interrupts. Interrupts are discussed in detail. Weekly interfacing problems are discussed. A design project is required.

COE 4902 Undergraduate Research in Computer Engineering

Three credit-hours

Prerequisites: Fourth-year Computer Engineering student with 3.00 or higher GPA. Departmental Permit.

Research study in advanced topics in areas of computer engineering like data communication systems, digital testing, digital signal processing, artificial intelligence, computer security, distributed systems, and parallel computation, among others. The research can be conducted in two ways: a research paper or the implementation of a project. Each project will be evaluated by observing the use of the recommended guidelines required to develop the project.

COE 4990 Special Topics in Computer Engineering

Three credit-hours. One four-hour or two two-hour lecture periods per week.

Prerequisites: Departmental permit according to topics to be addressed.

Advanced topics (4th year level) in areas of current research in computer engineering. Many include topics in data communication systems, computer graphics, robotics, computer architecture, digital testing, image processing, parallel computing, software engineering, computer languages, and real-time systems, among others.

COMPUTER ENGINEERING AND COMPUTER SCIENCE COURSES

CECS 2004 Discrete Structures

Three credit-hours. Two two-hour lectures per week.

Prerequisites: MATH 1330 or Equivalent

Corequisites: MATH 1340

Fundamental mathematical concepts related to computer science, including finite and finite sets, relations, functions, and propositional logic. Introduction to other proofing

techniques. Modeling and solving problems in computer science. Introduction to permutations, combination graphs, and trees with applications.

CECS 2200 Computer Programming Fundamentals

One credit-hour. One four-hour or two two-hour lectures per week.

Prerequisites: MATH 0110 or Equivalent

Introductory laboratory teaching the concept of an algorithm as a systematic solution to a problem. Students learn to represent algorithms using flowcharts and pseudocode. Fundamental constructs of structured programming languages such as variables, operators, selection, and repetition statements are then used to capture these algorithms for automated execution in a computer. Students learn to use a development environment and a high level language such as C++.

CECS 2202 Computer Programming I

Four credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2200

Corequisites: CECS 2203

The course is a follow-up to the CECS 2200 course and continues with the development of algorithms and programming skills using C++. It emphasizes modular program design using functions, arrays, and pointers. The course introduces fundamental object-oriented concepts such as class, object, instance variables, instance methods, and constructors and destructors.

CECS 2203 Computer Programming I Laboratory

Zero credit-hour. One four-hour or two two-hour lectures per week.

Corequisites: CECS 2202

This course is the Laboratory companion to the Computer Programming I course (CECS2202). It uses two different pedagogic strategies to assure that student carry out their lab projects successfully. The students complete a set of mini-projects in a closed laboratory setting. Each set of mini-projects provides them with the practical skills required to tackle a major project as a take home open-lab assignment. All projects are carried out using an Integrated Development Environment for the C++ language.

CECS 2222 Computer Programming II

Four credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2202

Corequisites: CECS 2223

This course continues the development of the students' skills in algorithm programming using the object oriented paradigm. It emphasizes dynamic memory allocation, composition, inheritance, templates, exception handling, and file processing.

CECS 2223 Computer Programming II Laboratory

Zero credit-hour. One four-hour or two two-hour lectures per week.

Corequisites: CECS 2222

This course is the Laboratory companion to the Computer Programming II course (CECS 2222). The students complete a set of mini-projects in a closed laboratory setting. Each set of mini-projects provides them with the practical skills required to tackle a major project as a take home open-lab assignment. All projects are carried out using an Integrated Development Environment for the C++ language.

CECS 3200 Assembly Language Programming

Three credit-hours. Two two-hour lectures per week.

Prerequisites: COE 2300 or CS 2302 for CS Majors

This course introduces students to the fundamental principles of machine language. Basic concepts such as number or data representation (binary, hexadecimal and others), branching and looping, memory organization, operands, instruction cycle, addressing modes, exception handling, etc. are introduced.

CECS 3202 Visual-Oriented Programming

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2202

This course is an introduction to Visual Basic. Course covers the fundamentals of visual programming in Visual Basic. Topics discussed cover: variables and operators, using decision structures, loops and timers, strings, modules, procedures, arrays, and graphical user interfaces.

CECS 3210 Advanced Programming

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2222

This course aims to advance your basic programming skills, with special attention to user interface design, problem solving, and coding style in an object-oriented event-driven language, such as C#. Topics include: objects, classes and events, GUI design, and multithreading. Optional topics are: graphics and databases.

CECS 3212 Data Structures

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2004, CECS 2222

The course covers fundamental data structures, the tradeoffs these imply for various sorting and searching algorithms, and their application using C++ or similar high-level language. The course emphasizes recursion, and the use of pointers, lists, stacks, queues, tables, and trees. The computational performance of searching and sorting techniques using big-O notation are also discussed. Several programs are assigned.

CECS 3214 Internet Programming I

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2222

Covers the fundamental concepts guiding the emergence of the Internet and WWW. Focuses on technologies used at the browser's side. Includes, XHTML, advanced elements such as tables, forms and frames, use of JavaScript for DOM manipulation. Emphasizes efficiency and scalability in the

creation and maintenance of websites, including style sheets (CSS) and separation of content from presentation. An introduction to XML and related standards is included.

CECS 3220 Human-Computer Interaction

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2222

The course explores user-centered design approaches in information system applications. Addresses the user interface and software design strategies, user experience levels, interaction styles, usability engineering and collaborative systems technology.

CECS 3234 UNIX Operating System

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2222

Concepts of the UNIX operating system are presented. The course will also provide a deep and thorough knowledge of UNIX and its utilities. Topics include system commands, system editors, awk, sed, text formatting, and shell programming. The use of modem and terminal software and system maintenance utilities are covered as well as system call in C, lex, yacc, ar, and make.

CECS 3302 Data Communications

Three credit-hours. Two two-hour lectures per week.

Prerequisites: COE 2300 or CS 2302 for CS Majors

This course is concerned with the exchange of data between directly connected devices. The key aspects of transmission, interfacing, link control, and error-free data transfers are examined. The physical and data link layers are discussed for a variety of LAN and WAN technologies. Design projects are required.

CECS 4200 Programming Languages

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 3212

The course covers general concepts and constructs of several major programming paradigms. The design issues involved in the various language constructs are discussed and how these choices lead to different languages. Imperative, declarative, logic, functional, and object-oriented programming paradigms are illustrated in languages such as Pascal, Prolog, Lisp and C++. Methods used for describing the semantics and syntaxes of programming languages are introduced, such as: EBNF, syntax graphs, attribute grammars, operational, and denotation semantics.

CECS 4202 Database Systems

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2004, CECS 2222

This course is an introduction to the database concept. The course covers data models, relational database concepts, hierarchies, relational algebra and SQL, storage structures, and the role of databases and computers in application environments. Various programming assignments in SQL and a design project are required.

CECS 4204 Software Engineering

Three credit-hours. Two two-hour lectures per week.

Corequisites: CECS 4202

Familiarity with Windows or Unix applications, and knowledge of advanced object oriented programming is required. An entire software development cycle is executed on a small scale project. The Object Oriented analysis, design, coding, and testing techniques using the Unified Modeling Language (UML) are discussed in detail. Tools to support Software Engineering methods for Project Planning, Software Configuration Management, and OOD are demonstrated and used by the students to create sample Software Engineering work products. Some of these Computer Aided Software Engineering (CASE) tools include MS Project, WinCVS, Visual Source Safe, Visual Studio .NET.

CECS 4206 Design and Analysis of Algorithms

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 3212

This course covers issues that arise in the analysis and design of algorithms used for solving computational problems. A number of common algorithm design paradigms and examples are presented and explained. Algorithm design issues are contemplated. Computability and computational tractability concepts are introduced. Examples of computational problems with no algorithmic solution are analyzed. The importance of time and space requirements are greatly considered as the student designs algorithms to solve computational problems.

CECS 4208 Computer Forensics

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 3212

The computer forensics course teaches students the basics of how a computer forensic case is carried out. The course covers the basic elements of criminology, legal theory as it applies to computer forensics, as well as the investigative process. The course teaches the necessary technical theory and practical aspects of forensic investigations. It emphasizes proper collection of evidence, proper documentation handling and information disposal procedures.

CECS 4210 Ethical Hacking

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 3212

This course covers the basic skill set in the area of ethical hacking. The course explains how to analyze exploits by examining and coding them, while discussing how to protect the computing infrastructure from those same attacks. It will also examine how the process of ethical hacking is carried out in a business environment.

CECS 4212 Artificial Intelligence (AI)

Three credit-hours. Two two-hour lectures per week.

Prerequisites: ENGI 2270, CECS 3212

The course surveys the major topics in Artificial Intelligence (AI). It begins with an overview of what constitutes AI and an introduction to intelligent agents. This is followed by a series of traditional AI topics such as logic, knowledge representation, reasoning, planning, inference using predicate calculus, heuristic and adversary search, genetic algorithms and machine learning. Other units follow on natural language processing and speech recognition.

CECS 4214 Network Security

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 3212

This course covers current network technologies and the methodologies used to secure them. The course provides a hands-on approach where the student will learn the theory as well as the implementation of network security technologies in a controlled environment. The course includes a "Capture the flag" simulation where students are expected to protect the infrastructure from real attacks on an isolated network.

CECS 4216 Reverse Engineering

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 3212

The subject of reverse software engineering is the process of analyzing binary code to create a higher-level representation of the program being examined. This is accomplished by applying reversing techniques to obtain the assembly code from the binary executable and then obtain the C/C++ structure from the recovered assembly code. The course will study the ways in which protection mechanisms have been circumvented in the past through reverse engineering and the current methods employed to protect programs from reverse engineering. The course also emphasizes the methods by which IT personnel and programmers can protect software applications from circumvention by an attacker, thereby protecting the IT infrastructure.

CECS 4218 Introduction to Game Design

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2200, EE 1130 for EE & CpE Majors

This course is an introduction to the process of game design prior to game development, including the development of an idea and the production of a game design document. Topics include game elements, player motivation, game dynamics, game culture, game design team roles and game design process workflow.

CECS 4220 E-Commerce

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2222

This course will study the structure, organization, and use of the Internet. Internet technologies and their potential applications are examined including electronic commerce, database connectivity, and security. An emphasis will be placed on evaluating, organizing, and developing efficient

models of electronic transactions and Web Information Systems.

CECS 4222 Game Programming Fundamentals

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2222, CECS 4218

In-depth coverage of the object-oriented architectures and software design patterns used for game design. Students work with a game engine software framework to design and implement several kinds of games. Additional topics include animation techniques, physics simulation, user controls, graphical methods, and intelligent behaviors.

CECS 4226 Computer Graphics

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2222

The course covers the representation and manipulation of two and three-dimensional transformations, projection, illumination and shading models. The course will focus on algorithms and techniques that have emerged in the past several years. Topics include basic modeling and rendering methods; volumes and scientific visualization techniques, visual programming languages and environments, and computer animation. Also presents computer graphics as an aid in the presentation and analysis of information. Additional topics include basic graphic techniques (e.g. histograms, bar charts, pie charts), the theory of graphic presentation of information, desktop publishing software, presentation software, and graphical output devices such as: graphics monitors (EGA, CGA, VGA, RGB, composite), laser printers, computer screen projection systems, and standards.

CECS 4228 Computational Theory

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 3212

Introduces basic concepts in computation and computability theory. The course covers formal languages, models of computation and computational complexity. Major topics include regular languages, context-free languages, decidability, reducibility, time complexity and space complexity.

CECS 4230 Operating Systems

Three credit-hours. Two two-hour lectures per week.

Corequisites: COE 4320 or CS 3300 for CS Majors

Operating systems are the programs that manage the computer hardware resources, and augment or enhance their basic functionality on behalf of the application programs that use the computer. The course discusses various aspects of computer operating systems including processes, process scheduling, memory management, concurrent programming, deadlocks, and others.

CECS 4234 UNIX Administration

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 3234

This course consists of an overview of the UNIX operating system and focuses on the Administrative tasks related to maintaining an UNIX based system, interconnecting UNIX with other operating systems and securing UNIX in a networked environment. A basic knowledge of the UNIX operating is required as well as general knowledge about computer systems. During the course the students will participate in several workshops ranging from the initial installation of an operating system to the final configuration and implementation.

CECS 4256 Internet Programming II

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 3214, CECS 4202

Focuses on technologies used at the Server's side for developing web applications. Includes XML, DTD's, XML Schemas, XSL, XSLT, and various markup languages based on these. Covers the configuration, management and development environments around major Web servers. Tools and patterns for application of various frameworks are covered including Java Servlets, JSP, ASP, ASPX and others. An introduction and overview of advanced techniques such as Web Services, JINI, and Java Spaces is carried out when possible.

COMPUTER SCIENCE COURSES

CS 2302 Digital Logic for Computer Science Majors

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2200

The course covers the following topics: digital and analog systems, binary systems, digital systems, structure and behavior, design levels, combinational and sequential systems.

CS 3010 Numerical Analysis for Computer Science Majors

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 2202, MATH 1360

Corequisites: SCIE 1440

This course gives students the ability to apply solutions for approximations and errors, numerical solutions of linear and non-linear algebraic equations, ODE, PDE, numerical solutions of scientific problems, curve-fitting.

CS 3300 Computer Architecture for Computer Science Majors

Three credit-hours. Two two-hour lectures per week.

Prerequisites: CECS 3200

This course introduces students to the fundamental concepts and architectural structures of computers. The basic elements of computer architecture and the conversion of assembly programming code to machine language (used to feed instructions to the processor for the optimum use of its resources) are covered in the course. Some of the topics are: procedures, string operations, bit manipulation, decimal

and floating point arithmetic, registers, input/output and memory management.

CS 4002 Computer Science Project I

Three credit-hours. Two two-hour meetings per week.

Prerequisites: All Computer Science core courses before 3rd year. Senior standing. Departmental permit.

First part of a two-term course on projects based on open-ended requirements. Projects will be selected in accordance with the student's area of interest. Students must approve both Computer Science Project Courses in sequence and without interruptions. Students that approve the first course and miss the second course will be required to repeat the first course again.

CS 4022 Computer Science Project II

Three credit-hours. Two two-hour meetings per week.

Prerequisites: CS 4002

Second part of a two-term course on projects based on open-ended requirements. Projects will be selected in accordance with the student's area of interest. Students must approve both Computer Science Project Courses in sequence and without interruptions. Students that approve the first course and miss the second course will be required to repeat the first course again.

CS 4902 Undergraduate Research in Computer Science

Three credit-hours.

Prerequisites: Third-year Computer Science student with 3.00 or higher GPA. Departmental Permit.

Research study in advanced topics in areas of computer science like artificial intelligence, databases, knowledge discovery, data warehousing, computer security, distributed systems, and parallel computation, among others. The research can be conducted in two ways: a research paper or the implementation of a project. Each project will be evaluated observing the use of the recommended guidelines required to develop the project.

CS 4990 Special Topics in Computer Science

Three credit-hours. One four-hour or two two-hour lectures per week.

Prerequisites: Departmental permit according to topics to be addressed.

Advanced topics (3rd and 4th year level) in areas of current research in computer science. Many include topics in data mining, e-commerce, evolutionary algorithms, and data warehousing, distributed computing, computer security, human computer interaction, e-learning, knowledge.

COURSES FOR NON-ELECTRICAL ENGINEERING MAJORS

ENGI 2310 Computer Programming & Algorithms

Three credit-hours. Two two-hour lectures per week.

Prerequisites: MATH 1330 or Equivalent

The students will learn the steps that lead to the possible solution to a problem. In addition, the course presents the

tools used in the development of a program.

ENGI 2320 Principles of Electrical Engineering

Three credit-hours. Two two-hour lectures per week.

Prerequisites: SCIE 1440

Introduction to fundamental electrical engineering concepts. Study of electrical quantities such as current, voltage, energy, and power. Study of the ideal behavior of resistors, inductors, and capacitors as well as various independent and dependant ideal energy sources. Introduction to basic techniques of electrical circuit analysis.

DEPARTMENTAL FACULTY

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Surveying and Geospatial Science Department

LAND SURVEYING AND MAPPING PROGRAM

Land Surveying is the science of determining the position of points on the surface of the Earth through the application of mathematics and the use of specialized instruments. The term "Earth surface" refers to everything on Earth that can be explored: the bottom of the seas, bays, lakes and rivers; the interior of caves and mines; mountains and deserts; and even the frozen and desolated polar regions. Surveying includes the measurement of angles and distances, the establishment of horizontal and vertical control points, plan confection, cadastral measurements, highway tracing and building locations, submarine topography and oceanic depths, plus the location of legal boundaries.

PROGRAM MISSION

Provide the theoretical and technical knowledge through an educational experience that enriches the lives of program students so that they are prepared to enhance the surveying profession and protect the health and welfare of the public while expanding the base of knowledge through research and scholarship.

PROGRAM EDUCATIONAL OBJECTIVES

1. Contribute to society with professionals that execute their work following the principles of moral conduct and ethics.
2. Generate graduates with the necessary knowledge and techniques to pursue education at a graduate level.
3. Generate graduates that can be employed and successfully work in a broad range of sub disciplines within the field.
4. Demonstrate an understanding of the need for lifelong learning via successful completion of continuous education.

PROGRAM EXPECTED OUTCOMES

- 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 design a system, component, or process to meet the desired needs.
- d. An ability to function on multi-disciplinary teams.
- e. An ability to identify, formulate, and solve applied sciences 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 Surveying solutions in a global and social context.
- i. Recognition of the need for, and the ability to engage in lifelong learning.
- j. A knowledge of contemporary issues.
- k. An ability to use the techniques, skills, and modern tools necessary for professional practice.

CAREER OPPORTUNITIES. The Geospatial Technology industry is currently undergoing the biggest process of growth among engineering related fields. Since Land Surveying and Mapping has been recognized among those professions, therefore this study program offers great job opportunities, along with conventional surveying opportunities. The combination of theoretical knowledge supported by the multidisciplinary technologies introduced in this bachelor degree opens a big spectrum of opportunities for diverse types of jobs. Governmental agencies and the private sector are constantly hiring professionals to work on surveying or related projects. Real Estate Industry is another market in which our students collaborate. Accredited by ABET since 2007, this program counts with the recognition of the degree offered in Puerto Rico among the 50 States and several other jurisdictions.

DEGREE OFFERED: The Surveying and Geospatial Science Department offers undergraduate courses leading to the degree of Bachelor of Science in Land Surveying and Mapping (B.S.L.S.). In order to get this degree, the student must complete the following minimum requirements:

MINIMUM GRADUATION REQUIREMENTS

4	Credit-Hours in Mathematics
10	Credit-Hours in Basic Science
21	Credit-Hours in Socio-Humanistic Studies and Languages
42	Credit-Hours in Surveying
47	Credit-Hours in Geomatic Science
6	Credit-Hours in Real Estates Appraisal
9	Credit-Hours Electives Component
139	Total Credit-Hours

LABORATORIES. The Department of Surveying and Geospatial Science develops skills on four main laboratories; GIS and Cartography lab, Remote Sensing and Photogrammetry lab, Land Surveying lab and Computer lab. Since the surveying profession is practiced mainly in the field, practical experience with use of our equipment is acquired in the field.

STUDENT ORGANIZATIONS: Students enrolled in the Department can become members of the following organizations: Land Surveying Student Chapter of Board of Engineers and Land Surveyors of Puerto Rico. The board, created by law in P.R., enrolls all licensed engineers and land surveyors. Also students can join the International Federation of Surveyors or American Society for Photogrammetry and Remote Sensing.

