POLYTECHNIC UNIVERSITY OF PUERTO RICO

UNDERGRADUATE CATALOG

Academic Years 2016 – 2020

POLYTECHNIC UNIVERSITY
SAN JUAN • ORLANDO • MIAMI

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Physical Address
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San Juan, PR 00918

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

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(787) 754-8000 / (787) 622-8000

Fax (787) 763-8919	Office of the President
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Fax (787) 773-0098	Civil and Environmental Engineering and Land Surveying
Fax (787) 771-0013	Civil and Environmental Engineering and Land Surveying
Fax (787) 281-8342	Electrical and Computer Engineering
Fax (787) 765-9207	Industrial and Systems Engineering
Fax (787) 771-0011	Mechanical Engineering
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Fax (787) 763-6867	Security
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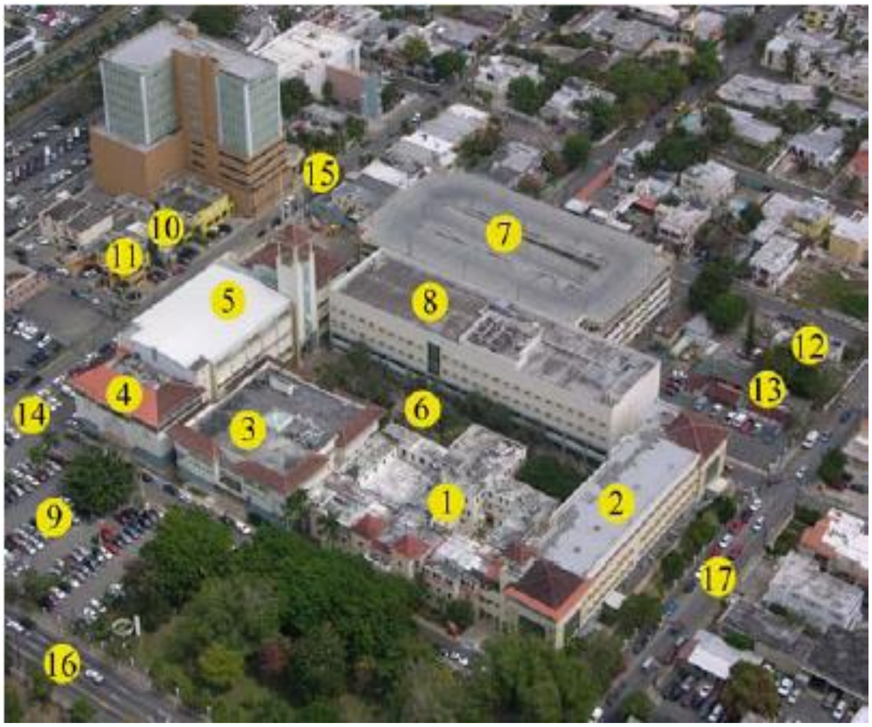
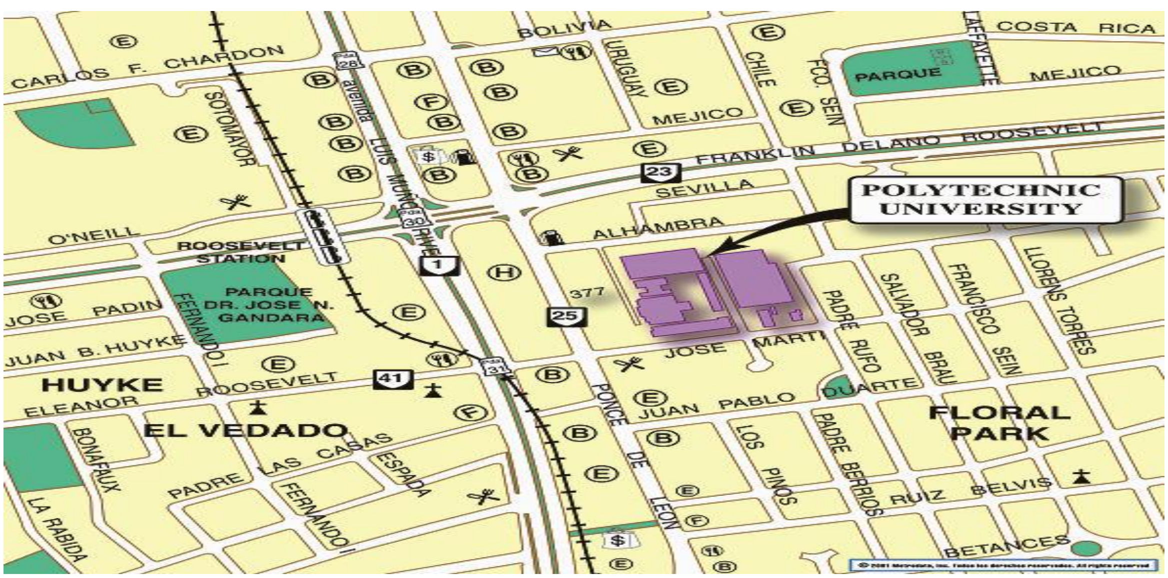
Fax (787) 754-8520	Student Support Services Program
Fax (787) 754-8450	Tutoring Services
Fax (305) 418-4325	Miami Campus
Fax (407) 677-5082	Orlando Campus