DEVELOPMENTAL STUDIES. All students who apply for admission and those selected who are admitted to Land Surveying and Mapping Program must show evidence that they have acquired the necessary skills and abilities to progress through this major. Those failing to do so (as reflected by the results of their College Entrance Examination Board tests, PUPR's placement test results, previous university experience, other tests, or criteria) will be required to take developmental courses. These courses are designed to help students to overcome deficiencies in languages, mathematics, and or science. These developmental courses are in addition to the 139 credits of the Land Surveying and Mapping Program. The courses are awarded their corresponding credits according to the contact hours. The courses are the following:

DEVELOPMENTAL STUDIES COMPONENT
(MAXIMUM OF 33 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
MATH 1330	Pre-calculus I	3
MATH 1340	Pre-calculus II	3
SCIE 0110	Introduction to Physics	3
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

LAND SURVEYING AND MAPPING CURRICULUM STRUCTURE

MATHEMATICS COMPONENT
(4 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4

SCIENCE COMPONENT
(10 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SCIE 1210	Chemistry Principles	4
SCIE 1211	Chemistry Principles Laboratory	0
SCIE 2410	General Physics I	3
SCIE 2420	General Physics II	3

SOCIO-HUMANISTIC AND LANGUAGES COMPONENT
(21 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SOHU 2010	Socio-humanistic Studies I	3
SOHU 2020	Socio-humanistic Studies II	3
ECON 3020	Macro Economics	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SPAN 2020	Business Spanish	3

REAL ESTATE APPRAISAL COMPONENT
(6 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
REA 2902	General Appraisal Principles	3
REA 3912	Eminent Domain	3

CONCENTRATION - COMPONENT

SURVEYING COMPONENT
(42 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SURV 2200	Surveying Applications	3
SURV 2202	Surveying Analysis	3
SURV 2300	Legal Aspects Surveying I	3
SURV 2302	Fundamentals of Surveying	4
SURV 2303	Fundamentals of Surveying Laboratory	0
SURV 2304	Legal Aspects in Surveying II	3
SURV 2802	Visualization of Spatial Information	3
SURV 3204	Analysis and Adjustment of Survey Measurements	3
SURV 3306	Advanced Surveying	4
SURV 3307	Advanced Surveying Laboratory	0
SURV 3308	Surveying Practice	3
SURV 3402	Route Surveying	4
SURV 3403	Route Surveying Laboratory	0
SURV 3804	Computer Applications for Land Surveyors	3

SURV	4310	Management of Surveying Projects	3
SURV	4404	Construction Surveying	3

**GEOMATIC SCIENCES
COMPONENT**
(47 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
GEOM	2800	Information Systems for Land Surveyors	3
GEOM	2102	Introduction to Geomatics	3
GEOM	3102	Geomorphology	3
GEOM	3104	Applied Hydrography for Surveyors	3
GEOM	3502	Fundamentals of Geodesy	3
GEOM	3604	Cartographic Design	3
GEOM	3606	Digital Cartography	3
GEOM	3608	Geographic Information Systems	3
GEOM	3702	Elements of Photogrammetry	4
GEOM	3703	Elements of Photogrammetry Laboratory	0
GEOM	4106	Dendrology	2
GEOM	4108	Senior Project I	1
GEOM	4110	Senior Project II	4
GEOM	4510	Global Positioning System	3
GEOM	4610	Land Development	3
GEOM	4702	Introduction to Remote Sensing and Image Interpretation	3
GEOM	5614	Cadastral and Land Information Systems	3

MINIMUM TOTAL PROGRAM CREDITS 139

ELECTIVES COMPONENT
(9 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
GEOM	4312	US Public Land Surveying Principles	3
GEOM	4314	Property and Inheritance Law	3
GEOM	4504	Surveying Space Techniques	3
GEOM	4506	Geometric Geodesy	3
GEOM	4508	Physical Geodesy	3
GEOM	4612	The Municipal Reform Legal System	3
GEOM	5616	GIS for Site Design	3
GEOM	5618	GIS for Business Applications	3
GEOM	5620	GIS for Environmental Management	3
GEOM	5622	GIS for Civil Infrastructure Systems	3
GEOM	5624	Special Topics in Geomatic	3
GEOM	5626	GIS & Cartography for Real Estate	3
REA	1900	Mathematics for Appraisers	3
REA	2904	Appraisal Procedures	3
REA	3906	Land Appraisal	3
REA	3908	Residence Appraisal I	3
REA	3910	Residence Appraisal II	3
REA	4914	Income Capitalization	3

CURRICULUM SEQUENCE

FIRST YEAR

FIRST QUARTER			
COURSE	TITLE	CREDIT-HOURS	
MATH	1350	Calculus I	4
GEOM	2102	Introduction to Geomatics	3
ENGL	1010	The Study of the Essay as Literary Genre	3
SPAN	1010	Linguistic Analysis of Literary Genres	3
13			

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS	
SURV	2200	Surveying Applications	3
SCIE	1210	General Chemistry I Principles	4
SCIE	1211	General Chemistry Laboratory	0
GEOM	2800	Information Systems for Land Surveyors	3
SOHU	2010	Socio-humanistic Studies I	3
13			

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS	
SURV	2202	Surveying Analysis	3
ECON	3020	Macro Economy	3
SPAN	2020	Business Spanish	3
SCIE	2410	General Physics I	3
12			

SECOND YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS	
SURV	2802	Visualization of Spatial Information	3
SURV	2302	Fundamentals of Surveying	4
SURV	2303	Fundamentals of Surveying Lab	0
REA	2902	General Appraisal Principles	3
GEOM	3604	Cartographic Design	3
13			

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS	
SURV	3306	Advanced Surveying	4
SURV	3307	Advanced Surveying Lab	0
SURV	2300	Legal Aspects in Surveying I	3
GEOM	2902	Fundamentals of Geodesy	3
GEOM	3606	Digital Cartography	3
13			

THIRD QUARTER		
COURSE	TITLE	CREDIT-HOURS
SURV 3402	Route Surveying	4
SURV 3403	Route Surveying Laboratory	0
GEOM 4510	Global Positioning Systems	3
SURV 2304	Legal Aspects in Surveying II	3
SOHU 2020	Visualization of Spatial Information	3
		13

SUMMER		
COURSE	TITLE	CREDIT-HOURS
SURV 3308	Surveying Practice	3

THIRD YEAR

FIRST QUARTER		
COURSE	TITLE	CREDIT-HOURS
SURV 3804	Computer Applications for Land Surveyors	3
GEOM 3608	Geographic Information Systems	3
SCIE 2420	General Physics II	3
ENGL 2020	Business English and Communication	3
		12

SECOND QUARTER		
COURSE	TITLE	CREDIT-HOURS
SURV 3204	Analysis & Adjustment of Survey Measurements	3
GEOM 4610	Land Development	3
REA 3912	Eminent Domain	3
GEOM 3102	Geomorphology	3
		12

THIRD QUARTER		
COURSE	TITLE	CREDIT-HOURS
SURV 4404	Construction Surveying	3
GEOM 3104	Applied Hydrography for Surveyors	3
GEOM 3702	Elements of Photogrammetry	4
GEOM 3703	Elements of Photogrammetry Laboratory	0
		10

FOURTH YEAR

FIRST QUARTER		
COURSE	TITLE	CREDIT-HOURS
SURV 4310	Management of Surveying Projects	3
GEOM 4702	Introduction to Remote Sensing & Image Interpretation	3
GEOM 4106	Dendrology	2
	Dept. Elective	3
		11

SECOND QUARTER		
COURSE	TITLE	CREDIT-HOURS
	Dept. Elective	3
	Free Elective	3
GEOM 4108	Senior Project I	1
GEOM 5614	Cadastral & Land Information Systems	3
		10

THIRD QUARTER		
COURSE	TITLE	CREDIT-HOURS
GEOM 4110	Senior Project II	4
		4
If Needed		
GEOM 4112	Senior Project II Extension	0

Cumulative Subtotal 139
Cumulative Grand Total 139

COURSE DESCRIPTIONS

SURV 2200 SURVEYING APPLICATIONS
Three credit hours. Two, two hour lecture periods per week. Prerequisite: MATH 1340.
 Review of geometric and trigonometric functions; and distance and angle measuring, bearing and azimuths, coordinates and traverse as applied to the analysis of land surveying problems.

SURV 2202 SURVEYING ANALYSIS
Three credit hours. Two, two hour lecture periods per week. Prerequisites: SURV 2200 or MATH 1360
 Analytical geometry review and elements of linear algebra as applied to the analysis of land surveying problems; and introduction to plane surveying calculations

SURV 2300 LEGAL ASPECTS IN SURVEYING I
Three credit hours. Two, two hour lecture period per week. Prerequisite: GEOM 2102
 Introduction to the Puerto Rico legal system and Civil Law relates to the surveyor professional practice, Contract Law and Ethical principles.

SURV 2302 FUNDAMENTALS OF SURVEYING
Four credit hours. Two, two hour lecture periods per week. Prerequisites: SURV 2202, Concurrent SURV 2303, MATH 1350
 The theory and practice of land surveying. Measurement of difference in elevations using leveling network. Measurement of distances using tapes and other methods;

also measurement of angles. Application to boundary identification.

SURV 2303 FUNDAMENTALS OF SURVEYING LABORATORY

Zero credit hours. One, four hour laboratory period per week. Prerequisites: SURV 2202, Concurrent SURV 2302
Laboratory practice of land surveying related to course SURV 2302. The practices will concentrate in the uses of Land Surveying Instruments. Measurement of difference in elevations using differential and trigonometric leveling. Measurement of distances using tapes and other methods; also measurement of angles. Application to Traverse and Polygonal closure.

SURV 2304 LEGAL ASPECT IN SURVEYING II

Two two-hour lecture periods per week. Pre-requisite: SURV 2300

Aspects of Local and Federal legal system related to the professional Surveyor practice. Ethical principles in the surveying profession. Legal aspects of the federal Retract Systems. Federal surveying practices.

SURV 2802 VISUALIZATION OF SPATIAL INFORMATION

Three credit hours. Two, two hour lecture periods per week. Prerequisite: GEOM 2800, MATH 1340
Basic knowledge of spatial information management and visualization using computer software (CAD).

SURV 3204 ANALYSIS AND ADJUSTMENT OF SURVEY MEASUREMENT

Three credit hours. Two, two hour lecture periods per week. Prerequisites: SURV 3306 (MIN C), SURV 3307
The concept of measurement, precision and accuracy, random, systematic and blunder errors are introduced in this course. Probability, reliability and statistical testing applied to analysis of survey data. Error propagation and alignment, and some examples of least-squares adjustment method are presented in this course.

SURV 3306 ADVANCED SURVEYING

Four credit hours. Two, two hour lecture periods per week. Prerequisites: SURV 2302, SURV 2303, Concurrent SURV 3307
Use of conventional signs to make sketches and field notes. Selection and use of equipment for topographic survey. Carrying out the topographic survey in the field. Computation of the results up the survey, plot of the points (manually and computer assisted). Interpolation of contour lines. Area and volume computation.

SURV 3307 ADVANCED SURVEYING LABORATORY

Zero credit hours. One, four hour laboratory period per week Prerequisites: SURV 2302, SURV 2303, Concurrent SURV 3306

Laboratory and field practice related to Advanced Surveying course topics.

SURV 3308 SURVEYING PRACTICE

Three credit hours. Two, two hour lecture periods per week. Prerequisite: SURV 3402, SURV 3403, SURV 4510
Discussion and development of land surveying project. The course will require field work, boundary and topography survey, design of evidence gathering, resurvey, retracement and analysis techniques for complex Land Survey System, riparian, mineral, land grant and fraudulent surveys; case studies.

SURV 3402 ROUTE SURVEYING

Four credit hours. Two, two hour lecture periods per week. Prerequisite: SURV 3306, SURV 3307 Concurrent SURV 3403
Geometric properties and design elements of horizontal and vertical alignment needed for the design and layout of routes.

SURV 3403 ROUTE SURVEYING LABORATORY

Zero credit hours. One, four hour laboratory period per week. Prerequisite: SURV 3306, SURV 3307; Concurrent SURV 3402
Laboratory practice of the main concepts related to course SURV 3402: Route Survey. The practices will concentrate in the application of geometric properties and design elements of horizontal and vertical alignment needed for the design and layout of routes.

SURV 3804 COMPUTER APPLICATION FOR LAND SURVEYORS

Three credit hours. Two, two hour lecture periods per week. Prerequisite: SURV 2302, SURV 2303, SURV 2802
Computer applications used for the land surveying professional practice. Computer drafting.

SURV 4310 MANAGEMENT OF SURVEYING PROJECTS

Three credit hours. Two, two hour lecture periods per week. Prerequisite: SURV 3306, SURV 3307
Study of the dynamics of management and the tools necessary to maintain an effective Land Surveying business practice; with focus on job costing, economic analysis and surveyor's ethics.

SURV 4404 CONSTRUCTION SURVEYING

Three credit hours. Two, two hour lecture periods per week and field laboratory. Prerequisite: SURV 3402, SURV 3204
Principles of construction surveying as used in various types of construction projects.

SURV 2095 PRINCIPLES OF SURVEYING FOR ENGINEERS LAB ENGINEERS

One credit hour. Three hours per week and field laboratory. Prerequisite: ENGI 1140, ENGI 2210

Through conferences and field practices, the student will learn the basic surveying concepts applicable for the design and construction of route.

GEOM 2102 INTRODUCTION TO GEOMATICS

Three credit hours. Two, two hour lecture periods per week. Prerequisite: None

Geomatics comprises the science, technology, and art involved in the measurement, representation, analysis, management, retrieval and display of spatial data concerning both the Earth's physical features and the built environment. It includes cadastral surveying, mapping sciences, land management, geographic information systems, geodesy, photogrammetry, remote sensing, hydrographic surveying and surveying ocean mapping. It has applications in all disciplines which depend on spatial data, including environmental studies, planning, engineering, navigation, geology and geophysics, oceanography, land development, land ownership, land administration and land use management. It is thus fundamental to all the geosciences disciplines which use spatially related data. This course offers the student an introduction to the fundamentals of these topics, a review of historic events and future of the profession.

GEOM 2800 INFORMATION SYSTEMS FOR LAND SURVEYORS

Three credit hours. Two two hour lecture periods per week. Prerequisites: NONE

In this course the students will develop skills in the use of computers, component, operative systems, printers, plotters, scanners, graphics, digital images, software, presentation and written data used in the presentation. They will also be introduced to information systems concepts and the appropriate techniques for effective administration and the use of them.

GEOM 3102 GEOMORPHOLOGY

Three credit hours. Two, two hour lecture periods per week. Prerequisite: SURV 2302, SURV 2303

The systematic description, analysis and understanding of landscapes and the process that change them. In order to understand this earth science is necessary to develop the study of three fundamental subjects. These are in order of development, denudation chronology and evolutionary studies, accurate description of the mechanism rate of operation of the geomorphic process and the adoption of a system-base attitude toward geo-morphological investigation in the area of specialization, which in this case is land surveying.

GEOM 3104 APPLIED HYDROGRAPHY FOR SURVEYORS

Three credit hours. Two, two hour lecture periods per week and field laboratory. Prerequisite: GEOM 3102

The knowledge of high and low plays an important role in planning, land use and hazard mitigation. Elements of planning and executing hydrographic survey with emphasis on achievable accuracies, reliability of collected data and display of the results will be outlined in this course.

GEOM 3502 FUNDAMENTALS OF GEODESY

Three credit hours. Two, two hour lecture periods per week. Prerequisites: SURV 2302, SURV 2303

Introduce the concepts of geodesy, geoids, earth gravity field. Relate Geodesy to other geosciences. Introduce the integrated Global Geodetic Observing System (IGGOS) and the concept of geodetic network.

GEOM 3604 CARTOGRAPHIC DESIGN

Three credit hours. Two, two hour lecture periods per week. Prerequisite: GEOM 2102

Introduction to concepts and theories of cartographic design. Special attention to cartographic modeling and visualization through the use of thematic cartography concepts.

GEOM 3606 DIGITAL CARTOGRAPHY

Three credit hours. Two, two hour lecture periods per week. Prerequisite: GEOM 3604

Introduction to digital cartography concepts. The course covers techniques, error handling and software used for the creation of vector and raster data.

GEOM 3608 GEOGRAPHIC INFORMATION SYSTEMS

Three credit- hours. Two, two-hour lecture periods per week. Prerequisite: GEOM 3606 (Minimum C), SURV 2302, SURV 2303

Discussion of topics related to design, development and application of Geographic Information Systems. Emphasis on problem solving using appropriate modeling tools.

GEOM 3702 ELEMENTS OF PHOTOGRAMMETRY

Four credit hours. Two, two hour lecture periods per week and field laboratory. Prerequisite: SURV 3306, SURV 3307, Concurrent GEOM 3703

Principles of Photogrammetry using aerial and terrestrial photography. History of photogrammetry, aerial cameras and camera calibration, geometry of the aerial photograph, stereoscopy and stereoscopes, parallax, and the theory and techniques of orientation. Stages of planning, flight design, and the terrestrial controls in Photogrammetry surveys.

GEOM 3703 ELEMENTS OF PHOTOGRAMMETRY LABORATORY

Zero credit hours. One, four hour laboratory period per week. Prerequisite: SURV 3306, SURV 3307, Concurrent GEOM 3702

Laboratory practice for the GEOM 3702: Elements of Photogrammetry course.

GEOM 4106 DENDROLOGY

Two credit hours. Two, two hour lecture periods per week. Prerequisites: SURV 2302, SURV 2303

Introduction to trees, their identifying characteristic, habitats, distribution, and systematic classification.

GEOM 4108 SENIOR PROJECT I

One credit hour. One, two-hour lecture periods per week. Prerequisites: SURV 3308, GEOM 4610, and Department Head Authorization.

Senior Project research proposal. Thru their respective research, students should be able to apply the skills and knowledge acquired in their previous years of study to a land surveying related research. Individual presentations will be made to the professors during the quarter. At the end of the quarter, final presentations will be made to a panel of professor. Approval of the research proposal should wrap-up this course.

GEOM 4110 SENIOR PROJECT II

Four credit hours. Two, two-hour lecture periods per week. Prerequisites: GEOM 4108, Department Head Authorization.

Implementation of the student's research proposed in Senior Project I course. Thru the research students should be able to apply the skills and knowledge acquired in their previous years of study. At the end of the quarter, a public defense of the research will be made to a panel of professor. Technical report should wrap-up this course.

GEOM 4112 SENIOR PROJECT II Extension

Zero credit hours. Prerequisites: Department Head Authorization.

Course that provides the student the opportunity to continue the development of his/her Senior Project II.

GEOM 4312 US PUBLIC LAND SURVEYING PRINCIPLES

Three credit hours. Two, two hour lecture periods per week. Prerequisites: SURV 2304

This class covers the basic principles of land survey systems with an emphasis on the United States Public Land Survey System together with the basic legal principles used by the Land Surveyor in the United States. These general legal principles will be discussed and applied to problems for finding solutions to common boundary conflicts.

GEOM 4314 PROPERTY & INHERITANCE LAW

Three credit hours. Two, two hour lecture periods per week. Prerequisites: SURV 2304

A study of law and jurisprudence covering Civil Law Property system and inheritance law.

GEOM 4504 SURVEYING SPACE TECHNIQUES

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: GEOM 3502

The very basic principles of satellite geodesy and the concept of satellite positioning techniques will be introduced.

Satellite Laser Ranging, altimetry and Very Long Baseline, Interferometry will be discussed briefly.

GEOM 4510 GLOBAL POSITIONING SYSTEM

Three credit- hours. Two, two-hour lecture periods per week. Prerequisite: GEOM 3502

Fundamentals of coordinate systems used in satellite geodesy, importance of the earth's gravity field and perturbation forces acting on the satellites will be introduced. Elements of planning and carrying out GPS-survey will be discussed.

GEOM 4610 LAND DEVELOPMENT

Three credit- hours. Two two-hour lecture periods per week and field laboratory. Pre requisite: GEOM 3608

This course covers a discussion on the principles and regulations governing the use and development of land. Historic review of land use patterns in Puerto Rico. Revision of zoning and subdivision regulations used in Puerto Rico.

GEOM 4506 GEOMETRIC GEODESY

Three credit hours. Two, two-hour lecture periods per week and field laboratory. Prerequisites: GEOM 3502

Introduction to the concept of ellipsoid as mathematical reference surface for geodetic computations. Reference ellipsoid. Parameters for reference ellipsoids used in north America and Puerto Rico (NAD 1927, NAD 1983, WGS 84, NAVD 88). Horizontal, vertical and 3D control networks. Standards of accuracy for geodetic control networks.

GEOM 4508 PHYSICAL GEODESY

Three credit - hours. Two two-hour lecture periods per week and field laboratory. Prerequisite: GEOM 4506

Study of the relation between the geoids, mass distribution, earth gravity field and equipotential surface. Deflections of the vertical. Curvature of the plumb lines. Gravimeters. Gravity measurements. Gravity networks. International Gravity Standardization Networks. International Gravity Standardization Network (IGSN71). Review of selected geodetic space techniques relates to investigation of earth's gravity field.

GEOM 4612 THE MUNICIPAL REFORM LEGAL SYSTEM

Three credit hours. Two, two hour lecture periods per week. Prerequisite: GEOM 4610

Land Use planning and development process at the municipal level changed with adoption of Law 81 of August of 1991, better known as "Ley de Municipios Autónomos" (Municipal Reform Law). This course emphasize on topics of this law, especially the ones related to land use planning process.

GEOM 4702 INTRODUCTION TO REMOTE SENSING & IMAGE INTERPRETATION

Three credit hours. Two, two hour lecture periods per week. Prerequisite: GEOM 3702 and GEOM 3703

This course introduces the students to the principles of image interpretation. The interpretation is based on aerial

photographs and satellite imagery. At the end of the course students should be able to correctly use remote sensing imagery. Also, they will be able to analyze and understand the basic concepts in the field.

GEOM 5600 GEOSPATIAL INFORMATION SCIENCE FUNDAMENTALS

Four credit hours. One, four hours lecture per week. Prerequisite: None

This course provides an introduction to the principles and concepts necessary to work in a digital cartographic environment, especially in the context of geographic information systems (GIS). The course also introduces the student to the basic concepts of performing spatial analyses using a geographic information system (GIS). The first part of the course gives an overview of basic cartography and mapping concepts and theories, which are fundamental to understanding and using a GIS. The second part of the course focuses on concepts and theories of GIS, including some of its analysis capabilities. Other technologies such as remote sensing and global navigation satellite systems will be discussed.

GEOM 5614 CADASTRAL & LAND INFORMATION SYSTEMS

Three credit hours. Two, two hour lecture periods per week. Prerequisite: GEOM 3608

Principles of cadastral systems, their history and contemporary development globally and in Puerto Rico. Emphasis on Land Information Systems and multipurpose cadastre.

GEOM 5616 GIS FOR SITE DESIGN

Three credit hours. Two, two hour lecture periods per week. Prerequisite: NONE

This is an introductory to intermediate-level GIS course that focuses on the application of geographic information systems in the practice of urban and regional planning, with a focus on site design. Topics covered will include data models and structures, coordinate systems and projections, thematic mapping, spatial analysis, acquisition and integration of spatial data from various sources, and GIS application development.

GEOM 5618 GIS FOR BUSINESS APPLICATIONS

Three credit hours. Two, two hour lecture periods per week. Prerequisite: NONE

This course offers an introduction to the use and analysis of spatial data in a Geographic Information Systems for business applications such as marketing (geomarketing), real estate, land economics and other business applications.

GEOM 5620 GIS FOR ENVIRONMENTAL MANAGEMENT

Three credit hours. Two, two hour lecture periods per week. Prerequisite: NONE

Introduction to the use of Geographic Information Systems for environmental management applications.

GEOM 5622 GIS FOR CIVIL INFRASTRUCTURE SYSTEMS

Three credit hours. Two, two hour lecture periods per week. Prerequisite: NONE

Introduction to the use of Geographic Information Systems for civil infrastructure system design and management.

GEOM 5624 SPECIAL TOPICS IN GEOMATICS

Three credit hours. Two, two hour lecture periods per week. Prerequisite: Director Approval

Advanced seminar dealing with topics in Geomatic Sciences, to be selected according to staff and student interests. The course will be designed to address professional current events, advanced skills, special knowledge, and/or particular topics of interest.

GEOM 5626 GIS & CARTOGRAPHY FOR REAL ESTATE APPRAISAL

Three credit hours. Two, two hour lecture periods per week. Prerequisite: NONE

Basics of cartography and Geographic Information Systems oriented toward the Real Estate Appraisal profession.

REA 1900 MATHEMATICS AND STATISTICS FOR APPRAISERS

Two, two hour lecture periods per week. Prerequisite: NONE

Mathematics and statistics to serve as basis for the most commonly used appraisal computations.

REA 2902 GENERAL APPRAISAL PRINCIPLES

Three credit hours. Two, two hour lecture periods per week. Prerequisites: ECON 3020

The basic and general principles necessary and supplementary to the appraisal of real estate.

REA 2904 APPRAISAL PROCEDURES

Two credit hours. Two, two hour lecture periods per week. Prerequisite: REA 2902: Appraisal Principles

The course will introduce the student to the steps related to the valuation process. The course provides an introduction to property description from its geographic and neighborhood point of view. The course also provides an introduction to construction and design basics.

REA 3906 LAND APPRAISAL

Three credit hours. Two, two hour lecture periods per week. Prerequisite: REA 2902

A course which covers the principles and applications of land appraisal; includes land property in small or large units wherever located.

REA 3908 RESIDENCE APPRAISAL I

Three credit hours. Two, two hour lecture periods per week. Prerequisite: REA 2902

The course will introduce the student to the fundamentals of residential appraisal.

REA 3910 RESIDENCE APPRAISAL II

Three credit hours. Two, two hour lecture periods per week. Prerequisite: REA 3904: Residential Appraisal

The course covers the fundamentals of residential appraisal and cost approach. The course emphasizes in the appropriate skills to produce and reason a residential report.

REA 3912 EMINENT DOMAIN

Three credit hours. Two, two hour lecture period per week. Prerequisite: SURV 2304, REA 2902

All legal principles governing the appraisal of real estate for forcible expropriations by various government agencies.

REA 4914 INCOME CAPITALIZATION

Three credit hours. Two, two hour lecture period per week. Prerequisite: REA 1900

The principles governing the appraisal of real estate which generates rental income, precisely from the aspect of the rentals produced by said property.

DEPARTMENTAL FACULTY

ACOSTA, JAVIER – Instructor; Information Systems, Civil Engineering, MSc Inter American University, 2008, BSCE, University of Puerto Rico, 1992.

COLÓN MERCADO, MARCOS – Assistant Professor; Master in Environmental Management, Polytechnic University of Puerto Rico, 2003; BSc Surveying and Topography, University of Puerto Rico, Mayagüez Campus, 1993.

CUADRADO, VICTOR - Lecturer; Master in Geo Information, Internal Institute for Geo-Information Science, Enschede, The Netherlands, 2002

LEON LICIER, ANABELLE – Lecturer; Master in Public Science, Complex Medical Science, 2009

MATOS FLORES, RAÚL - Associate Professor; PhD Candidate, Cartography, GIS and Remote Sensing, Universidad de Alcalá, Madrid, 2004; MSc. in Geographic Information Systems, Huddersfield University, Great Britain, 2002; Master in Planning, Concentration: Urban Planning, University of Puerto Rico, 1997; Bachelor in Arts, Geography, University of Puerto Rico, 1991.

OTERO TORRES, JASON – Instructor; Information Management Systems, MISM, Polytechnic University of Puerto Rico, 2013; Plymouth University, UK, BS, 2011.

PÉREZ GAUD, MIGUEL A. – Lecturer; Master in Environmental Management, Polytechnic University of Puerto Rico, 2009; Bachelor Science in Land Surveying and Mapping, Polytechnic University of Puerto Rico, 2001.

RODRÍGUEZ CABRERA, JULIO – Lecturer; Bachelor of Science in Biology from University of Puerto Rico at Mayaguez Campus.

RODRÍGUEZ RIVERA, MARISOL– Associate Professor; Surveying and Geospatial Science Department Head; Doctoral Studies Land Use Planning and Urban Development, Universidad de Valladolid, Spain, 1993; Master in Planning, Concentration: Urban Planning, University of Puerto Rico, 1997; Bachelor in Arts, Geography, University of Puerto Rico, 1991.

ROMERO GONZÁLEZ, VÍCTOR M. – Associate Professor; PhD Candidate Topographic Engineering and Photogrammetry, Universidad Politécnica de Madrid, 2004; Bachelor of Science in Land Surveying and Mapping, Polytechnic University of Puerto Rico, 1994.

TORRES, JESÚS A. – Lecturer; Bachelor of Science in Geology, University of Puerto Rico, Mayagüez Campus.

Industrial Engineering Department

INDUSTRIAL ENGINEERING PROGRAM

The curriculum is designed to develop industrial engineers (IE's) capable of planning, designing, implementing, and managing integrated production and service delivery systems that assure performance, reliability, maintainability, schedule adherence and cost control. The systems may be socio technical in nature and integrate people, information, materials, equipment, processes, and energy throughout the life cycle of the product, service, or program.

Industrial Engineering adopts as its goals: profitability, effectiveness, efficiency, adaptability, responsiveness, quality, and the continuous improvement of products and services throughout their life cycles. The humanities and social sciences, computer sciences, basic sciences, management sciences, along with physical, behavioral, mathematical, statistical, organizational and ethical concepts will be used to achieve these ends.

MISSION: To provide our graduates with the knowledge and skills in Industrial Engineering necessary to hold professional positions in industry and government, to pursue graduate studies and life-long learning, and to contribute with the development of the community and the society.

EDUCATIONAL OBJECTIVES: Within a few years of graduation, PUPR BSIE program graduates are expected to attain the following:

- Make smart, innovate and responsible decisions that contribute to the improvement of their organizations' overall goals and objectives.
- Become competent leaders of their profession and role models of their communities.
- Acquire new knowledge and expertise to stay current in industrial engineering and other fields of studies.

EXPECTED OUTCOMES: Upon graduation PUPR BSIE program graduates will be able to demonstrate the following program outcomes:

- a) An ability to apply knowledge of mathematics, science, and engineering.
- b) An ability to design and conduct experiments, as well as to analyze and interpret data.
- c) An ability to design production or service systems, components or processes to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

- d) An ability to function on multi-disciplinary teams.
- e) An ability to identify, formulate and solve industrial engineering 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 industrial engineering 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 techniques, skills and modern engineering tools necessary for engineering practice.

CAREER OPPORTUNITIES: Manufacturing and service companies in both the private and public sectors seek Industrial Engineering graduates for their skills and competencies. In addition to the manufacturing industries such as pharmaceutical, electronics, medical devices and assembly-processes companies, which traditionally hire IE's; other employers of our graduates include banks, hospitals, logistics-distribution firms, retailers, and consulting firms. Practicing industrial engineers serve as transition and integration consultants as well as developers and system architects in the design for producibility and usability of products and services. Industrial engineers, in senior positions, are sought as strategic planners and integrators because of their grasp of comprehensive and complex systems. IE's lead and manage engineering, manufacturing, service delivery, research and entrepreneurial firms, always searching for and fostering continuous change and improvement. In short, IE's are called upon to help assure profits, total quality control, cost effectiveness, timeliness, and satisfactory results for customers and strategic impact through continuous improvement and innovation initiatives. Industrial Engineers are particularly sensitive to promoting human values of health, safety and satisfaction.

The typical career path is an entry-level engineering or line supervision position that progresses to a management position in the firm or institution. Often, Industrial engineers ultimately become chief executive officers of their organizations.

DEGREE OFFERED: The Industrial Engineering Department offers undergraduate instruction leading to the degree of Bachelor of Science in Industrial Engineering (BSIE). In order to earn the degree, the student must complete the following minimum requirements:

MINIMUM GRADUATION REQUIREMENTS

18 Credit-hours in Mathematics

14 Credit-hours in Basic Science

21 Credit-hours in Socio-Humanistic Studies and Languages

28 Credit-hours in General Engineering

62 Credit-hours in Industrial Engineering

3 Credit-hours in Free Electives

146 Credit-hours

INDUSTRIAL ENGINEERING LABORATORIES

The Industrial Engineering Department offers students hands-on experiences in both academic laboratories as well as in industrial environments where students practice concepts and techniques learned in the classroom. IE laboratory facilities have been designed to cover major areas of the Industrial Engineering current practice, where students acquire current knowledge and expertise that the industry demands. This endeavor is developed through a significant investment of over \$0.5 million in state-of-the-art technology, both equipment and software-hardware support. Following is a brief description of the Industrial Engineering Laboratory facilities and equipment.

A. Human Factors and Methods Engineering Laboratory

This laboratory was designed to provide the students with the opportunity to carry out practical experiments concerning anthropometry, noise and illumination, work-station design, manual material handling, biomechanics and other areas of human performance evaluation and machine-human interactions for the workstation design. The laboratory includes adjustable workstations, ergonomic equipment, soundproof cabins, sound level meters, light meters, goniometers and push/pull gauges.

B. Methods Engineering and Work Measurement Laboratory

Students are exposed to the basic tools to analyzing and design a job in a cost-effective manner, as well as measuring the resulting output to establish a standard (reading a stop watch, recording cycle times, breaking a job into elements and rating a job). This laboratory was designed to provide the students the opportunity to carry out practical experiments concerning to motion and time studies techniques (Stopwatch, Work Sampling and Predetermined Time), method improvement, performance rating, allowance factor and learning curve. Different practices require the use of the following equipment: stopwatches, random reminders, MTM equipment and tables, assembly's parts and computers to download manufacturing assemblies and use of statistical software in order to develop time-study analyses and design software for workstation improvements (Design Tools).

C. Operations Management Laboratory

The Operations Management Laboratory consists of a Windows 7 Enterprise network with twenty (28) Intel Xeon personal computers. This facility is available for students use on an open-access environment, where students are given the opportunity to work on assignments and work-after class jobs at their own pace. This network offers the student the opportunity to access specialized software to tackle industrial engineering problems using state-of-the-art technologies. This laboratory has the equipment and software required to develop the system analysis, solutions development and decision-making skills in our students. There is support-hardware available in this laboratory including a laser printer. The different applications in the network includes AutoCAD, Statgraphics Plus, Minitab, Witness, Arena for Simulation, Mathcad, Microsoft Office Professional, Google Sketchup, Microsoft Project, Microsoft Visio, Microsoft Visual Studio, Microsoft SQL Server, and PSpice student version.

D. Software Instruction Laboratory

This lab consists of a Windows 7 Enterprise network with twenty-four (24) Intel Xeon personal computers for student use based on specific class needs and assignments, where student are requested for critical applications handling and on-class work. This network offers the student the opportunity to access specialized software to tackle industrial engineering problems using state-of-the-art technologies. This laboratory has the equipment and software required to develop the system analysis, solutions development and decision-making skills in our students. There is support-hardware available in this laboratory including a laser printer and a HP plotter. The different applications in the network include AutoCAD, Statgraphics Plus, Minitab, Witness, Arena for Simulation, Mathcad, Microsoft Office Professional, Google Sketchup, Microsoft Project, Microsoft Visio, Microsoft Visual Studio, Microsoft SQL Server, and PSpice student version.

DEVELOPMENTAL STUDIES: All students that request admission and are admitted to the Industrial Engineering Program must show evidence that they have acquired the academic abilities and skills necessary to progress through this major. Those not demonstrating the complete acquisition of these abilities and skills (as reflected by the results of their

College Entrance Examination Board tests, results in PUPR's placement test, previous university experience or other tests or criteria) will be required to take developmental courses. These courses are designed to help the students overcome deficiencies in languages, mathematics and science. The developmental courses are in addition to the 146 Credit-hours of the Industrial Engineering Program. The courses are awarded their corresponding credits according to the contact hours. These courses are the following:

DEVELOPMENTAL STUDIES COMPONENT
(MAXIMUM OF 33 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
MATH 1330	Precalculus I	3
MATH 1340	Precalculus II	3
SCIE 0110	Introduction to Physics	3

STUDENT ORGANIZATIONS: Students have the opportunity to get involved in the organization of conferences, seminars, plant trips, sport tournaments and many other activities through their active participation in student chapters. IE students may become part of the American Institute of Industrial Engineers student chapter #926, as well as members of the College of Engineers and Land Surveyors Student Chapter. Both groups provide students with the opportunity to get acquainted with their future colleagues, who are willing to share their knowledge and experience with students.

INDUSTRIAL ENGINEERING CURRICULUM STRUCTURE

MATHEMATICS COMPONENT
(18 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
MATH 1360	Calculus II	4
MATH 1370	Calculus III	4
MATH 2350	Differential Equations	3
MATH 2360	Linear Algebra	3

SOCIO-HUMANISTIC AND LANGUAGES COMPONENT
(21 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SPAN 1010	Linguistic Analysis of Literary Genres	3
SPAN 2020	Business Spanish	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English and Communication	3
SOHU 2010	Socio-Humanistic Studies	3
SOHU 2040	Ethics, Global, and Contemporary Issues	3
	Socio-Humanistic or Languages Elective	3

BASIC SCIENCE COMPONENT
(14 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SCIE 1210	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory	0
SCIE1430	Physics I (Mechanics)	4
SCIE 1431	Physics I Laboratory	1
SCIE1440	Physics II (Heat and Electricity)	4
SCIE 1441	Physics II Laboratory	1

GENERAL ENGINEERING COMPONENT
(28 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGI 1110	Engineering Graphics	3
ENGI 2110	Engineering Mechanics -Statics	3
ENGI 2120	Mechanics of Materials I	3
ENGI 2260	Engineering Economics	3
ENGI 2310	Computer Programming and Algorithms	3
ENGI 2320	Principles of Electrical Engineering	3
ENGI 2410	Engineering Mechanics Dynamics	3
ENGI 3510	Engineering Materials	3
ENGI 3520	Thermal Systems Engineering	4

INDUSTRIAL ENGINEERING COMPONENT
(62 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
IE 1000	Introduction to Industrial Engineering	3
IE 1611	Computer Tools for IE's Lab I	1
IE 2110	Financial and Cost Accounting	3
IE 2210	Probability for Engineers	3
IE 2220	Statistics for Engineers	3
IE 2310	Work Design and Human Factors	3
IE 2311	Work Design and Human Factors Lab.	1
IE 2611	Computer Tools for IE's Lab II	1
IE 3222	Statistical Quality Control	3
IE 3360	Job Design and Work Measurement	3
IE 3361	Job Design and Work Measurement Lab.	1
IE 3410	Materials Management and Inventory Control	3
IE 3422	Operations Research Models I	3
IE 3500	Service Engineering and Management	3
IE 3510	Production Planning and Control	3
IE 3522	Operations Research Models II	3
IE 3530	Industrial Organizational Behavior	3
IE 3710	Industrial Manufacturing Processes	3

IE 4212	Lean Six Sigma	3
IE 4560	Project Management Techniques	3
IE 4910	Facilities Planning and Design	3
IE 4915	Facilities Planning and Design Project	1
IE 4990	Capstone Design Course	3
IE 4995	Capstone Design Course Extension	3

FREE ELECTIVE COMPONENT	3
MINIMUM TOTAL PROGRAM CREDIT-HOURS	146

INDUSTRIAL ENGINEERING ELECTIVES COURSES
(TO BE SELECTED FOR THE IE TECH ELECTIVE)

COURSE	TITLE	CREDIT-HOURS
IE 4960	Industrial Engineering Practice	3
IE 5222	Design of Experiments	3
IE 5224	Quality Management Systems	3
IE 5228	Lean Servicing	3
IE 5990	Special Topics	3

CURRICULUM SEQUENCE

FIRST YEAR
FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
SOHU 2010	Socio-Humanistic Studies	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
IE 1000	Introduction to Industrial Engineering	3
		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1360	Calculus II	4
ENGI 1110	Engineering Graphics	3
SCIE 1210	Principles of Chemistry	4
SPAN 1010	Linguistic Analysis of Literary Genres	3
SCIE 1211	Principles of Chemistry Lab.	0
		14

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
MATH 1370	Calculus III	4
ENGL 2020	Business English and Communication	3
IE 1611	Computer Tools for IE's Lab I	1
SCIE 1430	Physics I (Mechanics)	4
SCIE 1431	Physics I Laboratory	1
		13

SECOND YEAR
FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
SOHU 2040	Ethics, Global, and Contemporary Issues	3
IE 2210	Probability for Engineers	3
SCIE 1440	Physics II (Heat and Electricity)	4
SCIE 1441	Physics II Laboratory	1
SOHU ELE	Socio-Humanistic Studies or Languages Elective	3
		14

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGI 2110	Engineering Mechanics -Statics	3
IE 2220	Statistics for Engineers	3
IE 2110	Financial and Cost Accounting	3
MATH 2350	Differential Equations	3
		12

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGI 2260	Engineering Economics	3
IE 3222	Statistical Quality Control	3
IE 2310	Work Design and Human Factors	3
IE 2611	Computer Tools for IE's Lab II	1
IE 2311	Work Design and Human Factors Lab.	1
		11

THIRD YEAR
FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
IE 3360	Job Design and Work Measurement	3
IE 3361	Job Design and Work Measurement Lab.	1
SPAN 2020	Business Spanish	3
ENGI 2320	Principles of Electrical Engineering	3
MATH 2360	Linear Algebra	3
		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
IE 3410	Materials Management and Inventory Control	3
ENGI 3510	Engineering Materials	3
ENGI 2310	Computer Programming and Algorithms	3
IE 3500	Service Engineering and Management	3
		12

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
IE 3510	Production Planning and Control	3
IE 3530	Industrial Organizational Behavior	3
ENGI 2120	Mechanics of Materials I	3
IE 3422	Operations Research Models I	3
		12

**FOURTH YEAR
FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
IE 4910	Facilities Planning and Design	3
ENGI 2410	Engineering Mechanics Dynamics	3
IE 3522	Operations Research Models II	3
IE 4212	Lean Six Sigma	3
		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
IE 4990	Capstone Design Course	3
IE 4915	Facilities Planning and Design Project	1
IE 3710	Industrial Manufacturing Processes	3
XXXX XXXX	Free Elective	3
		10

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
IE 4995	Capstone Design Course Extension	3
IE 4560	Project Management Techniques	3
ENGI 3520	Thermal Systems Engineering	4
		10

COURSE DESCRIPTIONS**ENGI 2260 - ENGINEERING ECONOMICS**

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1350

Introduction to economic evaluation of investments for engineering projects. Life cycle costing. Depreciation and income tax determination. Replacement analysis. Evaluation of public projects.

ENGI 2270- ENGINEERING PROBABILITY AND STATISTICS

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 1350

This course introduces the student to the basic concepts on probability and statistics and its application to the solution of engineering problems. Principles of probability theory,

discrete and continuous random variables, probability distribution, hypothesis testing, correlation and simpler linear regression concepts will be essential to identify, formulate and solve engineering problems.

**IE 1000-INTRODUCTION TO INDUSTRIAL ENGINEERING
Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1330**

This course offers students an overview of Industrial Engineering including major areas of study, techniques and software. A hands-on approach using case studies and lab exercises is used to present IE concepts and techniques.

IE 1611- COMPUTER TOOLS FOR IE'S LAB I

One (1) credit-hours. Two two-hour lecture periods per week. Prerequisites: ENGI 1110

Introduction to the use of computer software commonly used by industrial engineers in their day to day work. Key discussions on technology literacy and technological competence. Focus on data and process analysis using Minitab and Excel to be able to improve probability and statistics data analysis as well as process performance capabilities.

IE 2110- FINANCIAL AND COST ACCOUNTING

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 1611, SOHU 2040

Introduction to Financial and Cost Accounting. Introduction to double entry accounting. Development of the cost of goods sold statement, preparation of an activity based costing analysis. Preparation of an annual budget from production to include projected balance statement. Financial ratios. Relationships between activities, costs of resources, objectives and purposes. Use of cost-volume-profit (CVP) analysis as a planning and decision making aid.

IE 2210- PROBABILITY FOR ENGINEERS

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1350 Corequisite: IE 1611

Introduction to descriptive statistics. Principles of probability theory. Random variables and functions.

Expected value and variance of a random variable. Discrete and continuous probability distributions.

IE 2220- STATISTICS FOR ENGINEERS

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisite: IE 1611, IE 2210

This course introduces the student to the basic concepts on statistics and its application to the solution of engineering problems. The hypothesis testing, correlation and simpler linear regression concepts will be essential on the analysis of integrated systems, processes or components.

IE 2310- WORK DESIGN & HUMANS FACTORS

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 2210, ENGI 2110

A comprehensive study of the Human Factors Engineering emphasizing the systems approach to workplace and machine design. Emphasis is placed on optimizing the Human-Machine System interface by learning about the human musculoskeletal and cognitive capabilities and limitations. Topics covered include work physiology, human information processing, workstation design, biomechanics, displays and controls, human visual and auditory systems, and metal workload assessment.

IE 2311- WORK DESIGN & HUMANS FACTORS LABORATORY

One (1) credit-hour. One four-hour laboratory period per week or equivalent. Corequisite: IE 2310

A hands-on experience in Work Design and Human Factors Engineering. Emphasis is on in-depth practices of the main tools obtained in the Work Design and Human Factors course, in real workplaces and/or scenarios. The laboratory will cover anthropometry, workstation design, manual material handling, illumination and noise studies.

IE 2611- COMPUTER TOOLS FOR IE'S LAB II

One (1) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 1611

Introduction to the use of computer software commonly used by industrial engineers in their day to day work. Including spreadsheets-presentation software, Database management (MS Access) and Computer Aided Drawing using Sketchup.

IE 3222 - STATISTICAL QUALITY CONTROL

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisite: IE 2220

Fundamental concepts of Six Sigma and Lean. A comprehensive discussion of the major aspects of using statistical methodology for quality control and improvement and waste elimination. In-depth discussions of the DMAIC methodology discussing the details of the Define and the Measure tools related to statistical process Control, including the 7 tools for SPC, process capability analysis, measurement system analysis and introduction to acceptance sampling plans.

IE 3360- JOB DESIGN & WORK MEASUREMENT

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisite: IE 2310, ENGI 2260 Corequisite: IE 3222

Introduction to principles and techniques for analysis, design and measurements of work methods. Emphasizes in motion and time study. Among the topics covered are operation analysis, learning curve methodology, line balancing, worker and machine relationship, and work measurement techniques such as stopwatch, predetermined time, standard data and work sampling.

IE 3361- JOB DESIGN & WORK MEASUREMENT LABORATORY

One (1) credit-hour. One four-hour Laboratory period per week or equivalent. Prerequisite: IE 2311

Corequisite: IE 3360

Laboratory practices in analysis, design and measurements of work methods. Emphasis is placed on an in-depth practice of the main tools obtained in Job Design and Work Measurement course. The laboratories will cover practices related to stopwatch, performance factors, allowance factors, learning curve and predetermined time. A hands-on project to provide experience in the manufacturing industry implementing Stopwatch, MTM and Work Sampling techniques.

IE 3410 - MATERIALS MANAGEMENT AND INVENTORY CONTROL

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 2110, IE 2220

Introduction to inventory management and systems. Analytical methods for control and maintenance of inventory, emphasizing in mathematical models such as deterministic models for independent and discrete demand, and probabilistic models for independent demand, considering the safety stock and service level systems. Introduction to Materials Requirement Planning for inventory systems with dependent demand.

IE 3422- OPERATIONS RESEARCH MODELS I

Three (3) credit-hours. Two two-hours lecture periods per week. Prerequisites: IE 2210, MATH 2360

Deterministic and probabilistic models in Operations Research. Includes the use of linear programming techniques for modeling and solving linear problems. Mathematical algorithms are Simplex and the Dual, transportation, and assignment. Computer software is used to perform sensitivity analysis for LP problems. Probabilistic models include birth and death processes and queuing theory.

IE 3500 SERVICE ENGINEERING AND MANAGEMENT

Three (3) credit-hours. Two two-hours lecture periods per week. Prerequisites: IE 2611, IE 3222

The course will provide to the student the profile of the operation processes of several service industries. This profile will be used as a framework to develop operational improvement alternatives directed to enhance service delivery. Service operational management concepts will be presented combined with analytical tools to develop optimal solutions for process constraints.

IE 3510- PRODUCTION PLANNING AND CONTROL

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 3360, IE 3410

Analysis of Production System and interaction with Organizational Structures. Includes quantitative methods for forecasting, planning, capacity analysis, line balancing, production scheduling and distribution strategies.

Introduction to manufacturing philosophies such as Just in Time and Theory of Constraints.

IE 3522- OPERATIONS RESEARCH MODELS II

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 2220, IE 3422

Markov Chain concepts, Simulation principles and decision making under uncertainty. Use of animated simulation to evaluate the performance of different hypothetical manufacturing and service operations. Case studies to identify operational problems develop and test “what if scenarios”.