CAMPUS MAP



1. Main Building; University Administrative Offices
2. Engineering Laboratories Building
3. Library
4. Amphitheater
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)
6. Fifth Centennial Plaza
7. Student's Parking
8. Pavilion Building: (School of Business Administration, Management and Entrepreneurship, Surveying, and Geospatial Science Department)
9. Parking for Faculty, Administration, and Visitors
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

LOCATION MAP



ACADEMIC CALENDAR

Academic Years 2016 – 2020

FA 2016	August 8, 2016	October 29, 2016
WI 2016	November 14, 2016	February 18, 2017
SP 2017	March 6, 2017	May 27, 2017
SU 2017	June 5, 2017	July 15, 2017
FA 2017	August 7, 2017	December 17, 2017
WI 2017	January 8, 2018	March 24, 2018
SP 2018	April 9, 2018	June 16, 2018
SU 2018	June 20, 2018	July 25, 2018
FA 2018	August 6, 2018	October 27, 2018
WI 2018	November 19, 2018	February 23, 2019
SP 2019	March 1, 2019	June 1, 2019
SU 2019	June 10, 2019	July 27, 2019
FA 2019	August 5, 2019	October 26, 2019
WI 2019	November 11, 2019	February 15, 2020
SP 2020	March 2, 2020	May 23, 2020
SU 2020	June 1, 2020	July 10, 2020
FA 2020	August 3, 2020	October 24, 2020

***** The specific term dates are available in the Academic Calendars at www.pupr.edu or www.mypoly.pupr.edu/academics

ACTIVITIES ON THE ACADEMIC CALENDAR

Admissions Deadline
Third Saturday prior to the beginning of the term.

New and Transfer Students Orientation
One week prior to the beginning of the term.

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

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 the twelve-week period, equivalent to three-semester credit-hour.

Deadline for Late Registration and Course Changes
Friday of the first week of each term.

Deadline for Completing Pending Projects and to Remove Incomplete Grades:
Tenth (10) week after the end of the preceding term are allowed for this purpose (tenth week of the current term).

Deadline for the First Partial Examination
The fourth week of each term (first third of the term).

Deadline for the Second Partial Examination:
The eighth week of each term (second third of the term).

Deadline for Partial or Total Withdrawal
Students may withdraw totally or partially at the end of classes of each term and receive a grade of "W."

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 given term.

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

GENERAL INFORMATION

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 large private Hispanic Serving Engineering School in the United States and its territories. PUPR offers licensed and accredited programs at the undergraduate and graduate levels.