IE 3530- INDUSTRIAL ORGANIZATIONAL BEHAVIOR

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 2310, IE 2311

This course offers a conceptual framework for the study, understanding, and application of human behavior in organizations from the viewpoints of an industrial engineer. Discussion of historical and behavioral science research methodology. Examines interrelation of personality, perception, attitudes and job satisfaction. Focus is on the importance of motivation, group dynamics, and leadership and modern organization design.

IE 3710- INDUSTRIAL MANUFACTURING PROCESSES

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGI 3510

Fundamentals of Modern Manufacturing Technologies. Includes basic principles of selecting component materials, value-added processes, testing techniques and systems. An introduction to Computer Numerical Controlled Machines.

IE 4212 LEAN SIX SIGMA

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 2611, IE 3222

The LSS course carefully develops hypotheses about lean thinking and process experimentation to drive value-added thinking. LSS continues to build upon the DMAIC methodology to understand key problem solving advancement phases and tools that enable, apply and target projects for variability and cost reduction while increasing customer satisfaction and the overall experience.

IE 4560- PROJECT MANAGEMENT TECHNIQUES

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGI 2260, IE 2210

Role of project manager. Techniques for project selection, planning and control. Principles and methods for project budgeting and monitoring. Resource allocation analysis. Use of project management software (MS Project 2010).

IE 4910- FACILITIES PLANNING AND DESIGN

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisite: IE 3361, IE 3422, IE 3510

Understand and be able to develop a detailed-24-step execution plan using a systematic approach to facilities

planning and design. Understand the relationship between facilities planning and the lean thinking way of doing things. Understand the flow analysis techniques and apply them to different situations to assess facilities performance metrics and be able to develop measurable alternatives and recommendations. Apply the different sources of information required to build a plant layout and apply the layout cost function based on the flow x distance criteria.

IE 4915- FACILITIES PLANNING AND DESIGN PROJECT

One (1) credit-hour. By arrangement.

Prerequisite: IE 4910

Understand and be able to apply a detailed-24-step execution plan using a systematic approach to facilities planning and design. Be able to simplify a visual thinking to the systematic approach by using a “A3 method-brown paper canvas” to display required data to assess, evaluate and generate alternatives for the layout problem at hand. Be able to define the layout design problem by acquiring key customer and stakeholders’ information and organizing the data into clear and actionable goals with specific performance metrics.

IE 4960- INDUSTRIAL ENGINEERING PRACTICE

Three (3) credit-hours. By arrangement.

Prerequisite: IE3360, IE 3361, IE 3222

The student will participate in a real life work experience in a manufacturing or service facility during the entire academic term. Through this professional practice, the student should apply the theory and practice of an Industrial Engineer working in a real life project or projects and to significantly impact the wellbeing of the organization. The student will attend the facility as a regular employee and under the supervision of an Industrial Engineer or an organizational manager.

IE 4990- CAPSTONE DESIGN COURSE

Three (3) credit-hours. By arrangement

Prerequisite: IE 4212, IE 4910 and Department Head Approval. Corequisites: IE 4915

Students will be initiating a systematic design process in order to solve an industrial engineering real life problem at a company. Students will work on industry projects that are evaluated academically by the instructor and professionally by a company-assigned technical point-of-contact. The emphasis of this course is on the identification of, solutions to, recommendations for, and presentations to management using the DMAIC methodology. The Define, Measure and Analyze phases of a project are expected to be completed by the end of the term. Teams will integrate knowledge gained from previous courses and will take into consideration appropriate engineering standards and multiple design constraints.

IE 4995- CAPSTONE DESIGN COURSE EXTENSION

Three (3) credit-hours. By arrangement.

Prerequisite: IE 4990

Students will be completing a systematic design process in order to solve an industrial engineering real life problem at a company. Students will work on industry projects that are evaluated academically by the instructor and professionally by a company-assigned technical point-of-contact. The emphasis of this course is on the identification of, solutions to, recommendations for, and presentations to management using the DMAIC methodology. The Improve and Control phases are expected to be completed by the end of the term. Teams will integrate knowledge gained from previous courses and will take into consideration appropriate engineering standards and multiple design constraints.

IE 5222 DESIGN OF EXPERIMENTS

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 2220

Introduction to the application of Design of Experiments by using statistical tools such as Multiple Regression, Analysis of Residual, Analysis of Variance, Random Block and Factorial designs. A project and a computer software are used to evaluate experiment designs and their results.

IE 5224 QUALITY MANAGEMENT SYSTEM

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 3500

This course provides students with the basic knowledge and skills needed to analyze a different quality system program: ISO 9001, 13485 and the FDA's Quality System regulation: 21 CFR 820 and 21 CFR 210-211. How the requirements impact the day-to-day operations of organizations in any industry. Students learn by participating in group exercises and in-depth discussions.

IE 5228 LEAN SERVICING

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 3500

Lean services are the application of the lean thinking movement to service operations. Lean principles of Continuous Improvement and Respect for People have been successfully applied to all kinds of service settings, including healthcare, tourism and the public sector. Conceptually, these implementations follow very similar routes to those in manufacturing settings, and use the same tools and techniques such as 5S and visual management, standard work and A3 forms for rapid improvement events organization. The Special Topics class will be centered in developing skills to be able to transform traditional service settings in "lean service settings". We will use the "Lean Solution" book from Womack and lately, a book on healthcare named On the Mend. We will follow a case-study environment and practical discussions of case studies from the American Society of Quality and from the Lean Institute

IE 5990- SPECIAL TOPICS

Three (3) credit-hours. Two two-hour lecture periods per week. Prerequisite: Upon IE Department Head recommendation

Open course to include topics of special interest and actuality in the manufacturing and service environment.

DEPARTMENTAL FACULTY

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Mechanical Engineering Department

MECHANICAL ENGINEERING PROGRAM

Mechanical engineers use the fundamental principles of energy, material sciences, and mechanics in the design and production of mechanical devices and systems. In particular, mechanical engineers are heavily involved in the generation, conversion and transmission of energy and motion. The program is suited for students with a keen interest in applied physical sciences and mathematics. It is designed to prepare our graduates to face with success the new challenges of the industry and to benefit our society.

The curriculum leading to the Bachelor of Science in Mechanical Engineering (B.S.M.E.) covers the fundamental aspects of the field, stresses on basic principles and educates students to solve engineering problems. The curriculum integrates advanced computer skills, laboratory work and design projects in a teamwork setting throughout the program. The freshman and sophomore years emphasize courses in mathematics, sciences, humanities, computer programming, computer-aided drafting and design, conventional manufacturing, engineering mechanics, material sciences, solid mechanics and fluid mechanics. The junior and senior years are devoted to thermodynamics, heat transfer, intermediate fluid mechanics, system dynamics and controls, mechatronics, thermal and mechanical design, computer-aided engineering, computer aided-manufacturing. The program concludes with comprehensive capstone design courses in which the students apply the knowledge and concepts from previous courses in solving relevant problems from the industry.

Mechanical engineering students may decide to follow a traditional mechanical engineering path or to earn a concentration in aerospace engineering. Students following the traditional path may take elective courses in areas such as air conditioning systems, power plant engineering, internal combustion engines, turbomachinery, manufacturing, robotics, vibrations, dynamics of machinery, biomedical engineering, plastics engineering or any of the courses that are part of the concentration in aerospace engineering. The traditional course sequence also includes a course in entrepreneurship to enhance the business skills and self-employment opportunities of our graduates. Students enrolled in the B.S.M.E. with a concentration in Aerospace Engineering will take courses in aerospace-related areas such as aerodynamics, flight dynamics, propulsion systems, aerospace structures, and aircraft performance and design.

PROGRAM MISSION: The Mechanical Engineering program at Polytechnic University of Puerto Rico is designed to develop graduates from different backgrounds who can deal with situations that involve technological and humanistic/societal issues and to cultivate their potential for leadership. The program emphasizes on developing the ability and competency of our students in utilizing scientific and engineering methods for devising useful products to satisfy the community in an economical way, while considering the impacts on society.

PROGRAM EDUCATIONAL OBJECTIVE: Mechanical engineering graduates at Polytechnic University of Puerto Rico are expected to pursue (within a few years) a successful career in thermal and mechanical systems

1. in a technical engineering path
2. in an engineering management path
3. in research and development
4. as a self-employed entrepreneur

PROGRAM EXPECTED OUTCOMES: Every graduating mechanical engineer from our program shall be able to:

- a. an ability to apply knowledge of mathematics, science, and engineering;
- b. an ability to design and conduct experiments, as well as to analyze and interpret data;
- c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- d. an ability to function on multidisciplinary teams;
- e. an ability to identify, formulate, and solve engineering 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 engineering solutions in a global, economic, environmental, 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 engineering tools necessary for engineering practice.

CAREER OPPORTUNITIES:

Mechanical engineers have many professional options due to the breadth of their preparation. Mechanical engineers can work in design, research and development, manufacturing, service and maintenance, as well as technical sales.

Mechanical engineers can pursue their careers with local, state, and federal agencies, as well as with private enterprises, or even organize their own businesses. Graduates from this program have found successful careers in a variety of industries such as aerospace, pharmaceuticals, electric utilities, electronics, medical devices, air conditioning, food industry, mechanical services among others. Mechanical engineering graduates may also elect to pursue advanced degrees in engineering, or continue their education in other fields, such as law or business.

DEGREE OFFERED: The Mechanical Engineering program offers undergraduate instruction leading to the degree of Bachelor of Science in Mechanical Engineering (B.S.M.E.).

To obtain the B.S.M.E. degree, the student must complete the following minimum requirements:

15	Credit-hours in Mathematics
14	Credit-hours in Basic Science
21	Credit-hours in Socio-Humanistic Studies and Languages
19	Credit-hours in Engineering Science
66	Credit-hours in Mechanical Engineering
9	Credit-hours in Mechanical Engineering Electives
3	Credit-hours in Entrepreneurship
147	Total Credit-hours

Students pursuing the B.S.M.E. degree with a concentration in Aerospace Engineering take three additional credit-hours for a total of 150 credit-hours. To obtain the B.S.M.E. with a concentration in Aerospace Engineering, the student must complete the following minimum requirements:

15	Credit-hours in Mathematics
14	Credit-hours in Basic Science
21	Credit-hours in Socio-Humanistic Studies and Languages
19	Credit-hours in Engineering Science
62	Credit-hours in Mechanical Engineering
19	Credit-hours in Aerospace Engineering Concentration
150	Total Credit-hours

DEVELOPMENTAL STUDIES: Students admitted to the Mechanical Engineering Program must show evidence that they have acquired the academic abilities necessary to progress through this major. Those not demonstrating these abilities, as reflected by the results of their College Entrance Examination Board tests, PUPR's placement test, or previous university experience, are required to take developmental courses. These courses are designed to help the students overcome deficiencies in languages mathematics, and science. These courses are required in addition to the 147 credit hours required by the Mechanical Engineering Program.

DEVELOPMENTAL STUDIES COMPONENT

(MAXIMUM OF 33 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ATUL 0100	Adjustment to University Life	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3
ENGL 0100	Preparatory English	3
ENGL 0110	English Grammar	3
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
MATH 1330	Pre-Calculus I	3
MATH 1340	Pre-Calculus II	3
SCIE 0110	Introduction to Physics	3

LABORATORIES: The facilities and laboratories of the Mechanical Engineering Department at PUPR provide students with hands on experience on several important areas such as Fluid Mechanics, Thermal Engineering, Measurements, Engineering Materials, Mechatronics, Manufacturing, and Computer Aided Design and Computer Aided Manufacturing. The mechanical engineering experimental facilities are housed in the first and fourth floors of the Laboratory building. In addition to this, chemistry, physics, electronics and computers laboratories are also available to our students throughout the campus.

STUDENT ORGANIZATIONS: The Mechanical Engineering Department encourages its students to participate actively in the following student organizations:

- Student Chapter of the Institute of Mechanical Engineers of the College of Engineers and Land Surveyors of Puerto Rico (CIAPR)
- Society of Automotive Engineers (SAE)
- American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- American Society of Mechanical Engineers (ASME)

These organizations provide the students with the opportunity to get acquainted with the career and participate in conferences, seminars, and field trips to broaden their professional and social activities and nurture their leadership and communications skills.

MECHANICAL ENGINEERING CURRICULUM**MATHEMATICS COMPONENT**

(15 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
MATH 1360	Calculus II	4
MATH 1370	Calculus III	4
MATH 2350	Differential Equations	3

SCIENCE COMPONENT

(15 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SCIE 1210	General Chemistry I	4
SCIE 1211	General Chemistry I Lab.	1
SCIE 1430	Physics I	4
SCIE 1431	Physics Lab.	1
SCIE 1440	Physics II	4
SCIE 1441	Physics II Lab.	1

SOCIO-HUMANISTIC STUDIES AND LANGUAGES COMPONENT

(21 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
SPAN 1010	Linguistic Analysis of Literary Genre	3
SPAN 2020	Business Spanish	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English & Communication	3
SOHU 2010	Socio-Humanistic Studies I	3
SOHU 2040	Ethics, Global, & Contemporary Issues	3
*****	Socio-Humanistic Studies or Language Elec	3

ENGINEERING SCIENCES COMPONENT

(19 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ENGI 2270	Engineering Probability and Statistics	3
ENGI 2110	Engineering Mechanics, Statics	3
ENGI 2410	Engineering Mechanics, Dynamics	3
EE 2000	Circuit Analysis I	3
ENGI 2420	Fluid Mechanics	3
ENGI 2260	Engineering Economics	3
ENGI 2421	Fluid Mechanics Laboratory	1

MECHANICAL ENGINEERING COMPONENT (DOES NOT APPLY FOR CONCENTRATION IN AEROSPACE ENGINEERING)

(66 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ME 1210	Computer Aided Drafting and Design	3
ME 1211	Conventional Manufacturing Lab	1
ME 2010	Computer Programming for ME	3
ME 2020	Applied Numerical Analysis	3
ME 2210	Engineering Materials	3
ME 2211	Engineering Materials Laboratory	1
ME 2220	Mechanism Design	3
ME 2230	Solid Mechanics I	3
ME 3011	Engineering Measurements Laboratory	1
ME 3030	System Dynamics and Controls	3
ME 3040	Mechatronics	3
ME 3110	Thermodynamics I	3

ME 3120	Thermodynamics II	3
ME 3140	Intermediate Fluid Mechanics	3
ME 3150	Heat Transfer I	3
ME 3160	Heat Transfer II	3
ME 3230	Solid Mechanics II	3
ME 3240	Design of Machine Elements I	3
ME 3250	Design of Machine Elements II	3
ME 3260	Manufacturing Engineering	3
ME 4011	Mechatronics Laboratory	1
ME 4110	Design of Thermal Systems	3
ME 4111	Thermal Engineering Laboratory	1
ME 4251	Modeling & Product Realization Laboratory	1
ME 4992	Mechanical Engineering Capstone Design I	3
ME 4994	Mechanical Engineering Capstone Design II	3

ELECTIVE COURSES COMPONENT (DOES NOT APPLY FOR CONCENTRATION IN AEROSPACE ENGINEERING)
(9 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ME XXXX	Mechanical Engineering Electives	9

BUSINESS COMPONENT (DOES NOT APPLY FOR CONCENTRATION IN AEROSPACE ENGINEERING)
(3 CREDIT-HOURS)

COURSE TITLE	CREDIT-HOURS
MGMT 4660 Entrepreneurship	3

TOTAL MINIMUM PROGRAM CREDIT-HOURS: 147

MECHANICAL ENGINEERING COMPONENT (CONCENTRATION IN AEROSPACE ENGINEERING)
(62 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ME 1210	Computer Aided Drafting and Design	3
ME 1211	Conventional Manufacturing Lab	1
ME 2010	Computer Programming for ME	3
ME 2020	Applied Numerical Analysis	3
ME 2210	Engineering Materials	3
ME 2211	Engineering Materials Laboratory	1
ME 2220	Mechanism Design	3
ME 2230	Solid Mechanics I	3
ME 3011	Engineering Measurements Laboratory	1
ME 3030	System Dynamics and Controls	3
ME 3040	Mechatronics	3
ME 3110	Thermodynamics I	3
ME 3120	Thermodynamics II	3
ME 3140	Intermediate Fluid Mechanics	3
ME 3150	Heat Transfer I	3

ME 3160	Heat Transfer II	3
ME 3230	Solid Mechanics II	3
ME 3240	Design of Machine Elements I	3
ME 3250	Design of Machine Elements II	3
ME 3260	Manufacturing Engineering	3
ME 4011	Mechatronics Laboratory	1
ME 4251	Modeling & Product Realization Laboratory	1
ME 4992	Mechanical Engineering Capstone Design I	3
ME 4994	Mechanical Engineering Capstone Design II	3

AEROSPACE ENGINEERING CONCENTRATION COMPONENT
(19 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ME 2930	Introduction to Aerospace Engineering	3
ME 4930	Aerodynamics	3
ME 4931	Flight Dynamics	3
ME 4932	Aircraft Performance and Design	3
ME 4935	Aircraft Propulsion	3
ME 5152	Aerospace Laboratory	1
ME 5930	Aerospace Structures	3

MINIMUM TOTAL PROGRAM CREDIT-HOURS (Concentration in Aerospace Engineering): 150

MECHANICAL ENGINEERING ELECTIVE COURSES

COURSE	TITLE	CREDIT-HOURS
ME 2930	Introduction to Aerospace Engineering	3
ME 3940	Biomaterials	3
ME 3960	Introduction to Plastics Engineering	3
ME 3962	Plastics Processing	3
ME 4930	Aerodynamics	3
ME 4931	Flight Dynamics	3
ME 4932	Aircraft Performance and Design	3
ME 4935	Aircraft Propulsion	3
ME 4940	Bio-fluid Mechanics	3
ME 4942	Bio-solid Mechanics	3
ME 5910	Air Conditioning Systems Design	3
ME 5916	Internal Combustion Engines	3
ME 5918	Power Plant Engineering	3
ME 5922	Turbomachinery	3
ME 5930	Aerospace Structures	3
ME 5950	Mechanical Vibration	3
ME 5952	Introduction to Dynamics of Machinery	3
ME 5954	Introduction to Finite Element Method	3
ME 5956	Introduction to Design for Manufacturing	3
ME 5958	Robotics	3
ME 5970	Mechanical Engineering Practice	3
ME 5980	Undergraduate Research	3
ME 5990	Special Topics in Mechanical Engineering	3

CURRICULUM SEQUENCE**FIRST YEAR****FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
MATH 1350	Calculus I	4
ME 1210	Computer Aided Drafting & Design	3
ENGL 1010	The Study of Essay as a Literary Genre	3
SPAN 1010	Linguistics Analysis of Literary Genres	3

13**SECOND QUARTER**

COURSE	TITLE	CREDIT-HOURS
MATH 1360	Calculus II	4
SCIE 1430	Physics I	4
SCIE 1431	Physics I Lab.	1
ME 1211	Conventional Manufacturing Lab.	1
SOHU 2010	Socio-Humanistic Studies	3

13**THIRD QUARTER**

COURSE	TITLE	CREDIT-HOURS
MATH 1370	Calculus III	4
SCIE 1210	General Chemistry I	4
SCIE 1211	General Chemistry I Lab.	0
SCIE 1440	Physics II	4
SCIE 1441	Physics II Lab.	1

13**SECOND YEAR
FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
ENGI 2270	Engineering Probability & Statistics	3
ENGI 2110	Engineering Mechanics, Statistics	3
ME 2010	Computer Programming for ME	3
MATH 2350	Differential Equations	3

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**Students with concentration in
Aerospace Engineering add:**

ME 2930	Introduction to Aerospace Engineering	3
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15**SECOND QUARTER**

COURSE	TITLE	CREDIT-HOURS
ENGI 2410	Engineering Mechanics, Dynamics	3
ME 2210	Engineering Materials	3
ME 2020	Applied Numerical Analysis	3
EE 2000	Circuits Analysis I	3

12**THIRD QUARTER**

COURSE	TITLE	CREDIT-HOURS
ENGI 2420	Fluids Mechanics	3
ME 2220	Mechanism Design	3
ME 2230	Solids Mechanics I	3
ENGI 2260	Engineering Economics	3
ME 2211	Engineering Materials Lab.	1

13**THIRD YEAR****FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
ME 3230	Solids Mechanics II	3
ME 3140	Intermediate Fluid Mechanics	3
ME 3110	Thermodynamics I	3
ME 3030	System Dynamics & Controls	3
ENGI 2421	Fluid Mechanics Lab.	1

13**SECOND QUARTER**

COURSE	TITLE	CREDIT-HOURS
ME 3120	Thermodynamics II	3
ME 3150	Heat Transfer I	3
SOHU 2040	Ethics, Global & Contemporary Issues	3
ME 3011	Engineering Measurements Lab.	1
ME 3240	Design of Machine Elements I	3

13**THIRD QUARTER**

COURSE	TITLE	CREDIT-HOURS
ME 3160	Heat Transfer II	3
ME 3040	Mechatronics	3
ME 3260	Manufacturing Engineering	3
ME 3250	Design of Machine Elements II	3

12**FOURTH YEAR****FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS
SPAN 2020	Business Spanish	3
MGMT 4660	Entrepreneurship	3
ME 4110	Design of Thermal Systems	3
ME 4011	Mechatronics Lab.	1
ME ****	Mechanical Engineering Elective	3

13

Students with concentration in Aerospace Engineering register:

SPAN 2020	Business Spanish	3
ME 4935	Aircraft Propulsion	3
ME 5930	Aerospace Structures	3
ME 4930	Aerodynamics	3
ME 4011	Mechatronics Lab.	1
		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ME 4111	Thermal Engineering Lab.	1
ME 4992	ME Capstone Design I	3
ME 4251	Modeling & Product Realization Lab.	1
** ****	Socio-Humanistic Studies or Language Elective	3
ME ****	Mechanical Engineering Elective	3
		11

Students with concentration in Aerospace Engineering register:

ME 4992	ME Capstone Design I	3
ME 4931	Flight Dynamics	3
** ****	Socio-Humanistic Studies or Language Elective	3
ME 4251	Modeling & Product Realization Lab.	1
		10

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ME 4994	ME Capstone Design II	3
ENGL 2020	Business English & Communication	3
ME ****	Mechanical Engineering Elective	3
		9

Students with concentration in Aerospace Engineering register:

ME 4994	ME Capstone Design II	3
ME 5152	Aerospace Engineering Lab.	1
ME 4932	Aircraft Performance and Design	3
ENGL 2020	Business English & Communication	3
		10

COURSE DESCRIPTIONS

ENGI 2410 - ENGINEERING MECHANICS, DYNAMICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGI 2110

This course covers the study of kinematics and kinetics of particles and rigid bodies in the idealization of mechanical systems. The course emphasizes the application of

Newton's laws, work and energy, and impulse and momentum methods in the dynamic analysis of such systems.