UNDERGRADUATE OFFERINGS

Associate Degrees

- Associate Degree of Engineering in Software Development
- Associate Degree of Engineering in Supply Chain and Logistics
- Associate Degree in Land Surveying
- Associate Degree in Mechanical Engineering
- Associate Degree in Product Design

Bachelor's Degrees

- Bachelor in Architecture
- Bachelor of Interior Design

- Bachelor in Business Administration with major in Accounting
- Bachelor in Business Administration with major in Construction Management
- Bachelor in Business Administration with major in Entrepreneurship
- Bachelor in Business Administration with major in General Management
- Bachelor in Business Administration with major in Marketing

- Bachelor of Science in Biomedical Engineering
- Bachelor of Science in Chemical Engineering
- Bachelor of Science in Civil Engineering
- Bachelor of Science in Computer Sciences
- Bachelor of Science in Computer Engineering
- Bachelor of Science in Electrical Engineering
- Bachelor of Science in Environmental Engineering
- Bachelor of Science in Industrial Engineering
- Bachelor of Science in Land Surveying and Mapping
- Bachelor of Science in Mechanical Engineering
- Bachelor of Science in Mechanical Engineering in Aerospace Science

GRADUATE OFFERINGS
Certificates

- Graduate Certificate in Digital Forensics
- Graduate Certificate in Information Assurance and Security (GCIAS)

Master's Degrees

- Master in Architectural Conservation and Rehabilitation
- Master of Landscape Architecture

- Master of Business Administration with specialization in International Enterprises
- Master of Business Administration in General Management
- Master of Business Administration with specialization in Computer Information Systems (E-Commerce)
- Master of Business Administration with specialization in Computer Information Systems (Data Base)

- Master in Environmental Management

- Master in Engineering Management with specialization in Construction Management
- Master in Engineering Management with specialization in Manufacturing Management
- Master in Engineering Management with specialization in Renewable Resources Management
- Master in Engineering Management with specialization in Environmental Management

- Master in Manufacturing Competitiveness with specialization in Quality Management
- Master in Manufacturing Competitiveness with specialization in Pharmaceutical Products
- Master of Science in Manufacturing Competitiveness with specialization in Quality Management
- Master of Science in Manufacturing Competitiveness with specialization in Pharmaceutical Products

- Master of Science in Manufacturing Engineering with specialization in Industrial Automation
- Master of Science in Manufacturing Engineering with specialization in Pharmaceutical Processes
- Master of Science in Manufacturing Engineering with specialization in Quality Management

- Master of Engineering in Manufacturing Engineering with specialization in Pharmaceutical Processes
- Master of Engineering in Manufacturing Engineering with specialization in Industrial Automation
- Master in Engineering in Manufacturing Engineering with specialization in Quality Management

- Master of Science in Civil Engineering with specialization in Construction Engineering
- Master of Science in Civil Engineering with Specialization in Geotechnology
- Master of Science in Civil Engineering with specialization in Structures
- Master of Science in Civil Engineering in with specialization in Water Resources
- Master of Science in Civil Engineering with specialization in Water Treatment

- Master of Engineering in Civil Engineering with specialization Construction Engineering
- Master of Engineering in Civil Engineering with specialization in Geotechnology
- Master of Engineering in Civil Engineering with specialization in Structures
- Master of Engineering in Civil Engineering with specialization in Water Resources
- Master of Engineering in Civil Engineering with specialization in Water Treatment

- Master of Science in Electrical Engineering with specialization in Communication Systems
- Master of Science in Electrical Engineering with specialization in Digital Signal Processing
- Master of Science in Electrical Engineering with specialization in Power Systems and Renewable Energy

- Master of Engineering in Electrical Engineering with specialization in Communication Systems
- Master of Engineering in Electrical Engineering with specialization in Digital Signal Processing
- Master of Engineering in Electrical Engineering with specialization in Power Systems and Renewable Energy

- Master of Science in Computer Engineering with specialization in Internet Engineering
- Master of Science in Computer Engineering with specialization in Digital Signal Processing
- Master of Science in Computer Engineering with specialization in Software Engineering

- Master of Engineering in Computer Engineering with specialization in Internet Engineering
- Master of Engineering in Computer Engineering with specialization in Digital Signal Processing
- Master of Engineering in Computer Engineering with specialization in Software Engineering

- Master of Science in Computer Science with specialization in Computer Graphics and Game Technology
- Master of Science in Computer Science with specialization in Information Technology Management and Information Assurance
- Master of Science in Computer Science with specialization in Knowledge Discovery and Data Mining

- Master in Computer Science with specialization in Computer Graphics and Game Technology
- Master in Computer Science with specialization in Information Technology Management and Information Assurance
- Master in Computer Science with specialization in Knowledge Discovery and Data Mining