ENGI 2420 - FLUID MECHANICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENGI 2410 or ENGI 2910

This course covers the study and application of the fundamental principles of fluid mechanics. The course focuses in the static, kinematic and dynamic analysis of fluids in engineering systems. Application of momentum, energy and continuity principles to the analysis of incompressible flow applications. The course concludes with the analysis of viscous flows in pipes and open channels applications.

ENGI 2421- FLUID MECHANICS LABORATORY

One credit-hour. One four-hour laboratory period per week. Prerequisite: ENGI 2270 (or CEE 2110), ENGI 2420

Laboratory experiences to illustrate the fluid mechanics concepts learned in ENGI 2420. Analysis of results and statistical evaluation data from experiments in gravimetric flow, hydrostatic thrust, stability of floating bodies, flow through orifices, discharge over weirs, impact of a jet and friction on pipes and accessories. The laboratory emphasizes team work and communication skills through the submission of oral and written reports.

ME 1210 – COMPUTER AIDED DRAFTING AND DESIGN

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: None

This course presents an introduction to the principles of graphics communication in mechanical engineering. The course covers key engineering visualization techniques such as sketching, solid modeling, assemblies, dimensioning, tolerance definition and drafting using standard practices and state-of-the-art computer applications. The course emphasizes orthographic projections and multi-view drawings for engineering design and fabrication. At the end of the course, the students will work on a team-based design of a prototype device to be fabricated in ME 1211.

ME 1211 – CONVENTIONAL MANUFACTURING LABORATORY

One credit-hour. One four-hour laboratory period per week. Prerequisite: ME 1210.

This course presents an introduction to the practices and techniques in conventional processes for the manufacturing of engineering components. The course focuses on techniques for the use of band saws, milling machines, lathes and welding machines. The end of the course integrates the fabrication (under the guidance of the instructor) of the prototype device already designed in ME 1210.

ME 2010 –COMPUTER PROGRAMMING FOR MECHANICAL ENGINEERING**Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1350**

This course will introduce the students to the development of algorithms and computer programs using MATLAB. The course will cover basic program construction techniques such as top-down designs, flowcharting, pseudocoding, editing and debugging. Students will apply the learned techniques to the solution of engineering problems.

ME 2020 - APPLIED NUMERICAL ANALYSIS**Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 2010**

This course will introduce the students to the application of numerical methods and techniques to the solution of engineering and mathematical problems. The course addresses relevant topics in numerical analysis such as: root finding techniques, solution of linear algebraic equations, determination of eigenvalues and eigenvectors, curve fitting, as well as the application of numerical techniques for the differentiation, integration and solution of ordinary differential equations. The course emphasizes the use of MATLAB programming.

ME 2210 - ENGINEERING MATERIALS**Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1210, SCIE 1211 Corequisites: ENGI 2110**

This course introduces mechanical engineering students to the structures and properties of engineering materials such as metals, ceramics, glasses, polymers and composites. The course covers important topics such as atomic bonding, crystalline and non-crystalline structures, mechanical behavior, phase transformations and thermal processing techniques. The course emphasizes the selection and application of engineering materials to the design of engineering applications.

ME 2211- ENGINEERING MATERIALS LABORATORY**One credit-hour. One four-hour laboratory period per week. Prerequisite: ENGI 2270, ME 2210**

Laboratory experiences to support the concepts learned in ME 2210. Characterization and statistical analysis of mechanical properties of metals using tension, hardness, micro-hardness, metallography, phase transformation and heat treatment techniques. The laboratory emphasizes team work and communication skills through the submission of oral and written reports.

ME 2220 - MECHANISM DESIGN**Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENGI 2410, ME 1211, ME 2020**

This course introduces students to the application of fundamental concepts of kinematics and kinetics to the

analysis and design of mechanisms in mechanical systems. The course focuses to the design of linkages, cams and gears using analytical, graphical and computer-aided techniques.

ME 2230 - SOLID MECHANICS I**Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENGI 2110, ME 2020, ME 2210**

This course introduces mechanical engineering students to the concepts of stress, strain and deformation of structural components in mechanical systems. The course covers the analysis of structural members under axial, torsion and bending loading conditions.

ME 3110 - THERMODYNAMICS I**Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGI 2420**

This course introduces mechanical engineering students to the fundamental concepts of thermodynamics. The course focuses on thermodynamic properties, energy and mass conservation, entropy and second law analysis as well as the study of ideal gas mixtures and psychrometrics.

ME 3011- ENGINEERING MEASUREMENTS LABORATORY**One credit-hour. One four-hour laboratory period per week. Prerequisites: EE 2000**

Laboratory practices to introduce students to experimental techniques in mechanical engineering applications. The laboratory has an emphasis in the statistical analysis of experimental results. The practices cover the selection and calibration of instrumentation, data acquisition techniques, and measurement error analysis. The laboratory emphasizes team work and communication skills through the submission of oral and written reports.

ME 3030 - SYSTEM DYNAMICS AND CONTROLS**Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENGI 2420, EE 2000**

This course covers the modeling, analysis and control of dynamic systems. An emphasis is placed in the mathematical modeling to determine the transient and steady-state response of mechanical, electrical, thermal and fluid systems. The course also covers the analysis and design of linear feedback control systems in the time and frequency domains.

ME 3040- MECHATRONICS**Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3030, ME 3011**

This course introduces mechanical engineering students to the automation and digital control of industrial applications using electrical, electronic, hydraulic, and pneumatic control devices and systems. Topics in this course include design of control circuits and analysis of the response of several mechanical systems to external conditions.

ME 3120 - THERMODYNAMICS II

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3110, ME 2020

This course continues the study of the fundamental concepts and applications of thermodynamics. The course focuses on the application of thermodynamic principles to the analysis and design of vapor-powered, gas-powered, refrigeration and heat pump systems, refrigeration systems. The course concludes with key concepts in reacting mixtures and combustion principles.

ME 3140 - INTERMEDIATE FLUID MECHANICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ENGI 2420, ME 2020 Co-Requisites ENGI 2421

This course is a continuation of ENGI 2420 to address specific applications for mechanical engineers. The course presents a comprehensive view to the differential analysis of fluid flow, the study of flow over immersed bodies and the boundary layer theory and the analysis of compressible fluid flow. The course concludes with the treatment of fluid mechanics to turbomachinery applications.

ME 3150 - HEAT TRANSFER I

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3110, ME 3140

This course presents an introduction of fundamental concepts of heat transfer. The course focuses on unidirectional and multidirectional steady-state conduction, transient conduction and radiation heat transfer.

ME 3160 - HEAT TRANSFER II

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 3150, ENGI 2421

This course is a continuation of ME 3150 to cover basic concepts in heat convection transfer. This course provides an emphasis on external forced convection, internal forced convection, natural convection, and convection with change of phase. The course concludes with the analysis and design of heat exchangers and an introduction to the principles of mass transfer.

ME 3230 - SOLID MECHANICS II

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 2230

This course continues the development of stress-strain analysis techniques for structural members in mechanical systems. The course emphasizes the application of stress and strain transformation techniques to structural members under combined loadings and thin-walled pressure vessels. The course also introduces students to theories of failure for static load conditions and the design of machinery components. The course concludes with the analysis of indeterminate beams, the buckling stability of columns and an introduction of energy methods.

ME 3240 - DESIGN OF MACHINE ELEMENTS I

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 3230

This course covers the design of mechanical components subjected to static and fatigue loads. The students are exposed to the design of machines using non-permanent joints (e.g., fasteners, screws, etc.), permanent joints (e.g., welding, brazing, bonding, etc.), mechanical springs, rolling and journal bearing design.

ME 3250 - DESIGN OF MACHINE ELEMENTS II

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 2220, ME 3240

This course continues the development of machine design techniques from ME 3240. Design of key mechanical components such as gears, shafts, couplings, brakes, clutches and flexible mechanical elements (e.g., belts, chains, etc.) subjected to static and fatigue loads.

ME 3260 - MANUFACTURING ENGINEERING

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 3230

This course presents mechanical engineering students a survey of manufacturing processes including: casting, forming, machining, welding, brazing, adhesive bonding, mechanical fastening, as well as forming and shaping plastics and composite materials. The course also covers important topics in quality assurance, testing and inspection of manufactured products.

ME 4011- MECHATRONICS LABORATORY

One credit-hour. One four-hour laboratory period per week. Prerequisites: ME 3040

Laboratory experiences in automation using electrical, electronic, hydraulic, and pneumatic control systems. The laboratory practices include the selection and implementation of sensors and actuators (i.e., mechanical, pneumatics and hydraulics), along to electronic data acquisition systems and Programmable Logic Controllers. The laboratory emphasizes team work and communication skills through the submission of oral and written reports. situations.

ME 4110 - DESIGN OF THERMAL SYSTEMS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3120, ME 3160, ENGI 2260

This course provides senior-level students an integrated approach to analyze, simulate, and design energy systems such as heat exchangers and pumps. The course also incorporates system economics and design optimization techniques in the design of such systems.

ME 4111- THERMAL ENGINEERING LABORATORY

One credit-hour. One four-hour laboratory period per week. Prerequisites: ME 4110

Laboratory experiences to illustrate senior-level students the practical aspects of fluid and thermal systems such as heat

exchangers, steam generators, cooling towers, refrigeration and air conditioning systems, wind tunnel, compressible fluid flow, and turbomachinery. The laboratory emphasizes team work and communication skills through the submission of oral and written reports.

ME 4251 – MODELING AND PRODUCT REALIZATION LABORATORY

One credit-hour. One four-hour laboratory period per week. Prerequisite: ME 3260, ME 2220

This course presents senior-level students an opportunity to integrate computer-aided design (CAD), computer-aided engineering (CAE) and computer-aided manufacturing (CAM) applications in the design and development of engineering products. The course emphasizes the modeling and simulation of mechanical systems to predict the mechanical behavior and optimize the design as well as the use of modern manufacturing equipment such as rapid prototyping, numerical controlled programming, foam cutters and 3D scanners in the fabrication of a prototype.

ME 4992 - MECHANICAL ENGINEERING CAPSTONE DESIGN I

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: approval by the Department Head of the Mechanical Engineering Department

Comprehensive course to emphasize the key knowledge and concepts through the Mechanical Engineering program. Teams work in open-ended, multi-disciplinary design projects focused on solving industrially relevant problems. The course implements a systems engineering approach and emphasizes on the generation and selection of ideas as well as the application of analysis and design tools developed in previous courses. The course ME 4992 covers the development of the project from problem definition to its final design. The course stresses on team work, project management and communication skills through several technical presentations through the progress of the project.

ME 4994 - MECHANICAL ENGINEERING CAPSTONE DESIGN II

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 4992

This course is an extension of ME 4992. The course ME 4994 covers the development of the project from its final design to the construction and validation of a prototype. The course stresses on team work, project management and communication skills through several technical presentations through the progress of the project and the submission of a final comprehensive report.

MECHANICAL ENGINEERING ELECTIVE COURSES

ME 2930 - INTRODUCTION TO AEROSPACE ENGINEERING

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: SCIE 1430

Introduction to the basic concepts of aerodynamics and how they are applied to the flight of aircraft: lift, drag, propulsion, performance, stability and design. Developing problem solving skills in a design team setting will be used to work with the concepts discussed.

ME 3940 - BIOMATERIALS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 2210

Introduction to the terminology, definitions, and concepts that are required to select, manipulate, evaluate and use materials in biomedical applications. This course covers structure-property relationships, biocompatibility criteria, and physiological/clinical performance.

ME 3960 – INTRODUCTION TO PLASTICS ENGINEERING

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 3220.

This course covers the fundamentals of plastic materials, historic review, classification, definitions and terminology. Furthermore, the course covers chemical, physical and mechanical properties, processing techniques and recycling of plastic materials.

ME 3962 – PLASTICS PROCESSING

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 3960

This course is centered in the processing of plastics materials. Preliminary concepts such as: crystallization, glassy state, visco-elasticity, polymeric and composites compounds are covered. The course also covers processing techniques like casting, compression molding, injection, calendaring, extrusion, thermoforming, bending, machining, welding, gluing, and surface coating are compared establishing their applications.

ME 4930 – AERODYNAMICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 2930, ME 3140

This course introduces the aerodynamics of bodies and the principles of airfoil design. The course covers concepts in incompressible airfoil theory and incompressible wing theory as well as topics in gas dynamics including expansion waves, and supersonic airfoil theory.

ME 4931 – FLIGHT DYNAMICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 4930

This course is designed to give aerospace engineering undergraduate students the fundamental concepts of modeling of the aircraft dynamic and aerodynamic behavior as well as concepts of static, dynamic stability and simulation of the aircraft dynamics. Also the concept of handling qualities will be introduced. The students will also be introduced to MATLAB software package for the analysis of dynamic systems.

ME 4932 – AIRCRAFT PERFORMANCE AND DESIGN

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 4931

An introduction to the Performance and Design of Aircraft. Airplane aerodynamics, Propulsion Characteristics, Steady and Accelerated Flights, Propeller Driven and Jet-Propelled Airplanes.

ME 4935 – AIRCRAFT PROPULSION

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 3120

This course covers aircraft gas turbine engine and rocket propulsion from its basic principles to more advanced treatments in engine components. The course includes the transition duct aerodynamics, inlet distortion (both steady-state and dynamic), and compressor stall/surge characteristics; the inclusion of propulsion system integration shows propulsion as one element of a larger system (namely, aircraft) and the necessity of trade-off in overall system design; the principles behind the design of combustors and afterburners are covered in the discussion on combustion chemistry, combustor and afterburner design; material, manufacturing and cooling requirements; fundamentals of chemical rocket propulsion principles; different turbine cooling schemes and principles with a follow-up multi-stage cooled turbine design; and focus on design approaches to alleviate harmful emissions, both current and the direction for the future as well as regulatory requirements on engine pollutions.

ME 4940 – BIO-FLUID MECHANICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGI 2420

Introduction to the study of blood flow in the cardiovascular system and gas flow in the pulmonary system. Emphasis on modeling and the potential of flow studies for clinical research application.

ME 4942 – BIO-SOLID MECHANICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 2230

The mechanics of living tissue, e.g., arteries, skin, heart muscle, ligament, tendon, cartilage and bone. Constitutive equations and some simple mechanical models. Mechanics of cells and applications.

ME 5152 – AEROSPACE ENGINEERING LABORATORY

One credit-hour. Two two-hour laboratory period per week. Prerequisite: ME 4935, ME 4931, ME 5930

Experimental analysis of airfoils, fans, turbines, flight dynamics simulations, aerospace structures, vibrations, and instrumentation systems are performed. Comparison of experimental and theoretical results. The laboratory emphasizes team work and communication skills through the submission of oral and written reports.

ME 5910 - AIR CONDITIONING SYSTEMS DESIGN

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3120, ME 3160

Application of the principles of thermodynamics to the analysis and design of air conditioning systems. Principles for the control of moist air properties to meet comfort and industrial requirements. Heat transmission in building structures. Calculation of heating and cooling loads. Component performance, distribution, selection, and controls.

ME 5916 – INTERNAL COMBUSTION ENGINES

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME3120, ME 3160

The principles of thermodynamics, compressible fluid flow, and combustion processes as applied to the study of spark ignition and compression-ignition engines. Operating power cycles, engine performance, heat losses, efficiencies, and air pollution are included.

ME 5918 - POWER PLANT ENGINEERING

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3120, ME 3160

This course presents a study of the thermal and economic aspects of power plants. The course covers fuel and combustion processes as well as power cycles (e.g., Rankine cycles and Brayton cycles) in power plants. The course focuses in the design and operation of power plant components such as boilers, condensers, cooling towers, feed-water heaters. The course also introduces the students to non-conventional power plants using renewable energy sources.

ME 5922 - TURBOMACHINERY

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3120, ME 3160

Dimensional analysis, energy transfer in rotating passages. Flow through passages and over blades and vanes. Centrifugal pumps, fans, and compressors. Axial flow pumps, fans, and compressors. Steam and gas turbines. Hydraulic turbines. Wind turbines.

ME 5930 – AEROSPACE STRUCTURES

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3230

This course introduces the students to the analysis and design of aerospace structural components. The course

covers the development of design criteria, the determination of structural loads, and the selection of materials in aerospace applications. The course emphasizes the analysis and design of thin-walled structures as key structural elements in aerospace applications.

ME 5950– MECHANICAL VIBRATION

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3030

This course presents an introduction to free and forced vibration of single degree and multiple degree of freedom systems. The course covers modeling and analysis techniques for mechanical systems to determine natural frequencies, mode shapes and forced response under harmonic and transient loads. The course also introduces to the practical design aspects of vibration control devices.

ME 5952 – INTRODUCTION TO DYNAMICS OF MACHINERY

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3030

This course presents an introduction to the analysis and design of rotating machinery. The course combines the theory and application of dynamics, vibrations, fluid mechanics, and tribology to the design of such systems.

ME 5954 – INTRODUCTION TO FINITE ELEMENT METHOD

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3150

Introduction to the fundamental aspects of the finite element method (FEM) and its applications. Review of matrix algebra and an introduction to FEM formulations. Analysis of truss, beam and frame structures. One- and two-dimensional elements.

ME 5956 – INTRODUCTION TO DESIGN FOR MANUFACTURING

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3230, ME 3260

Design for Manufacturing and Assembly (DFM/A) is an approach to product design that systematically includes consideration of manufacturability and assembly in the design. DFM/A includes organizational changes, design principles, and guidelines. The scope of DFM/A is expanded also to other areas as marketability, testability, serviceability, maintainability.

ME 5958 – ROBOTICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 3040, ME 4011

Introduction to robotic manipulators. Layout design of robot arms. Kinematics and Dynamics Analyzes. Analytical methods and algorithms for computer implementation.

Motion description of manipulators in terms of trajectories in space. Control of robotic manipulators using digital computers. Robot programming.

ME 5970 - MECHANICAL ENGINEERING PRACTICE

Three credit-hours. Time schedule by arrangement. Prerequisites: ME 3110, ME 3230, approval by the Director of the Mechanical Engineering Department

A course organized in collaboration with the industry or government agencies to provide the student with practical experience in mechanical engineering. The project must be pre-approved by the Director of the Mechanical Engineering Department. The project execution is jointly supervised by a designated faculty member from the Mechanical Engineering Department and a qualified representative from the cooperating organization. A minimum of 200 hours of field experience is required.

ME 5980 - MECHANICAL ENGINEERING UNDERGRADUATE RESEARCH

Three credit-hours. Time schedule by arrangement. Prerequisite: Instructor and Head of the Department Consent.

Individual research project under the supervision of a faculty member.

ME 5990 - SPECIAL TOPICS IN MECHANICAL ENGINEERING

Three credit-hours. Time schedule by arrangement. Prerequisite: Instructor and Head of the Department Consent.

Arranged by individual faculty with special expertise, these courses survey fundamentals in areas that are not covered by the regular mechanical engineering course offerings. Specific course descriptions are disseminated by the Mechanical Engineering Office well in advance of the offering.

COURSES FOR NON-MECHANICAL ENGINEERING STUDENTS

ENGI 2430 - ENGINEERING THERMODYNAMICS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGI 2420

This presents an introduction to fundamental concepts in thermodynamics and heat transfer for non-mechanical engineering students. The course discusses thermodynamic properties, principles of conservation of mass and energy, entropy and second law of thermodynamics as well as vapor and gas power cycles. The course concludes with an introduction to heat transfer concepts in steady conduction and unsteady heat conduction as well as natural and forced convection heat transfer.

ENGI 3440 - THERMOFLUIDS

Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGI 2410

An introduction to thermodynamics and fluid mechanics. Study the concepts of energy and the laws governing the transfers and transformations of energy. Emphasis on thermodynamic properties and the first and second law analysis of systems and control volumes. Integration of these concepts into the analysis of basic power cycles is introduced. Study of the fundamentals of fluid mechanics. Application of momentum, energy and continuity principles to the analysis of incompressible flow applications. The course concludes with the analysis of viscous flows in pipes.

DEPARTMENTAL FACULTY

ALVARADO DÍAZ, CARLOS A. – Professor; Ph.D. Bio-Medical Engineering, University of Connecticut 2005; M.S. Mechanical Engineering, Ohio State University, 1997; B.S. Mechanical Engineering, University of Puerto Rico, 1995.

CABRERA RUIZ, EDUARDO – Associate Professor; M.S. Mechanical Engineering, University of Puerto Rico, Mayagüez, 2001; B.S. Mechanical Engineering, University of Guanajuato, 1997.

CARRERAS CRUZ, ÁNGEL– Associate Professor; M. Engineering Management, Polytechnic University of Puerto Rico, 1999; B.S. Mechanical Engineering, Polytechnic University of Puerto Rico, 1995.

ESPINOZA, ALBERT A. – Assistant Professor; M.S. Mechanical Engineering, The University of Texas at Austin, 2009; B.S. Mechanical Engineering, The University of Texas, 2006.

GERENA COLÓN, DIOLINETE – Assistant Professor; Associate Director, Mechanical Engineering Department; M.E. Mechanical Engineering, Polytechnic University of Puerto Rico, 2013; B.S. Mechanical Engineering, University of Puerto Rico, Mayagüez, 1991.

JIMENEZ VELEZ, RAFAEL– Assistant Professor; M.S. Civil Engineering, Cornell University, 2002; B.S. Civil Engineering, Polytechnic University of Puerto Rico, 2001.

NORIEGA MOTTA, JULIO A.– Professor; Ph.D. Mechanical Engineering, University of West Virginia, 2006; M.S. Mechanical Engineering, University of Puerto Rico, Mayagüez, 1993; B.S. Mechanical Engineering, University of San Carlos, 1983.

ORDOÑEZ ESTEVEZ, SANDRA L. – Assistant Professor; M.S. Electrical Engineering, University of Puerto Rico, Mayagüez, 2005; B.S. Electrical Engineering, Pontificia Bolivariana University, 2000.

PELAEZ CARPIO, HUGO M. – Associate Professor; Ph.D. Marine Sciences, University of Puerto Rico, Mayagüez 2001; M.S. Chemical Engineering, University of Puerto Rico, Mayagüez, 1995; B.S. Chemical Engineering, University of San Marcos, 1987.

PINO ROMAINVILLE, FRANCISCO A. – Associate Professor; Ph.D. Mechanical Engineering, University of West Virginia, 2008; M.S. Mechanical Engineering, University of West Virginia, 2005; B.S. Industrial and System Engineering, Universidad of Piura, Peru, 2000.

RESTREPO TORRES, BERNARDO – Associate Professor; Mechanical Engineering Department Head; Ph.D. Mechanical Engineering, University of West Virginia, 2011; M.S. Mechanical Engineering, University of Puerto Rico, Mayagüez, 2001; B.S. Mechanical Engineering, Corporación Universitaria Tecnológica de Bolívar, 1996.

SANTAPURI SUSHMA – Associate Professor; Ph.D. Mechanical Engineering, Ohio State University, 2012; B.T. Mechanical Engineering, Indian Institute of Technology, Madras, 2007.

SKRZYPINSKI ROMANOW, ANTONI E. – Professor; D.Sc. Mechanical Engineering, 1980; Ph.D. Mechanical Engineering, 1970; B.S. Mechanical Engineering, University of Mining and Metallurgy, Cracow, Poland, 1961.

SOSA ANCAJIMA, RONALD M.– Associate Professor; M.S. Mechanical Engineering, University of Puerto Rico, Mayagüez, 1996; B.S. Mechanical Engineering, Universidad Nacional de Trujillo, 1987.

SCHOOL OF MANAGEMENT AND ENTREPRENEURSHIP

BUSSINESS ADMINISTRATION PROGRAM

The School of Management and Entrepreneurship seeks to provide theoretical and practical knowledge to those students who aim to receive a bachelor's degree in Business Administration (BBA). Building upon the heritage and accomplishments of our schools of engineering and architecture, the School of Management is dedicated to advancing business knowledge and the practical application of business principles in a global technological environment. Our faculty has created a business curriculum which emphasizes the link between business management and technology. Our curriculum is also designed to provide an interdisciplinary approach to business decision making, blending broad-based knowledge of the business functions with an emphasis in a particular discipline. Students are exposed to the areas of Accounting, Economics, Finance, Organizational Management, and Statistics, and their application in a corporate, service, manufacturing or entrepreneurial environment.

CAREER OPPORTUNITIES

Business Administration graduates are highly regarded and sought by the manufacturing, production, and construction industries, as well as the government and service sector of our economy. They serve as liaison between the technology resources of an industry and the human resources that make it work. The ability to do so is acquired through the various techniques of analysis and synthesis presented throughout the curriculum.

MISSION

The School of Management and Entrepreneurship at Polytechnic University of Puerto Rico is dedicated to provide the students a well-rounded, technology-oriented business education that will empower them to become tomorrow's socially responsible business leaders.

EDUCATIONAL OBJECTIVES OF THE BUSSINESS ADMINISTRATION PROGRAMS

The main objectives of the academic programs offered at the School of Management and Entrepreneurship are to:

1. Provide a multi-disciplinary approach to business decision-making.

2. Enhance the student's awareness and skills in technology, and their understanding of its application in a global business environment.
3. Improve the student's leadership abilities, teamwork, and communication skills.

PROGRAM EXPECTED OUTCOMES

The Business Administration Program is designed to develop broad knowledge of the business disciplines, awareness and skills in the use of technology for business decision-making, a sense of social responsibility, as well as effective communication and team-work skills.

Graduates from the Business Administration Program shall be able to:

- A. Demonstrate the ability to gather and analyze information for research and creative problem solving.
- B. Employ effective communication skills in a variety of business situations and daily work environments.
- C. Acquire the ability to utilize leadership skills, to influence and support others in the performance of their tasks.
- D. Demonstrate the ability to work effectively as a team member and team leader.
- E. Develop the ability to manage technological change, and understand its role in the global business environment.
- F. Demonstrate ability for self-evaluation, and behavior modification; and evidence comprehension of business ethics and social responsibility.
- G. Develop the ability to integrate and apply knowledge of the various business disciplines, in conjunction with the selected specialization, to improve the decision making process.
- H. Acquire the ability to conceptualize, plan, develop and apply the necessary skills to engage in an entrepreneurial endeavor.

DEGREE OFFERED: The School of Management offers a bachelor's degree in Business Administration (BBA) with majors in:

- Accounting
- Construction Management
- General Management
- Entrepreneurship
- Marketing

To obtain the degree, the student must complete the following minimum requirements:

MINIMUM GRADUATION REQUIREMENTS

36	Credit-hours in General Education
47	Credit-hours in General Business Administration
6	Credit-hours in free electives
33	Credit-hours in Business Administration Major
122	Total credit-hours to obtain a Bachelor in Business Administration

MAJORS IN BUSINESS ADMINISTRATION (33 CREDIT-HOURS)

Although students can select their courses from any of the four (4) majors, they should take 12-15 credit-hours in Departmental Electives from corresponding areas in Business Administration:

ACCOUNTING- 18 credit-hours in Accounting, 12 credit-hours in Directed Department Electives, 3 Credit-Hours in Project in Accounting, Total: 33 credit-hours.

CONSTRUCTION MANAGEMENT- 15 credit-hours in Construction Management, 15 credit-hours in Directed Department Electives, 3 credit-hours in Project in Construction Management, Total: 33 credit-hours.

GENERAL MANAGEMENT- 15 credit-hours- in Management, 15 credit-hours in Directed Department Electives, 3 credit-hours in Project in General Management, Total: 33 credit-hours.

MARKETING- 15 credit-hours in Marketing, 15 credit-hours in Directed Department Electives, 3 credit-hours in Project in Marketing, Total: 33 credit-hours.

Note: Not all classes are offered in all school terms. The student needs to plan his/her classes carefully to finish in the optimal time frame.

STUDENT ORGANIZATIONS: Students have the opportunity to get involved in academic, professional and cultural activities such as conferences, seminars, visits to plants and factories, through their active participation in the Student Association of Business Administration (*A.E.A.E. Asociación de Estudiantes de Administración de Empresas*), *Capítulo Estudiantil de la Cámara de Comercio de Puerto Rico* and Students in Free Enterprise (SIFE). They can also participate in other student associations and fraternities organized and/or recognized by Polytechnic University of Puerto Rico.

DEVELOPMENTAL STUDIES: All students who request admission and are admitted to the Business Administration Program must show evidence that they have acquired the academic abilities and skills necessary to progress through this major. Those who do not have these abilities and skills as reflected by the results of their College Entrance Examination Board exam, High School grades, previous university experience or other evidence, will be required to take additional courses to gain the knowledge. Thus, there may be variations on how to fulfill the minimum graduation requirements stated above. The component of these courses, if required, is in addition to the credit-hours of the Business Administration Program. The courses are awarded their corresponding credit-hours according to the contact hours. Some of the courses are the following:

DEVELOPMENTAL STUDIES COMPONENT (MAXIMUM OF 18 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
SPAN 0100	Preparatory Spanish	3

BUSINESS ADMINISTRATION CURRICULUM

GENERAL EDUCATION COMPONENT (36 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
COMP 1010	Introduction to Computer & Basic Language	3
ECON 3010	Micro Economics	3
ECON 3020	Macro Economics	3
ENGL 0110	English Grammar	3
ENGL 1010	The Study of Essay as a Literary Genre	3
PHIL 3000	Business Ethics	3
SOHU 2010	Socio-Humanistic I	3
SOHU 2020	Socio-Humanistic II	3
SPAN 0110	Spanish Grammar	3
SPAN 1010	Linguistic Analysis of Literary Genre	3
	Socio-humanistic Elective	3
	Socio-humanistic Elective	3

BUSINESS ADMINISTRATION COMPONENT (47 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS
ACCO 2010	Accounting Principles I	4
ACCO 2020	Accounting Principles II	4
COMP 2010	Business Application Programs	3

COMP	3010	Database Management	3
ENGL	2020	Business English	3
FINA	2010	Finance	3
MARK	1010	Marketing	3
MATH	1310	Applied Mathematics for Business I	3
MATH	1320	Applied Mathematics for Business II	3
MGMT	1010	Introduction to Management	3
MGMT	2020	Business Law	3
MGMT	2010	Organizational Theory Management	3
SPAN	2020	Business Spanish	3
STAT	2010	Probability & Statistics	3
STAT	2020	Statistics & Hypothesis Testing	3

FREE ELECTIVES (6 CREDIT-HOURS):

Select two (2) Courses: from any Area of Interest.

MAJORS IN BUSINESS ADMINISTRATION*

ACCOUNTING COMPONENT*

(33 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
ACCO	3310	Cost Accounting	4
ACCO	3330	Intermediate Accounting I	4
ACCO	3340	Intermediate Accounting II	4
ACCO	3350	Puerto Rico Income Tax	3
ACCO	4310	Advanced Accounting	3
ACCO	4370	Accounting Project	3
		21	
Directed Department Electives		12	
TOTAL CREDIT-HOURS		33	

* Not all classes are offered in all school terms. The student needs to plan his/her classes carefully to finish in the optimal time frame.

CONSTRUCTION MANAGEMENT COMPONENT*

(33 CREDIT- HOURS)

COURSE	TITLE	CREDIT-HOURS	
MGMT	3210	Construction Management	3
MGMT	3220	Construction Contracts and Legal Documents	3
MGMT	3230	Construction Materials and Methods	3
MGMT	3240	Construction Estimates and Costs	3
MGMT	4210	Project Planning and Control (PERT)	3
MGMT	4270	Construction Management Project	3
		18	
Directed Department Electives		15	
TOTAL CREDIT-HOURS		33	

GENERAL MANAGEMENT COMPONENT

(33 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
MGMT	3610	Human Resources Management	3
MGMT	3620	Organizational Behavior	3
MGMT	4610	Total Quality Management	3
MGMT	4620	Strategic Management	3
MGMT	4630	Organizational Development	3
MGMT	4670	General Management Project	3
		18	
Directed Department Electives		15	
TOTAL CREDIT-HOURS		33	

Note: Not all classes are offered in all school terms. The student needs to plan his/her classes carefully to finish in the optimal time frame.

MARKETING COMPONENT

(33 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
MARK	3410	Sales & Retail Management	3
MARK	3430	Product Management	3
MARK	3450	Advertising	3
MARK	3460	Service Marketing	3
MARK	4410	Marketing Research	3
MARK	4470	Marketing Project	3
		18	
Directed Department Electives		15	
TOTAL CREDIT-HOURS		33	

* Note: Not all classes are offered in all school terms. The student needs to plan his/her classes carefully to finish in the optimal time frame.

ENTREPRENEURSHIP COMPONENT

(33 CREDIT-HOURS)

COURSE	TITLE	CREDIT-HOURS	
ENTR	3010	Business Creativity and Innovation	3
ENTR	3020	Electronic Business	3
ENTR	4010	International Business	3
ENTR	4020	Entrepreneurial Finance	3
ENTR	4620	Strategic Management	3
ENTR	4070	Entrepreneurial Project	3
		18	
Directed Department Electives		15	
TOTAL CREDIT-HOURS		33	

DIRECTED DEPARTMENT ELECTIVES

The students can select their courses from any of the six (6) majors. **Student should take (12-15) credit-hours from those corresponding Business Administration areas **.

COURSE	TITLE	CREDIT-HOURS
ACCO 3110	Managerial Accounting	3
ACCO 3320	Computer Applications in Accounting	3
ACCO 3350	Puerto Rico Income Tax	3
ACCO 3360	Federal Income Tax	3
ACCO 4320	Auditing	3
ACCO 4330	Accounting for Governmental and Not-for-Profit Organizations	3
ISYS 3510	Management Information Systems	3
ISYS 3520	Business Programming Language-Cobol I	3
ISYS 3560	Programming Language: Level I	3
ISYS 3570	Programming Language: Level II	3
ISYS 3580	Strategic Information Technology Management	3
ISYS 3590	Electronic Commerce	3
ISYS 4530	Local Area Network	3
FINA 3710	Intermediate Managerial Finance	3
FINA 3730	Money and Banking	3
FINA 3740	Capital Markets	3
FINA 3750	Risk and Insurance Coverage	3
FINA 4710	Investments	3
FINA 4720	International Finance	3
MARK 3410	Sales & Retail Management	3
MARK 3420	Consumer Behavior	3
MARK 3430	Product Management	3
MARK 3440	Service Marketing	3
MARK 3450	Advertising	3
MARK 3460	Public Relations	3
MGMT 4120	Advanced Operations and Production Management	3
MGMT 3210	Construction Management	3
MGMT 3250	Construction Equipment	3
MGMT 3260	Construction Safety	3
MGMT 4220	Government Regulations	3
MGMT 3610	Human Resources Mgmt.	3
MGMT 3670	Labor Relations	3
MGMT 4640	Collective Bargaining	3
MGMT 4650	Adm. of Wages and Salaries	3
MGMT 4660	Entrepreneurship	3

BBA WITH MAJOR IN ACCOUNTING CURRICULUM SEQUENCE**FIRST YEAR**

FIRST QUARTER		
COURSE	TITLE	CREDIT-HOURS
ENGL 0110	English Grammar	3
SPAN 0110	Spanish Grammar	3
SOHU 2010	Socio-humanistic Studies I	3
MATH 1310	Applied Mathematics for Business I	3
TOTAL CREDIT-HOURS		12

SECOND QUARTER		
COURSE	TITLE	CREDIT-HOURS
ENGL 1010	The Study of the Essay as a Literary Genre	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SOHU 2020	Socio-humanistic Studies II	3
MATH 1320	Applied Mathematics for Business II	3
TOTAL CREDIT-HOURS		12

THIRD QUARTER		
COURSE	TITLE	CREDIT-HOURS
COMP 1010	Introduction to Computer & Basic Language	3
ECON 3010	Micro Economics	3
MARK 1010	Marketing	3
MGMT 1010	Introduction to Management	3
TOTAL CREDIT-HOURS		12

SECOND YEAR

FIRST QUARTER		
COURSE	TITLE	CREDIT-HOURS
ACCO 2010	Accounting Principles I	4
COMP 2010	Business Application Programs	3
ECON 3020	Macro Economics	3
MGMT 2010	Organizational Theory Management	3
TOTAL CREDIT-HOURS		13

SECOND QUARTER		
COURSE	TITLE	CREDIT-HOURS
ACCO 2020	Accounting Principles II	4
COMP 3010	Database Management	3
MGMT 2020	Business Law	3
STAT 2010	Probabilities & Statistics	3
TOTAL CREDIT-HOURS		13

BBA WITH MAJOR IN CONSTRUCTION MANAGEMENT CURRICULUM SEQUENCE

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGL 2020	Business English	3
FINA 2010	Finance	3
SPAN 2020	Business Spanish	3
STAT 2020	Statistics & Hypothesis Testing	3
TOTAL CREDIT-HOURS		12

THIRD YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
ACCO 3310	Cost Accounting	4
ACCO 3330	Intermediate Accounting I	4
ACCO 3350	Puerto Rico Income Tax	3
PHIL 3000	Business Ethics	3
TOTAL CREDIT-HOURS		14

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ACCO 3340	Intermediate Accounting II	4
	Free Elective	3
	Directed Dept. Elective	3
	Sohu Elective	3
TOTAL CREDIT-HOURS		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ACCO 4310	Advanced Accounting	3
	Directed Dept. Elective	3
	Directed Dept. Elective	3
	Sohu Elective	3
TOTAL CREDIT-HOURS		12

FOURTH YEAR

FIRST QUARTER

	Free Elective	3
	Directed Dept. Elective	3
ACCO 4370	Accounting Project	3
TOTAL CREDIT-HOURS		9

FIRST YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGL 0110	English Grammar	3
SPAN 0110	Spanish Grammar	3
SOHU 2010	Socio-humanistic Studies I	3
MATH 1310	Applied Mathematics for Business I	3
TOTAL CREDIT-HOURS		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGL 1010	The Study of the Essay as a Literary Genre	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SOHU 2020	Socio-humanistic Studies II	3
MATH 1320	Applied Mathematics for Business II	3
TOTAL CREDIT-HOURS		12

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
COMP 1010	Introduction to Computer & Basic Language	3
ECON 3010	Micro Economics	3
MARK 1010	Marketing	3
MGMT 1010	Introduction to Management	3
TOTAL CREDIT-HOURS		12

SECOND YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
ACCO 2010	Accounting Principles I	4
COMP 2010	Business Application Programs	3
ECON 3020	Macro Economics	3
MGMT 2010	Organizational Theory Management	3
TOTAL CREDIT-HOURS		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ACCO 2020	Accounting Principles II	4
COMP 3010	Database Management	3
MGMT 2020	Business Law	3
STAT 2010	Probabilities & Statistics	3
TOTAL CREDIT-HOURS		13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGL 2020	Business English	3
FINA 2010	Finance	3
SPAN 2020	Business Spanish	3
STAT 2020	Statistic & Hypothesis Testing	3
TOTAL CREDIT-HOURS		12

THIRD YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
MGMT 3210	Construction Management	3
MGMT 3220	Construction Contract & Legal Documents	3
PHIL 3000	Business Ethics	3
	Directed Department Elective	3
TOTAL CREDIT-HOURS		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
MGMT 3230	Construction Material & Methods	3
MGMT 3240	Construction Estimates & Cost	3
	Directed Department Elective	3
	Directed Department Elective	3
TOTAL CREDIT-HOURS		12

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
MGMT 4210	Project Planning & Control	3
MGMT 4270	Construction Mgmt. Project	3
	Free Elective	3
	Sohu Elective	3
TOTAL CREDIT-HOURS		12

FOURTH YEAR

FIRST QUARTER

	Directed Department Elective	3
	Directed Department Elective	3
	Free Elective	3
	Sohu Elective	3
TOTAL CREDIT-HOURS		12

BBA WITH MAJOR IN GENERAL MANAGEMENT CURRICULUM SEQUENCE

FIRST YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGL 0110	English Grammar	3
SPAN 0110	Spanish Grammar	3
SOHU 2010	Socio-humanistic Studies I	3
MATH 1310	Applied Mathematics for Business I	3
TOTAL CREDIT-HOURS		12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ENGL 1010	The Study of the Essay as a Literary Genre	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SOHU 2020	Socio-humanistic Studies II	3
MATH 1320	Applied Mathematics for Business II	3
TOTAL CREDIT-HOURS		12

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS
COMP 1010	Introduction to Computer & Basic Language	3
ECON 3010	Micro Economics	3
MARK 1010	Marketing	3
MGMT 1010	Introduction to Management	3
TOTAL CREDIT-HOURS		12

SECOND YEAR

FIRST QUARTER

COURSE	TITLE	CREDIT-HOURS
ACCO 2010	Accounting Principles I	4
COMP 2010	Business Application Programs	3
ECON 3020	Macro Economics	3
MGMT 2010	Organizational Theory Management	3
TOTAL CREDIT-HOURS		13

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS
ACCO 2020	Accounting Principles II	4
COMP 3010	Database Management	3
MGMT 2020	Business Law	3
STAT 2010	Probabilities & Statistics	3
TOTAL CREDIT-HOURS		13

**BBA WITH MAJOR IN ENTREPRENEURSHIP
CURRICULUM SEQUENCE**

THIRD QUARTER			
COURSE	TITLE		CREDIT-HOURS
ENGL	2020	Business English	3
FINA	2010	Finance	3
SPAN	2020	Business Spanish	3
STAT	2020	Statistics & Hypothesis	3
TOTAL CREDIT-HOURS			12

THIRD YEAR			
FIRST QUARTER			
COURSE	TITLE		CREDIT-HOURS
MGMT	3610	Human Resources Mgmt.	3
MGMT	3620	Organizational Behavior	3
MGMT	4610	Total Quality Mgmt.	3
PHIL	3000	Business Ethics	3
TOTAL CREDIT-HOURS			12

SECOND QUARTER			
COURSE	TITLE		CREDIT-HOURS
MGMT	4620	Strategy Management	3
		Directed Dept. Elective	3
		Directed Dept. Elective	3
		Free Elective	3
TOTAL CREDIT-HOURS			12

THIRD QUARTER			
COURSE	TITLE		CREDIT-HOURS
MGMT	4630	Organizational Development	3
MGMT	4670	General Management Project	3
		Directed Dept. Elective	3
		Sohu Elective	3
TOTAL CREDIT-HOURS			12

FOURTH YEAR			
FIRST QUARTER			
			CREDIT-HOURS
		Directed Dept. Elective	3
		Directed Dept. Elective	3
		Free Elective	3
		Sohu Elective	3
TOTAL CREDIT-HOURS			12

FIRST YEAR			
FIRST QUARTER			
COURSE	TITLE		CREDIT-HOURS
ENGL	0110	English Grammar	3
SPAN	0110	Spanish Grammar	3
SOHU	2010	Socio-humanistic Studies I	3
MATH	1310	Applied Mathematics for Business I	3
TOTAL CREDIT-HOURS			12

SECOND QUARTER			
COURSE	TITLE		CREDIT-HOURS
ENGL	1010	The Study of the Essay as a Literary Genre	3
SPAN	1010	Linguistic Analysis of Literary Genres	3
SOHU	2020	Socio-humanistic Studies II	3
MATH	1320	Applied Mathematics for Business II	3
TOTAL CREDIT-HOURS			12

THIRD QUARTER			
COURSE	TITLE		CREDIT-HOURS
COMP	1010	Introduction to Computer & Basic Language	3
ECON	3010	Micro Economics	3
MARK	1010	Marketing	3
MGMT	1010	Introduction to Management	3
TOTAL CREDIT-HOURS			12

SECOND YEAR			
FIRST QUARTER			
COURSE	TITLE		CREDIT-HOURS
ACCO	2010	Accounting Principles I	4
COMP	2010	Business Application Programs	3
ECON	3020	Macro Economics	3
MGMT	2010	Organizational Theory Management	3
TOTAL CREDIT-HOURS			13

SECOND QUARTER			
COURSE	TITLE		CREDIT-HOURS
ACCO	2020	Accounting Principles II	4
ENTR	1010	Principles of Entrepreneurship	3

MGMT	2020	Business Law	3
STAT	2010	Probabilities & Statistics	3
TOTAL CREDIT-HOURS			13

THIRD QUARTER			
COURSE	TITLE		CREDIT-HOURS
ENGL	2020	Business English	3
FINA	2010	Finance	3
SPAN	2020	Business Spanish	3
STAT	2020	Statistics & Hypothesis	3
TOTAL CREDIT-HOURS			12

THIRD YEAR			
FIRST QUARTER			
COURSE	TITLE		CREDIT-HOURS
ENTR	3010	Business Creativity and Innovation	3
ENTR	3020	Electronic Business	3
		Directed Dept. Elective	3
PHIL	3000	Business Ethics	3
TOTAL CREDIT-HOURS			12

SECOND QUARTER			
COURSE	TITLE		CREDIT-HOURS
MGMT	4620	Strategic Management	3
ENTR	4010	International Business	3
		Directed Dept. Elective	3
		Free Elective	3
TOTAL CREDIT-HOURS			12

THIRD QUARTER			
COURSE	TITLE		CREDIT-HOURS
ENTR	4020	Entrepreneurial Finance	3
ENTR	4070	Entrepreneurial Project	3
		Directed Dept. Elective	3
		Sohu Elective	3
TOTAL CREDIT-HOURS			12

FOURTH YEAR			
FIRST QUARTER			
			CREDIT-HOURS
		Directed Dept. Elective	3
		Directed Dept. Elective	3
		Free Elective	3
		Sohu Elective	3
TOTAL CREDIT-HOURS			12

BBA WITH MAJOR IN MARKETING CURRICULUM SEQUENCE

FIRST YEAR

FIRST QUARTER			
COURSE	TITLE		CREDIT-HOURS
ENGL	0110	English Grammar	3
SPAN	0110	Spanish Grammar	3
SOHU	2010	Socio-humanistic Studies I	3
MATH	1310	Applied Mathematics for Business I	3
TOTAL CREDIT-HOURS			12

SECOND QUARTER			
COURSE	TITLE		CREDIT-HOURS
ENGL	1010	The Study of the Essay as a Literary Genre	3
SPAN	1010	Linguistic Analysis of Literary Genres	3
SOHU	2020	Socio-humanistic Studies II	3
MATH	1320	Applied Mathematics for Business II	3
TOTAL CREDIT-HOURS			12

THIRD QUARTER			
COURSE	TITLE		CREDIT-HOURS
COMP	1010	Introduction to Computer & Basic Language	3
ECON	3010	Micro Economics	3
MARK	1010	Marketing	3
MGMT	1010	Introduction to Management	3
TOTAL CREDIT-HOURS			12

SECOND YEAR

FIRST QUARTER			
COURSE	TITLE		CREDIT-HOURS
ACCO	2010	Accounting Principles I	4
COMP	2010	Business Application Programs	3
ECON	3020	Macro Economics	3
MGMT	2010	Organizational Theory Management	3
TOTAL CREDIT-HOURS			13

SECOND QUARTER			
COURSE	TITLE		CREDIT-HOURS
ACCO	2020	Accounting Principles II	4
COMP	3010	Database Management	3
MGMT	2020	Business Law	3

STAT	2010	Probabilities & Statistics	3
TOTAL CREDIT-HOURS			13

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS	
ENGL 2020	Business English	3	
FINA 2010	Finance	3	
SPAN 2010	Business Spanish	3	
STAT 2020	Statistics & Hypothesis Testing	3	
TOTAL CREDIT-HOURS			12

THIRD YEAR**FIRST QUARTER**

COURSE	TITLE	CREDIT-HOURS	
MARK 3410	Sales & Retail Mgmt.	3	
MARK 3430	Product Management	3	
PHIL 3000	Business Ethics	3	
	Directed Dept. Elective	3	
TOTAL CREDIT-HOURS			12

SECOND QUARTER

COURSE	TITLE	CREDIT-HOURS	
MARK 3450	Advertising	3	
MARK 3460	Public Relations	3	
	Directed Dept. Elective	3	
	Sohu Elective	3	
TOTAL CREDIT-HOURS			12

THIRD QUARTER

COURSE	TITLE	CREDIT-HOURS	
MARK 4410	Marketing Research	3	
MARK 4470	Marketing Project	3	
	Directed Dept. Elective	3	
	Free Elective	3	
TOTAL CREDIT-HOURS			12

COURSE DESCRIPTIONS**ACCOUNTING COURSES****ACCO 2010- ACCOUNTING PRINCIPLES I**

Four credit-hours. Two and a half hour lecture periods twice per week. Pre-requisites: MATH 0110, and COMP1010

Study the basic accounting principles and concepts. Complete accounting cycle using different procedures for

preparation, adjustments, and presentation of financial statements. Use of general and special journals, general and subsidiary ledgers, worksheets, inventory pricing systems and methods, control of assets, liabilities and equity's accounts.