- Master of Engineering in Mechanical Engineering with specialization in Aerospace

- Master in Geospatial Science and Technology

- Master in Science in Education in Mathematics and Natural Sciences

Online Programs

- Master in Engineering Management
- Master of Science in Manufacturing Engineering
- Master of Science in Manufacturing Competitiveness
- Master of Engineering in Manufacturing Engineering
- Master in Manufacturing Competitiveness with specialization In Quality Management
- Master in Business Administration with specialization in Computer Information Systems (E-Commerce)
- Master in Business Administration with specialization in Computer Information Systems (Data Base)

Doctoral Program

- Doctor of Philosophy in Engineering and Applied Sciences

LICENSURE

Puerto Rico Education Council (PREC)
P.O. Box 19900
San Juan, Puerto Rico 00910-1900
Telephone: (787) 724-7100

License renewal date: 2020

ACCREDITATIONS

Middle States Commission on Higher Education (MSCHE)
3624 Market Street
Philadelphia, PA 19104-2680
Telephone (267) 284-5000
Webpage: www.middlestates.org

In 2005, the Middle States Commission on Higher Education reaccredited the institution, and on November 18, 2010, reaffirmed it. In 2010, PUPR submitted the Periodic Review Report and was commended for the evaluation results. PUPR was reaccredited in 2015; the next accreditation will be in 2023.

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, http://www.abet.org:

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

The Land Surveying and Mapping program was accredited by the Applied Science Accreditation Commission of ABET.
111 Market Place, Suite 1050
Baltimore, MD 21202-4012
Telephone: (410) 347-7700

National Architectural Accrediting Board (NAAB)
1735 New York Avenue, NW
Washington, DC 20006
Telephones: (202) 783-3007, (202) 783-2822

In 2009, NAAB accredited the Bachelor of Architecture. The next accreditation visit will be in 2023.

Landscape Architectural Accreditation Board (LAAB)
636 Eye Street, NW
Washington, DC 20001-3736
Telephone: (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. The next expected accreditation visit will be in 2022.

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.

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 campuses 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 using multiple methods of delivery 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 empathic 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 socioeconomic 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 courses, course components, and 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 the project.

Following the assessment to "prove" the effectiveness of the program, it should identify important stakeholders. The data gathering and its analysis are 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 the 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 impact 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.

U.S. Citizenship and Immigration Services

Department of Education of Puerto Rico

Department of Social Services of Puerto Rico (Vocational Rehabilitation)

Veterans Administration

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 parking building.

PUPR opened branch campuses in the following cities:

Polytechnic University of Puerto Rico, Miami
8180 NW 36 St.; Suite 401
Miami Florida, USA 33166

Polytechnic University of Puerto Rico, Orlando
5550 North Econlockhatchee Trail
Orlando, Florida USA 32858

Instituto Tecnológico de Santo Domingo (INTEC)
Ave. Los Próceres, Calle Gala
Postal 342-9 y 249-2, Santo Domingo

Universidad Latina de Panamá
Cede Central Panamá, Apartado 0823-00933
Panamá, República de Panamá

LIBRARY

The library of Polytechnic University of Puerto Rio is an academic unit with the mission to offer a physical and virtual space where, through the access to information resources and services and with the guidance and support of information professionals, the academic community can interact, develop skills, exchange ideas, discover new sources and create new knowledge resulting in an empowering lifelong learning experience. This statement is consonant with the university's mission, and all library services are directed towards achieving it.

The library collection is specialized in areas of Engineering, Land Surveying, Architecture, Landscape Architecture, Education, Management and Entrepreneurship, and support the university's academic programs. The collection also includes over 160,000 books and serial volumes which are catalogued and searchable through the online catalog. The resources are organized in open stacks, and students can browse and choose from a variety of books, videos, and journals. The library offers services and resources on site as well as online. The library is subscribed to thousands of online resources including full-text electronic books and periodicals. Remote access to online resources is available through the library's website and blog. All textbooks and core reference books listed in the syllabi are available for use within the library, as a service to students and in compliance with PUPR's mission.