ACCO 2020- ACCOUNTING PRINCIPLES II

Four credit-hours. Two and a half hour lecture periods twice per week. Prerequisite: ACCO 2010

Study the accounting principles and procedures in partnerships and corporations. Review of the organizational characteristics in areas such as administration, liquidation, legal aspects and distribution of capital in these types of businesses. Analyze the earnings per share concept and procedures for financing through bonds and stocks in great detail. Also, include the financial statements' analysis for corporations, partnerships and sole proprietorship.

ACCO 3310- COST ACCOUNTING

Four credit-hours. Two and a half hour lecture periods twice per week. Pre-requisite: ACCO 2020

Study the basic cost accounting concepts, methods and procedures used in the determination of the unit cost of a product. It includes the procedures for the three main elements of the cost of a product (raw materials, direct labor and manufacturing overhead) by the two cost accumulation methods (job order and process cost) and by standards cost. Special emphasis is placed on the discussion of managerial analysis and control of production costs.

ACCO 3320- COMPUTER APPLICATIONS IN ACCOUNTING

Three credit-hours. Two hour lecture periods twice per week. Prerequisites: COMP 2010, ACCO 2020

Study accounting computer software like Peachtree, Excel, among others with extensive use in today's business. This course simulates accounting scenarios to show how accounting concepts apply to real-world situations. Following step-by-step directions, the students pass through full accounting cycle. Complete bookkeeping work, create a chart of accounts, payment register, checks, invoices, inventory, and prepare necessary adjusting entries for the presentation and analysis of financial statements and tax returns. Visit web sites of Peachtree Corp., IRS and others related to the area.

ACCO 3330,3340- INTERMEDIATE ACCOUNTING I- II

Eight credit-hours. Two and a half hour lecture periods twice per week. Prerequisites: ACCO 2020, ACCO 3330

This is a two term course with the purpose to cover financial accounting in depth. It examines topics such as the development of the conceptual framework and the evolution of the profession's regulatory bodies and its pronouncements. Also, includes review of the complete accounting cycle plus the analysis of its components and related topics. Use of time value of money techniques

(Present Value of \$1 and of an Ordinary Annuity or of an Annuity Due) to account for amortization of bonds, mortgages, interest on loans and other financial instruments.

ACCO 3350- PUERTO RICO INCOME TAX

Three credit-hours. Two hour lecture periods twice per week. Prerequisite: ACCO 2020

Study the principles and procedures used to prepare income tax return for individuals, partnerships and corporations according to the Income Tax Law of the Commonwealth of Puerto Rico. Special attention is given to the computation of gross income and deductions according to the law to determine taxable net income. Visit the Department of the Treasury web site in the Internet to download software and forms of return.

ACCO 3360- FEDERAL INCOME TAX

Three credit-hours. Two hour lecture periods twice per week. Prerequisite: ACCO 2020

It is the study of the concepts and procedures used to prepare the federal income tax return for individuals, partnerships and corporations according to the United States Internal Revenue Code. Special attention is given to the computation of adjusted gross income and the exemptions and deductions to determine net taxable income including the preparation of schedules visiting the IRS web site in the Internet. This course will prepare the students about taxes for the CPA exam.

ACCO 4310- ADVANCED ACCOUNTING

Three credit-hours. Two hour lecture periods twice per week. Prerequisite: ACCO 3340

Analyze special problems in the Accounting field. Discuss in depth how to account for business combinations, the home office and branch relationship and consolidated financial statements preparation through worksheet adjustments.

ACCO 4320- AUDITING

Three credit-hours. Two hour lecture periods, twice per week. Pre-requisite: ACCO 3330

A study of the AICPA Professional Standards and their applications in the examination of financial statements, the standard short-form opinion, internal control systems, auditing programs, and the rules of professional and ethical responsibilities and legal liabilities of an independent auditor. Special attention is given to the role of the auditor in the survival of an economic entity. Also, study the contemporary development of the auditing field. Review the requirements to become a CPA. Also students will be illustrated with real life situations and visit web site in the Internet.

ACCO 4330- ACCOUNTING FOR GOVERNMENTAL AND NOT-FOR-PROFIT ORGANIZATIONS

Three credit-hours. Two hour lecture periods twice per week. Prerequisite: ACCO 3340

The study of basic accounting concepts for governmental and non-profit entities, including hospitals, universities, churches, among others. Contrast the marked differences between for-profit (business) accounting and governmental and non-profit accounting. These organizations serve entirely different purposes in society than do business entities. State the need to report on management's accountability to citizens (taxpayers, donors) who largely finance its operations, creditors, oversight bodies, and others for how resources had been used in providing services.

ACCO 4370- ACCOUNTING PROJECT

Three credit-hours. By Arrangement Prerequisite: Department Head Authorization

This course is an application of all concepts learned through accounting specialization courses. The student will work the accounting cycle in the real business environment, use their creativity submitting ideas to improve weak points and flaws identified in the accounting system worked. Also, the student can demonstrate the ability to work effectively as a team member implementing his/her leadership skills. The work performance by the students will also, be supervised by an instructor from the Accounting Program. A written report and a group presentation are the instruments used to assess the student learning in the class.

COMPUTER COURSES

COMP 1010- INTRODUCTION TO COMPUTERS AND BASIC LANGUAGE

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MATH 0110

Introduction to the computers used. A brief historical overview. Study the Operating Systems (DOS). Introduction, the repetition, decision and other programming structures using QBASIC language.

COMP 2010- BUSINESS APPLICATIONS PROGRAMS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: COMP 1010

Learn the use of the currently most popular business software packages: at present they are Microsoft Office 2002, Publisher 2002, etc. special emphasis on Excel spreadsheet.

COMP 3010- DATABASE MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: COMP 2010

Study of the principles of a database systems. Survey of the techniques and methodologies used in data base management. Software design analysis and programming in the data base environment. Introduce internet environment. Interface business application programs with Internet.

ENTREPRENEURSHIP COURSES

ENTR	3010	Business Creativity and Innovation
ENTR	3020	Electronic Business
ENTR	4010	International Business
ENTR	4020	Entrepreneurial Finance
	4620	Strategic Management
ENTR		
ENTR	4070	Entrepreneurial Project

ENTR 1010 PRINCIPLES OF ENTREPRENEURSHIP

Three credit-hours. Two hour lecture periods, twice per week.

Provides an introduction and general description of business principles. Students will acquire a solid foundation in entrepreneurship and a better understanding of the role entrepreneurs play in the global economy. The course is designed to expose students to the knowledge, techniques and skills, competencies and resources required to be an entrepreneur. In addition, it emphasizes the skills to be developed by a person with an interest in establishing and managing a business.

ENTR 3010 BUSINESS CREATIVITY AND INVIATION

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: ENTR 1010 OR MGMT 4660

Study of the principles of a database systems. Survey of the techniques and methodologies used in data base management. Software design analysis and programming in the data base environment. Introduce internet environment. Interface business application programs with Internet.

ENTR 3020 ELECTRONIC BUSINESS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: ENTR 1010 OR MGMT 4660

Study of the principles of electronic business (e-business) electronic commerce (e-commerce), electronic marketing (e-marketing) and electronic entrepreneurship (e-entrepreneurship) terminologies and concepts for developing small and medium enterprises. In addition, it covers how businesses need to adapt and innovate in a constantly changing technology. Students develop administrative and operational plans aimed to new business, or improving an existing one considering emerging technologies and opening markets.

ENTR 4010 INTERNATIONAL BUSINESS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: ENTR 1010

Study the principles of international business (as a system) and the theories behind it. It examines the international business environment, legal/political configurations, sociocultural aspects, technological mechanisms and logistics required to export, import, manufacture and sell products and services to other countries that support trade

and investment. It provides students with opportunities and required information to establish alliances and businesses outside Puerto Rico's territory. It will also review various government agencies and private entities that promote trade with other countries. This course may require a travel outside of Puerto Rico.

ENTR 4020 ENTREPRENEURIAL FINANCE

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: FINA 2010

Focuses on financial analysis and reveal students how to determine the entrepreneurship financing needs that business ventures face in all stages of their life cycles. It examines the different financial alternatives available according to the economic position of enterprises. The topic of entrepreneurial finance analysis involves many issues including business financial position, working capital needs, permanent financing, cash flow position and financial institutions terms and conditions; in addition to the implications of financial decision-making.

ENTR 4070 ENTREPRENEURIAL PROJECT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: Departmental Head Authorization

The project course is oriented to integrate the knowledge and skills that student obtains throughout the Entrepreneurship major. Students must demonstrate knowledge of the necessary elements to establish a business through one of two alternatives: a preparation of a complete business plan or an internship where skills and knowledge acquired at the Entrepreneurship Program become evident. A project report and an oral presentation are intended outcomes of the class. This course may require traveling outside of Puerto Rico.

FINANCE COURSES

FINA 2010- FINANCE

Three credit-hours, Two hour lecture periods, twice per week. Prerequisite: ACCO 2020, ECON 3010, STAT 2010

Discuss the basic principles of finance administration. The course includes the measurement of risk-profit, analysis of financial statements, planning and control of budget and the cost of financing.

FINA 3710- INTERMEDIATE MANAGERIAL FINANCE

Three credits-hours, Two hour lecture periods, twice per week. Prerequisites: FINA 2010, ECON 3010

Study the budget and capital structure models, dividends policy, and administration of current assets. Use mathematical models, such as, linear programming trees used in the decision-making process of optimal financial variables.

FINA 3720- FINANCIAL MATHEMATICS

Three credits-hours, Two hour lecture periods, twice per week. Prerequisite: MATH 1320

This course will enable the student to develop, use and apply tables of financial factors. The use of financial calculators will be emphasized while working in practice exercises related to different concepts and the corresponding methodology to be applied in each particular case.

FINA 3730- MONEY AND BANKING

Three credits-hours, Two hour lecture periods, twice per week. Prerequisite: FINA 2010, ECON 3020

Discuss the money and banking system of the United States. Discuss the basic concepts of financial banking and non-banking institutions. Different classifications of financial markets and the basic theories of determining interest rates are analyzed. Emphasis is placed on the importance of the financial and money sector of the economy. The Central Bank System of the United States of America, the Federal Reserve and its money policy are explained.

FINA 3740- CAPITAL MARKETS MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: FINA 3710

Discussion of the characteristics of liquid investments and configuration of the financial markets with which they deal. Also, the function of brokerage companies and investment banking are studied. The financial press will be analyzed and interpreted. Examine the use and language of financial markets, their structure in order to understand investment and financing processes. After review of market analysis and assessment dynamics, particular attention will be given to financial models and strategies, essential in the decision-making process.

FINA 3750 RISK AND INSURANCE COVERAGE

Three credit- hours. Two hour lecture periods, twice per week. Prerequisites: FINA 2010, ECON 3020, STAT 2010

Course directed at understanding what is risk or hedge and which risks are insurable for the companies and individuals. Other aspects the course considers are cost quantification, the efficiency of life insurance, public responsibility, contingencies debt and miscellaneous.

FINA 4710 INVESTMENTS

Three credit- hours. Two hour lecture periods, twice per week. Prerequisites: FINA 3740, STAT 2010

A study of the theoretical aspect and its application in liquid investments and their markets. Debt values are analyzed, along with profit sharing and hybrids. The nature of the market of share options, reading and interpretation of the financial press and the negotiation with a registered broker are studied.

FINA 4720 INTERNATIONAL FINANCE

Three credit- hours. Two hour lecture periods, twice per week. Prerequisites: FINA 2010, ECON 3020

A course designed to offer a collection topic of about the complexity of investing and financing with international

funds. It discusses the phases and techniques in reducing risks in money exchange, the decision of capital structure, direct or indirect investment in international securities as part of capital budgets and other relevant complexities.

FINA 4730 ADVANCED MANAGERIAL FINANCE

Three credit- hours. Two hour lecture periods, twice per week. Prerequisites: FINA 2010, ECON 3010

Study the budgets and capital structure models, dividend, policies, and the administration of current assets. Use mathematical models such as, linear programming and decision-making trees used in the process of financial variables.

FINA 4740 FINANCE IN BANKING INSTITUTIONS

Three credit- hours. Two hour lecture periods, twice per week. Prerequisite: FINA 3730

Study the financial environment in banking institutions. Analyze the tools used by regulating agencies and financial analysts to determine the economics and operational systems of the banking industry. Current trends and changes in financial institutions will be studied.

FINA 4750 CURRENT FINANCIAL TRENDS

Three credit- hours. Two hour lecture periods, twice per week. Prerequisite: FINA 3740

The course will provide basic understanding of new trends, practices, and theories in the current financial environment. This is not a traditional course. Group-dynamic techniques are employed to search information, develop research or look into current trends in a field selected by the students.

FINA 4770 FINANCE PROJECT

Three credit- hours. Two hour lecture periods, twice per week. Prerequisite: Director's Authorization

The course will provide the students with an opportunity to apply the knowledge and skills acquired in the area of finance to plan, make projections, and aid in the decision-making process that will benefit public and private enterprises in the areas of stock exchange transactions, banking, insurance firms, financing, and others. Among the topics to be discussed are the theories of Miller and Modigliani, Miller and Orr, Altman F. Score, and others.

INFORMATION SYSTEM COURSES

ISYS 3510- MANAGEMENT INFORMATION SYSTEMS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: MGMT 1010, COMP 1010

This course is an introduction to the concepts of management information systems. Emphasize the management information systems design. (Service and manufacturing environment will be of special interest). Analyze the organization in terms of its structure and information requirements. Identify major subsystems of the organization such as requirement planning, production

function, personnel function marketing, finance and other applications.

ISYS 3520- BUSINESS PROGRAMMING LANGUAGES- COBOL I

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: COMP 1010

Introduction to the COBOL programming language, flowcharting and SCO UNIX operating system; using structured programming concepts and techniques applicable to business problems.

ISYS 3530- FILE STRUCTURES & ORGANIZATION- COBOL II

Three credit-hours. Two hour lecture periods, twice per week. Pre-requisite: ISYS 3520

Advance topics in COBOL and their applications to business. Develop of the data structures. Special emphasis on alternative physical data to planning, analyzing and controlling administrative processes in industry in the areas of accounting, finance, marketing, operations, production and manufacturing.

ISYS 3540 COMPUTERS & INFORMATION TECHNOLOGY

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: Comp 2010

This course provides students with a conceptual framework on the fundamentals and technology in the areas of computer architecture, operating systems, software translators, compilers and telecommunications. The emphasis on Telecommunications and Networks serve as facilitator course allowing students to communicate effectively, realistic and efficient with members of the information system area.

ISYS 3550- DATA COMMUNICATIONS AND NETWORKS I

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: COMP 3010

Study the topics in teleprocessing. Analyze data transmission, channels, computer equipment's configurations, procedures and security of teleprocessing systems; teleconferencing, electronic mail, electronic fund transfer, integration of teleprocessing and automation into MIS, Internet, Electronic Commerce & EDS Concepts.

ISYS 3560 PROGRAMMING LANGUAGE FOR BUSINESS ADMINISTRATION

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: COMP 1010

The course concentrates on fundamentals of new programming languages using an object-oriented programming language and /or other new programming languages developed for the new Information Technology Infrastructure. Course contents emphasize program construction, algorithm development, coding, debugging,

and documentation of command line interface based applications. The assignments and labs of the course will be done in the Java Language and Windows environments to demonstrate language development.

ISYS 3580- STRATEGIC INFORMATION TECHNOLOGY MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: COMP 2010

This course focuses on the entrepreneurial and administrative tasks performed by a general manager as he formulates and implements strategies for a new or established IT business. Students will learn strategies for developing or modifying a firm's business model in accordance with information systems resources, markets and management processes restructuring.

ISYS 3590- ELECTRONIC COMMERCE

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: COMP 3010

The course lays emphasis on techniques to plan and design a platform-independent commerce Web site. Content focuses on web business strategies, and the necessary hardware and software tools for Internet commerce, including: comparison and selection of commerce architecture; installation and configuration; security considerations, and planning of a complete business-to-consumer and business-to-business site.

ISYS 4510- SYSTEM ANALYSIS AND DESIGN

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: ISYS 3510

Introduce the student to basic system analysis tools and the procedure for conducting a system analysis. Topics relate on conducting a system requirement, the initial analysis, logical design and the general systems proposal. Students gain practical experience through projects and/or case studies.

ISYS 4520- COMPUTER SECURITY AND AUDIT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: ISYS 3510

Introduce the EDP auditing, with emphasis on audit of deficiency, effectiveness, control and security. Other topics include audit techniques and their effect on information system development. Cover an examination of security measures as they apply to protecting information over communication lines and various preventive techniques.

ISYS 4530- LOCAL AREA NETWORK SYSTEMS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: ISYS 3550

Evaluation of computer Local Area Network technology. The use of data, text, voice and image technology in the application of data processing, word processing and telecommunications networks and the impact of automation

in the office environment. Students will learn how to install, run, maintain and manage Local Area Network Systems.

ISYS 4570- MANAGEMENT INFORMATION SYSTEMS PROJECT

Three credit-hours. By Arrangement.

Prerequisite: Department Head Authorization

The project course is oriented to integrate the knowledge and skills that student obtains in Management Information Systems area. The course involves field project in collaboration with industry or government. Students will work closely with their client to develop a project in one of the following areas: Programming Development, Telecommunications or Systems Analysis and Design. The class requirements include a project proposal, written report and an interview.

MANAGEMENT COURSES

MGMT 1010- INTRODUCTION TO MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week.

Study the dynamic and new workplace, the implications for management, focusing on the competitive environment and aspects of information technology and decision making. It also describes the historical foundations of management, its global dimensions, ethical and social responsibility, strategic management and entrepreneurship, organizational and work process design, human resources management and the new role of leadership for the establishment of innovation technologies.

MGMT 2010- ORGANIZATIONAL MANAGEMENT THEORY

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 1010

Study the functions of organizations, and how they affect and are affected by the environment in which they operate. This course will provide the students with the necessary skills to understand how organizational structure, culture and internal processes must be transformed in order to achieve organizational goals effectively and efficiently.

MGMT 2020- BUSINESS LAW

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 1010

Analyze the general principles of the Puerto Rican legal system. It focuses on Puerto Rican Business Law; specifically about business contract doctrine; the legal structure of partnerships and corporations of elements and characteristics of the Letter of Credit. Cover basics of transportation law and Federal Bankruptcy Law. 142

INDUSTRIAL MANAGEMENT COURSES

ACCO 3110- MANAGERIAL ACCOUNTING

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: ACCO 2010, FINA 2010

Focuses on the compilation, use, and analysis of financial accounting tools for management decision process, the role of the accounting manager in the enterprise, and the interpretation of financial systems; the use of costs as a tool for planning and controlling the activities of manufacturing and distributing merchandise as well as directing service enterprises. Emphasis on quantitative aspects of budgets, cost per unit, break-even point, and decision process techniques.

MGMT 3120- OPERATIONS & PRODUCTION MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: MGMT 1010, STAT 2020

Introduces the principles of operation and production management. Operation strategy and competitiveness issues are presented. Fundamentals of product design and process selection, Total quality and statistical process control tools are presented. Just in Time production system, forecasting and work system design between other topics are discussed.

MGMT3130- MATERIALS AND PURCHASING MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: MGMT 3120, STAT 2020

A study of the purchasing and materials function in manufacturing, service and public organizations. Topics include source selection, make-buy analysis, inventory control, ware-housing. The course emphasizes on innovative models of intervention theories and methods, business transformation, corporate evolution and organizational culture change, geared to develop a fundamental new philosophy of business.

MGMT 3140- INVENTORY AND MATERIAL REQUIREMENT PLANNING/CAPACITY REQUIREMENT PLANING

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: MGMT 3120, COMP 2010

Fundamentals of inventory management, capacity planning and materials requirement planning. Introduction to supply change management. Topics include inventory management, aggregate planning, master scheduling, capacity planning and material requirement planning.