Library service hours include weekends and holidays totaling 82 hours weekly. Study areas and computer facilities are open 24/7 providing students adequate, comfortable and secure space for individual or team study. There are scanning, printing and photocopy services. Carrels and rooms for individual or group studying are distributed throughout the three levels of the building. Services for students with disabilities are offered at the Center for Technological Assistance on the first floor. Special software and equipment are available for students with hearing or visual impairments. Students with special needs can reserve rooms for individual tutoring and study. The library has Wi-Fi and internet access, and some study rooms are equipped with large monitors and VGA cables to facilitate laptops connection for teamwork assignments.

The library houses: reading and lounge areas, group-study rooms, computers with access to engineering software, copying, printing and scanning 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. Facilities also include an open space area with tables, conference rooms for faculty, staff, or students' meetings, information literacy laboratories equipped with video projectors, smart boards, computer equipment and computer stations for students and large capacity rooms for academics activities for up to 150 people.

The Information Literacy Program is based on the standards established by the Association of Academic and Research Libraries of the American Library Association. Workshop and orientation are offered at the premises to groups or individuals or online. The Program promotes the development of skills that position students to become life-long learners. A librarian is the program coordinator and works with faculty and department directors creating activities to integrate into the courses across the curriculum for the development of information literacy skills. Information Literacy is one of the eight Institutional Learning Goals.

Professional librarians, as faculty members, are active in the educational process. Along with the library staff, they work together to offer users specialized information assistance and services such as interlibrary loans, information literacy, and bibliographic search, among others. The library also has presence in the web 2.0 for direct communication with students. A blog is kept up-to-date with information and recommended links to reliable sources.

DISTANCE EDUCATION

Distance education is an integral and congruent component with PUPR mission. Thus, in addition to on campus courses, Polytechnic University of Puerto Rico (PUPR) offers fully online and hybrid courses, both at the graduate and the undergraduate levels. The latter delivery formats open a new door to college educational opportunities to students with time and distance constraints imposed by job and family obligations, among other constraints.

Distance Education Center at Polytechnic University (known in Spanish as CEDUP)

CEDUP is responsible for the management, design, and development of projects arising from the academic offering using distance education as its teaching methodology, in all three PUPR campuses. The institution provides through its Distance Education Center, an ongoing program of orientation, training, and technical support services for students taking online/hybrid courses and faculty teaching distance courses.

CEDUP supports the online academic programs through its human and technological resources. The Center has specialists in the use and management of the Blackboard platform, Instructional Systems Design, Graphic Design, Multimedia Integration, and Instructional Technology. The Center works as a production site of course development where sound instructional design principles are used along with Quality Matters™ Standards resulting in courses that meet distance education programs excellence Standards.

The online/hybrid courses provide interaction between faculty and learners and among learners through activities that encourage critical thinking and problem solving, as defined in the course objectives. The interaction between learners and the instructor and between learners takes place through diverse media; feedback to students is constructive and timely. The learning modules incorporate multimedia teaching technology to create images with the content, audio, video or capsules with educational content expert, computer graphics and interactivity tools.

The institution's Learning Management System (Blackboard) is used to organize an online learning environment that provides the means to track users, assess performance, deploy content, and access general administrative functions such as management of user's records and enable the creation of learning content; use of interactive features such as threaded discussions, and discussion forums.

Student support services include training on how to use Blackboard to successfully complete an online/hybrid course. Prior to enrolling in an online/hybrid course, students must attend one of the *Blackboard Students Workshop* offered by CEDUP multiple times every academic term. Additional training and technical support are provided to students regarding academic integrity tools and any other technical aspect associated with successfully participating in institutional online/hybrid courses available through Blackboard. The institution continually improves software and hardware to support greater access and uptime, including portal and servers reliability.

Academic Integrity in Distance Education

Polytechnic University of Puerto Rico *seeks to foster a spirit of honesty and integrity. Any work submitted by a student must represent an original work produced by that student.* Consequently, to maintain the academic integrity in distance learning courses, the University has developed a *Policy and Procedure to Support the Academic Integrity of Online Courses*. The Policy and Procedures seek to verify and ascertain the identity of a student enrolled in an online/hybrid course, as well as monitoring performance of students who take remote exams, as required by the Higher Education Opportunity Act of 2008.

Distance Learning Students

Every student who wants to register for online courses is required to possess basic knowledge for the use of programs such as word processors, presentation creation, and e-mail management. Also, the student must have skills in searching for information from webpages with a navigator or browser.

It is also the student's responsibility to verify the minimum systems requirements to access course information residing in Blackboard, read the Policy to Support the Academic Integrity of Online Course and install the tools needed to verify and ascertain the identity of the student enrolled in the online/hybrid course (Respondus™ Lockdown Bowser), among others.

State Authorization for Online Programs and Courses

The State Authorization Reciprocity Agreement (SARA) is an agreement among member states, districts and territories that establishes comparable national standards for interstate offering of postsecondary distance education courses and programs. It is intended to make it easier for students to take online courses offered by postsecondary institutions based in another state. PUPR has been approved by Puerto Rico Council of Education (CEPR in Spanish) to participate in the National Council for State Authorization Reciprocity Agreements.

Complaint Process

It is the goal of PUPR to provide students with an expeditious, fair, equitable, and consistent procedure for resolving their academic grievances. The purpose of an academic grievance is to give students a fair review and an opportunity to be heard. Students are expected to follow the procedures established by the college or academic department in which they are pursuing a course of study; however, academic grievances regarding a course grade must be filed with college or academic department unit in which the course is offered.

Students residing in other states while enrolled in a course offered by PUPR are encouraged to utilize the internal complaint or review policies and procedures, typically initiated within the academic department, before filing a complaint with their state agency or agencies. See Institution's Home State SARA Portal Entity listed at https://www.nc-sara.org/state-portal-entity-contacts.

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 toward serving the need of all the alumni, especially professional engineers and surveyors. Given the reality of our industrialized society and rapid technological advances, this program provides the resources necessary for the renewal of licenses for working professionals. It offers short-term non-credit seminars, conferences, symposiums, workshops and courses of a technological nature.

STUDENT INFORMATION AND SERVICES

VICE PRESIDENCY FOR ENROLLMENT MANAGEMENT AND STUDENT 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, Career & Internship Services Program, Alumni, Student Council, Student Organizations, and Social Activities.

The office has a vice president, associate vice president, and the administrative secretary. It is located in the Main Building, first floor, interior garden. Service hours are from Monday to Thursday, from 8:00 a.m. to 5:00 p.m., and Friday from 8:00 a.m. to 3:00 p.m.

CAREER & INTERNSHIP SERVICES PROGRAM

The Career and Internship Services Program was created in November of 1989. It serves as a liaison between government agencies and private industries, and Polytechnic University students and alumni, facilitating professional work experiences. The program allows students, in most cases, to receive economic revenues and earn a three-credit elective course through the internship. The work assignment must have prior approval from the Career & Internship Services Program Director.

The Career and Internship Services Program is available to students in their third, fourth, and fifth year of study and at the graduate level who accomplish the minimum requirements for the project.

The primary objective of our office is to facilitate the integration of the academic education and the workplace. The Program offers different job opportunities as students continue pursuing their academic degrees. On the other hand, the Placement Office has the mission of helping students, graduation candidates and alumni to obtain professional experiences related to their study fields and interests.

Qualifying for our Services - COOP'S and Internships

- Fill out an Application Form
- Attend a group or individual orientation
- Prepare a resume in English prior to any referral for job interviews
- Sign the Program Agreement and Legal Consent to Disclose Information
- 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 enthusiastic and responsible
- Participate in employer's interviews
- Present US citizenship or Visa documentations (If required)
- Is registered at the Professional Practice course (COOP3010) three (3) credit-hours/free elective course (If required)

Placement Program Requirements

The Placement Program purpose is to provide students with career-related experiences in business, industry and government.