MGMT 4110- STATISTICAL QUALITY CONTROL

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: MGMT 3120, STAT 2020

Study the theory and application of statistical control techniques to industrial and service processes; specifically the theory of the control chart method, including sensitivity

measurement and the design of process control systems. Acceptance sampling, including both variables and attributes, is surveyed. Operating characteristic curves and various criteria are also included; Statistical and mathematical concepts are explored.

MGMT 4120- ADVANCED OPERATIONS & PRODUCTION

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: MGMT 3120, STAT 2020

Analyze the production systems; include quantitative methods for capacity planning and production scheduling. Use the quantitative models and computer programs for the solution of Operation Management problems. Computer models as Linear Programming, Waiting Lines and Transportation Models will be studied.

MGMT 4170- INDUSTRIAL MANAGEMENT PROJECT

Three credit-hours. By Arrangement. Prerequisite: Department Head Authorization.

The industrial Management Project consists of a field research project in which the student will have the opportunity to apply all concepts, strategies, techniques and theoretical principles learned through the Industrial Management specialization. The areas of research will include topics of Industrial or Production management. For example: Statistical Quality Control, Material Requirement Planning, Just-in-Time Systems, Supply Management, Scheduling and Product Design among other Industrial Management topics.

CONSTRUCTION MANAGEMENT COURSES

MGMT 3210- CONSTRUCTION MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 1010

This course discusses the concepts of Construction Management with emphasis in the contractor enterprise organization including the operation and administration of a construction company, trade of services, costs control, and the project organization. It also addresses the basic concepts of economy used in the construction industry and its impact in the construction projects organization

MGMT 3220- CONSTRUCTION CONTRACTS AND LEGAL DOCUMENTS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: MGMT 2020

Study of construction contracts and legal documents, specifically: definitions, interpretation and utilization of drawings, specifications, agreements, bidding forms, general conditions, bonds, subcontracts and related documents. Cover the impact of the legal systems on corporate strategy, managerial decisions and planning processes; consumer, contract, commercial and secured financing laws. Also, discuss employer liability to

PROSHO/OSHA, regulation aspects of the construction industry.

MGMT 3230- CONSTRUCTION MATERIALS AND METHODS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: MATH 1320, MGMT 3210

Introduction to the materials and methods of building construction and to construction drawings. Discuss the foundation, structural framing, floor, roof and wall systems, mechanical, electrical and communication installations. Field Trip.

MGMT 3240- CONSTRUCTION ESTIMATES & COSTS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: FINA 2010, MGMT 3210

The course presents the necessary concepts to prepare a construction cost estimate. It exposes the student to different elements of direct and indirect costs that are considered conceptual or detailed cost estimates

MGMT 3250- CONSTRUCTION EQUIPMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 3210

Study the selection and acquisition of construction equipment, application of financial decision making on equipment selection; application of engineering fundamentals and economics of performance characteristics and production equipment specification.

MGMT 3260- CONSTRUCTION SAFETY

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: MGMT 3210, MGMT 3250

Study the federal and state laws that apply to the construction industry in the Commonwealth of Puerto Rico. PROSHO/ OSHA Regulations will be covered. Cover regulation and control of the working environment of employees in the construction industry, safety equipment and safety procedures.

MGMT 4210- PROJECT PLANNING AND CONTROL (PERT)

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 3210

Study the Network planning techniques for project management and resource allocation. Emphasis on PERT, CPM, heuristic models for multi-project, and scheduling. The use of computer software for project planning will be covered. Management techniques of construction are discussed in relation to alternative means of project execution. Organizational structures, management systems and controls are examined from the point of view of owners, constructors and managers.

MGMT 4220- GOVERNMENT REGULATIONS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 3220

Study of the government regulations and legal requirements for a construction project in the Commonwealth of Puerto Rico. As well as the regulations of different state agencies such as "ARPE", "Junta de Calidad Ambiental", "Autoridad de Energía Eléctrica", "Autoridad de Acueductos y Alcantarillados". The course includes standard federal regulatory agencies like Environmental Protection Agency (EPA), HUD or FDI. Legal requirements of state and federal agencies and their regulations are the class topics.

MGMT 4270- CONSTRUCTION MANAGEMENT PROJECT

Three credit-hours. By Arrangement. Prerequisite: Department Head Authorization

Study the stages of a construction project from the development and planning, to estimating cost, construction, project control and final stage. Students must apply real world construction projects to different techniques and models learned. The work performed by the students will be supervised by instructors from the Business Administration Program. A written paper is required.

GENERAL MANAGEMENT COURSES

MGMT 3610- HUMAN RESOURCES MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 1010

A framework for the study, understanding and application of human resources management in an organization. It includes topics such as: Human resources, equal employment opportunity and global human resources management, planning, job analysis, design, recruitment, selection, performance evaluation compensation, employee benefits and services, orientation and training; career planning and development, maintaining labor relations and employee's safety and health.

MGMT 3620- ORGANIZATIONAL BEHAVIOR

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 2010

The main focus of this course is to understand the actions of individuals, and groups in an organizational context. To manage organizational behavior effectively the emphasis should be placed on acquiring, developing and applying the knowledge and skills of people. The course is based on a strategic approach to organizational behavior which involves organizing, acquiring, developing and managing people's knowledge and skills effectively to implement the organization's strategy and gain competitive advantage.

MGMT 3670- LABOR RELATIONS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 2020

The course emphasizes aspects of the industrial relations, the governmental employment and labor legislation. The fundamentals of labor economy, organization and practices

of labor unions, articulation of decisional process and solutions of labor conflicts in the industry and the government in a framework of the existing labor legislation are studied

MGMT 4610- TOTAL QUALITY MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 1010

Studies the principles and concepts of Total Quality Management enhancement to the traditional way of doing business through an approach that attempts to maximize the effectiveness of an organization through the continual improvement of the quality of its products, services, people, processes, and environments. It must to integrate strategy, process efficiency, effectiveness, teamwork, and shared decision making concerns, both conceptually and practically. Requires an unwavering focus on the customer, both internally and externally.

MGMT 4620- STRATEGIC MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 3620

The course in Strategic Management is the study of contemporary models geared to the formulation, implementation, evaluation and control of strategies in organizations. It focuses on strategic management and business policy, corporate governance and social responsibility, the impact of technology, globalization issues and strategic decision making in the development of competitive organizations in a turbulent and ever changing environment

MGMT 4630- ORGANIZATIONAL DEVELOPMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 4620

The study of organizational change and transformation of organizational processes, management decision-making styles, organizational effectiveness, efficiency and productivity. The course emphasizes on innovative models of intervention theories and methods, business transformation, corporate evolution and organizational culture change, geared to develop a fundamental new philosophy of business.

MGMT 4640-COLLECTIVE BARGAINING

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 1010

This course introduces the labor relations process placed in a historical and legal perspective. It will provide students the strategies, tools and information needed to execute effectively from an administrative position or labor union position in the collective bargaining process.

MGMT 4650-WAGES AND SALARIES ADMINISTRATION

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MGMT 1010

The course is based on the scientific principles and the theories that tend to explain the human behavior in the working world. The course intends that the student know how a compensation system is developed according to the needs of the organization and the employees. Also emphasizes the concept of job evaluation and its remuneration as an independent variable from the employee.

MGMT 4660- ENTREPRENEURSHIP

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: None

This course teaches the process of establishing and managing a business enterprise. The student will learn to identify and develop the necessary skills to become an entrepreneur as well as laws, and social and economic factors related to business establishment. Also, the student will analyze the conflicts and problems faced by an entrepreneur in his/her way to success.

MGMT 4670- GENERAL MANAGEMENT PROJECT

Three credit-hours. By Arrangement. Prerequisite: Department Head Authorization

The General Management Project consists of a field research project in which the student will have the opportunity to apply all concepts, strategies, techniques and theoretical principles learned through the General Management major. The areas of research and intervention are: Organizational Theory, Organizational Behavior, Strategic Management, Total Quality Management, and Human Resources Management.

The work performed by the students will also be supervised by instructors from the Business Administration Program. A written report is part of the class requirements

MARKETING COURSES

MARK 1010- MARKETING

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: None

This course offers an overview of the important marketing topics while keeping the focus on practical fundamentals, background, strategies and practices. Students will learn how to apply these principles in their careers. It covers the standard introductory marketing topics: market segmentation, environment, decision making and planning, the 4 P's, advertising, not-for-profit and service marketing, market research, multicultural and global issues, retailing and wholesaling.

MARK 3410- SALES AND RETAIL MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MARK 1010

Study the principles and problems involved in recruiting and supervising the sales force. Methods of evaluating prospective salesmen; budgeting and control as they apply

to the sales function, incentive programs to stimulate the sales activity. Also study of the retail function in an organization, consideration of managerial problems in the operation of a large and small retailing organization, control of retail operations, design of retailing facilities and retailing strategies. Current development in the field will be analyzed.

MARK 3420- CONSUMER BEHAVIOR

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MARK 1010

Study the consumer motivation, decision making process in selection of goods and services. Analyze the prevailing theories on consumer behavior. Study the methods used to examine this behavior that will help in marketing decision making aimed at consumers.

MARK 3430- PRODUCT MANAGEMENT

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MARK 1010

Study of techniques and practices applied to the creation, development and market implementation of new or existing products. Stages of product lifecycle and marketing strategies that can be used in each stage are analyzed. This course also discusses the necessary skills to become a Product Manager.

MARK 3440 SERVICE MARKETING

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MARK 1010

Study the service sector of the economy. Development of marketing strategies to improve productivity and effectiveness of the services, publicity and media promotion for the service industry. Strategic development plans for service industry.

MARK 3450- ADVERTISING

Three credit-hours. Two hour lecture periods, twice per week, Prerequisites: MARK 1010

Analysis of consumer behavior to know his motivations, fundamental techniques in the communication area, formulation of goals and objectives, creative strategies, analysis of the promotional media use by the enterprise and a study of the socio economic issues that affect sales promotions. Topics of research may be: advertising as the enabling economic component in TV, newspapers, the Internet, etc.

MARK 3460- PUBLIC RELATIONS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: MARK 1010

Introduces strategic issues and effective practices of communication between organizations and their constituencies. The course includes the study of public opinion research, media relations, public communication campaigns, consumer identity, and representational ethics. Students gain practical experience in writing news releases, conducting surveys, and designing integrated

communications campaigns. Public relations help our complex pluralistic society to reach decisions and function more effectively by contributing to mutual understanding among groups and institutions. It serves to bring private and public policies into harmony.

MARK 4410- MARKETING RESEARCH

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: COMP 2010, MARK 1010, STAT 2020

Study the research activity in the marketing field, data collection analysis and methods. Emphasize marketing quantitative techniques, computers role in marketing research, control and evaluation of the marketing function.

MARK 4470 MARKETING PROJECT

Three credit-hours. By Arrangement.

Prerequisite: Department Head Authorization

The Marketing Project course is oriented to integrate the knowledge and skills that student obtain in marketing area. The student will be using his presentation, research, creative and organization skills. The marketing project must be assigned by the professor in two principal aspects: First, make a research project creating a marketing plan for a professor theme. Second, the student can work in a company in marketing area (not sales). A written paper is required.

QUANTITATIVE COURSES

STAT 2010- PROBABILITY AND STATISTICS

Three credit-hours. Two hour lecture periods, twice per week. Prerequisites: MATH 1320, COMP 1010

Introduction to fundamentals of descriptive and inferential statistics. Procedures for recollection, analysis and presentation of data. Topics like: frequency distributions, graphical methods for data presentation, central tendency and dispersion measurements, probability, discrete and continuous probability distributions. Fundaments of statistical inference.

STAT 2020- STATISTICS AND HYPOTHESIS TESTING

Three credit-hours. Two hour lecture periods, twice per week. Prerequisite: STAT 2010

A continuation of Probability & Statistics course. This course offers the fundamentals of statistical inference. It includes a review of sampling distributions and the principles of hypothesis testing for one, two or more populations regarding the mean, variance and proportion. Goodness fit testing, forecasting methods, ANOVA – One way, among other statistical methods.

DEPARTMENTAL FACULTY

AYALA AYALA, ABIGAIL– Lecturer II in Economics; M.A Economics, University of Puerto Rico, Río Piedras Campus, 1990; B.A. Economics, University of Puerto Rico, Río Piedras Campus, 1986.

BEARD PEÑA, JULIO– Lecturer I in Construction Management; M.E.M in Construction Management, 2000; B.S.C.E. Polytechnic University of Puerto Rico, 1997.

CAPARRÓS GONZALEZ, WILFREDO– Lecturer III in Management Information Systems and Computer Science; M.B.A. in Management Information Systems, Sacred Heart University, San Juan, PR, 1999.

RODRÍGUEZ RIVERA, MARISOL – Associate Professor; Surveying and Geospatial Science Department Head, Ph.D. Candidate, Project Engineering from Universidad Tecnológica de Panamá and Geography from Universidad de León in Spain; Doctoral Studies Land Use Planning and Urban Development, Universidad de Valladolid, Spain, 1993; Master in Planning, Concentration: Urban Planning, University of Puerto Rico, 1997; B.A. Geography, University of Puerto Rico, 1991.

ROMERO GONZÁLEZ, VÍCTOR M. – Associate Professor; Ph.D. Candidate, Topographic Engineering and Photogrammetry, Universidad Politécnica de Madrid, 2004; B.S. Land Surveying and Mapping, Polytechnic University of Puerto Rico, 1994.

DÁVILA APONTE, EDWIN – Professor and Business Administration Department Head; Ph.D., Entrepreneurship Development, Inter American University of Puerto Rico, Río Piedras Campus, 2006; M.B.A. Accounting, Inter American University of Puerto Rico, Río Piedras Campus, 1999; B.B.A., Accounting, Caribbean University, Bayamón, Puerto Rico, 1986.

DÍAZ SÁNCHEZ, JOSÉ RAÚL– Professor in Statistics; M.B.A Catholic University of Puerto Rico, 1983; B.S.I.E. University of Puerto Rico, Mayagüez, 1978; A.S., The University of the State of New York, 1993. PE.

ESQUILÍN ROSA, ALVIN– Lecturer I in Computer Science; M.B.A. Polytechnic University of Puerto Rico, 2003; Bachelor in Computer Programming, E.D.P. College, 1995.

GINORIO TORRES, CÁNDIDA– Lecturer III in Management; M.A., Inter American University of Puerto Rico, 1983; B.S. University of Puerto Rico, Río Piedras Campus, 1967.

GONZALEZ JUARBE, JUAN– Lecturer III in Construction Management, Ed.D. University of Puerto Rico, 2003; M.B.A, University of Puerto Rico, 1990; M.S.C.E Lamar University,

Beaumont, Texas, 1971; B.S.C.E, University of Texas at El Paso, 1969; Pre-Eng. Canal College, Panama, 1967.

GONZALEZ MARÍN, GUILLERMO– Lecturer II in Marketing; M.B.A. Inter American University, Puerto Rico, 1973; B.A. Widener University, Chester, PA.

IRIZARRY GONZALEZ, JANET– Associate Professor in Management; Ph.D. Organizational Psychology, California School of Professional Psychology, 1992; M.A., Organizational Psychology, California School of Professional Psychology, 1991; M.A Education, Counseling and Guidance, University of Puerto Rico, 1983; B.A. Education, University of Puerto Rico, 1981; B.A., Philosophy and Arts, University of Puerto Rico, 1976.

MARTINEZ QUIÑONES, EFRAÍN– Lecturer I in Computer Science, M.E.M. Polytechnic University of Puerto Rico, 1999; BSEE, Polytechnic University of Puerto Rico, 1997.

MARTINEZ RAMOS, EDDA– Associate Professor in Accounting and Finance; Ph.D. Candidate in Finance, University of Puerto Rico, Río Piedras Campus, CPA, 1995, M.B.A in Finance, Inter American University of Puerto Rico, 2004; M.B.A in Accounting, 1996, Inter American University of Puerto Rico; B.B.A. in Accounting, University of Puerto Rico, Río Piedras Campus, 1992.

MELÉNDEZ ORTIZ, ARTEMIO– Associate Professor in Finance and Economics; M.B.A. Inter American University of Puerto Rico, 1980; B.B.A University of Puerto Rico, Río Piedras Campus, 1967.

MOJICA CARRASQUILLO, SONIA I. – Associate Professor in Management. M.B.A. Polytechnic University of Puerto Rico, 1999; B.S Turabo University, 1991.

MORALES RIVERA, SARAH –Lecturer I in Accounting; M.B.A in Accounting, Metropolitan University of Puerto Rico, 2005. B.B.A. in Accounting, Colegio Universitario Tecnológico de Bayamón, (UPR) 1989.

NAVIA CHINEA, NYDIA– Lecturer I in Accounting; M.B.A. in Accounting, University of Phoenix, 1998; B.B.A. in Accounting, University of Puerto Rico, 1987.

NUÑEZ VÉLEZ, EDWIN– Lecturer I in Accounting; M.B.A. in Accounting, University of Phoenix, 2008; B.B.A in Marketing and Management, Polytechnic University of Puerto Rico, 2003.

PADILLA RUIZ, EVER– Lecturer II in Business Law and Ethics; Juris Doctor, Pontifical Catholic University of Puerto Rico, School of Law, 1999; B.A. in Political Sciences, University of Puerto Rico, Mayagüez Campus, 1994.

RIVERA RIVERA, JOSÉ O– Associate Professor; Dean, School of Management and Entrepreneurship, Ph.D.

Candidate, University of Central Florida; M.S.E.M., Florida Institute of Technology, Melbourne, Florida, 1998; B.S.I.E University of Puerto Rico, Mayagüez Campus, 1993.

RODRÍGUEZ PÉREZ, LUIS H– Associate Professor in Marketing; J.D Inter American University, School of Law, 1999. M.B.A. Marketing, 1993; B.S. Computer Science, University of Puerto Rico, Bayamón Campus, 1989.

ROSARIO ALVAREZ, NICOLÁS– Lecturer III in Entrepreneurship and Marketing; Ph.D. Entrepreneurial and Managerial Development, Inter American University of Puerto Rico, 2005; M.B.A. Marketing, Inter American University of Puerto Rico, 1994; M.B.A. Human Resources, Inter American University of Puerto Rico, 1993; B.B.A. Management, University of Puerto Rico, Cayey Campus, Colegio Universitario de Cayey, 1990.

COMBINED BACHELOR'S & MASTER'S DEGREE PROGRAM

Polytechnic University of Puerto Rico, has designed the combined bachelor's-master's degree program. The objective is to provide talented PUPR undergraduate students the opportunity to complete the combined bachelor's-master's degree in a reduced time period, after completing 105 credit- hours of the undergraduate program (excluding developmental courses).

Admission

Conditions for admission to the combined program will be the following:

1. Be an honor student (GPA of 3.25 to 4.00). When the student has a GPA of 2.75 to 3.24 his application may be evaluated and conditionally admitted to the combined program.
2. Complies with the minimum undergraduate number of credit-hours for the combined Bachelor's – Master's Program.
3. Be recommended by the corresponding Department Head and Graduate Program Mentor.
4. Be authorized to enroll in graduate courses by the Dean of the Graduate School.

Procedure

1. Once the student confirms that he/she qualifies to the combined program, he/she must complete and submit the application to the Graduate School Student Affairs Office. Also the student must include with the application an official academic evaluation analysis.
2. The application is evaluated to verify that the student indeed qualifies to the program.
3. The department chairperson and graduate program mentor submit their recommendations to the dean of the Graduate School.
4. The dean verifies the recommendations and gives it approval/denial of the student's application. The final decision is notified to the student in a formal letter. Also a copy of the letter is sent to the student file at the Registrar's Office and Financial Aid Office.

General Comments

1. Whenever any of the courses is passed with a grade of "C" or lower, the student is disqualified to continue in the combined program.
2. In the event that the application is denied, the student may appeal the decision, to a committee composed by the Undergraduate Department Head, Graduate Program Mentor, Dean of Graduate School and the Vice President of Academic Affairs. The decision of the committee is final.

XIV. DECLARATIONS AND CERTIFICATIONS

NON-DISCRIMINATION CLAUSE

Polytechnic University of Puerto Rico does not discriminate against any individuals for reasons of gender, political or religious affiliation, economic or social status, ethnic origin, or for any other reason considered unlawful. This policy applies both in the recruitment of personnel and in the acceptance of students.

STUDENTS' RIGHTS TO KNOW UNDER THE FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA)

Annual Notice to Students

Each year, Polytechnic University of Puerto Rico informs the students about the Family Educational Rights and Privacy Act enacted in 1974 (FERPA). This Law, with which the University will totally comply, was designed to protect the privacy of students' academic records, to establish the students' rights to inspect and review their educational records, and to provide guides in cases where incorrect or misleading information must be corrected through formal or informal hearings. Students will also have the right to file complaints concerning alleged failure by the University in complying with the Law.

Our institutional policy explains in detail the procedure which Polytechnic University of Puerto Rico will follow to comply with the provisions of the Law. This policy can be found in the Library, in the Reference section. There the **Institutional Regulations to Protect the Students' Right to Privacy** may be found.

Questions related to this Law will be referred to the Vice Presidency of Enrollment Management and Student Services. The student who files a complaint and who considers that the decision granted has been unfair, or does not conform with the dispositions within the Law, may request in writing the mediation of the University President. As an additional recourse, the student who considers that his/her rights have been violated can file a complaint with the Family Educational Rights and Privacy Act Office, Department of Education, Office 4074, Switzer Building, Washington, D.C. 20201. This complaint must be related to alleged deficiencies incurred by Polytechnic University of Puerto Rico in complying with FERPA.

PUBLIC NOTICE DESIGNATING WHAT IS DIRECTORY INFORMATION

Through these means, Polytechnic University of Puerto Rico designates the following categories of information about students as public information or Directory Information. This information may be divulged by Polytechnic University of Puerto Rico for any particular purpose, and at its discretion.

Category I Name, address, telephone number, attendance date, courses.

Category II Institutions previously attended, specialized fields, awards, honors (including Dean's List), and degrees obtained, including dates.

Category III Present and past participation in sports and officially recognized activities, physical appearance (height, weight) of athletes, place and date of birth.

Students who are registered at the present time have the right to request that no information about them be divulged under FERPA. To forbid the University to divulge information, a written request must be sent to the Registrar's Office of Polytechnic University of Puerto Rico at the following address:

Polytechnic University of Puerto Rico
P.O. Box 192017
San Juan, Puerto Rico 00919 2017

The form used to request that no Directory Information be divulged is found in the Registrar's Office. Polytechnic University of Puerto Rico understands that if a student does not make this request to prevent information from being divulged, the information can be made public.

RESERVATION OF THE RIGHT TO MODIFY THE CATALOG

The provisions of the various sections of this Catalog are to be considered directive in character and not as an irrevocable contract between the student and the University. The University reserves the right to make any changes that are deemed necessary or desirable.

APPROVAL OF THE CATALOG

I certify that this Catalog has been approved for distribution for the academic years 2011 - 2012 to 2016 - 2017.



Ernesto Vázquez Barquet
President
Polytechnic University of Puerto Rico