- Fill out an Application Form
- Prepare a resume in English prior to any referral for job interviews.
- Sign the Legal Consent to Disclose Information
- Participate in employer's interviews
- Present US citizenship or Visa documentations (If required)

Professional Practice

Course Descriptions

Course Code	Course Title	Type of Course	Prerequisites	Credit - Hours
COOP 3010, Section 39	Professional Practice	Blended (face to face & virtual modality)	a. Completion of at least first $3^{1/2}$ years of study for engineering or architecture students, 2 years of study for Business Administration students. b. Minimum of 2.50/4.00 GPA	3
COOP 3010 (E), Section 39	Professional Practice Extension	Blended (face to face & virtual modality)	a. Completion of at least first $3^{1/2}$ years of study for engineering or architecture students, 2 years of study for Business Administration students. b. Minimum of 2.50/4.00 GPA c. Continuing a previous project	1

Assessment

- Essay based on an article with a focus on a professional environment.
- Technical Project
- Performance Evaluation

Grading

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 point per credit-hour)
WF Student abandoned course without authorization

(0 honor point per credit-hour)

I (with Grade) Incomplete with a grade (Points will be equivalent to the grade that accompanies the Incomplete)

INTEGRATED STUDENT SERVICE CENTER

The Integrated Service 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 by the Center. It provides students with a one-stop office in which to fulfill all transactions.

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 3:00 pm and Saturdays from 8:00 am to 1:00 pm. These office hours satisfy our daytime, evening and Saturday students.

DEPARTMENT OF ATHLETIC ACTIVITIES

The Department of Athletic Activities is responsible for planning and coordinating sports 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 and 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 reopened 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.

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.

HONOR PROGRAM

The mission of the Honor 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 honor courses, visits to museums and industries, scholarships, and newsletter 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 Honor 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 from 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 cost of the enrollment validation.
- Students with GPA of 3.25 or higher may be eligible for the honors scholarships if the 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 787-622-8000 extensions 384 and 420.

RESERVE OFFICERS' TRAINING CORPS

Since 1985, 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 Officer's 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.

SECURITY OFFICE

Pursuant to Public Law 101 – 542 "Student Right to Know and Campus Security Act of 1990," Polytechnic University of Puerto Rico created the Security Office. This office is responsible for creating, promoting and maintaining academic and working conditions on campus, 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 various agencies who participate in our operations.

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

The office provides to all students, faculty members, and employees with an identification card that is required to gain access to the campus and services.

The Security Office offers the following services:

- Installation and operation of 24 hours a day, seven days a week monitoring system.
- Implementation of the vehicle access control system at the 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.

To disclose crime statistics of incidents occurring within the university campus and in adjacent areas such as streets or avenues close to the institution. The statistics must be compiled by the Office of Security in its Incident Reports and with information or data provided by the Puerto Rico Police. The Clery Act requires reporting felonies in seven major categories; these are the following:

1. Criminal Homicide
    a. Murder and nonnegligent manslaughter
    b. Negligent manslaughter
2. Sexual Offenses
    a. Forced
    b. Non forced

3. Robbery
4. Aggravated Assault
5. Burglary, where:
    a. There is evidence of domicile violation (intrusion), which may be forced or not involving force.
    b. Illegal entry must be of a structure - it has four walls, a roof and a door.
    c. There is evidence that the entry was made in order to commit a felony or robbery.
6. Motor Vehicles Theft
7. Arson

Schools are also required to report statistics for the following categories of detentions or referrals for a campus disciplinary action (if a detention was not made):

1. Violations Alcoholic Beverage Act
2. Violations Alcoholic Beverage Control Act
3. Illegal Possession of Weapons

Hate crimes should be reported by category of prejudice, including race, gender, religion, sexual orientation, ethnicity and disability. Statistics for four additional crime categories are also needed if the offense is classified as a hate crime:

1. Larceny-theft.
2. Simple assault.
3. Intimidation
4. Destruction/damage/vandalism of property

GUIDANCE AND COUNSELING OFFICE

The Guidance and Counseling Office offers support and guidance in the personal, occupational and academic aspects that may hinder students from achieving a college education. The services are aimed at assisting students in making appropriate educational, occupational 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 and reasonable modification coordination in the classroom.

Counselor Services

- Academic Counseling
- Personal Counseling
- Occupational and Career Counseling
- Guidance
- New Students Registration and Enrollment Process
- Reasonable Modification Coordination for Students with Functional Diversity
- Psychological Services
- Alcohol, Drugs, and Violence Prevention Program (*Programa de Calidad de Vida*, in Spanish)

AOD Program

The Alcohol and Other Drugs Program (AOD Program) better known is 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 of 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, workshop 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 the therapy.
- Monitoring the student, regarding behavior and academic progress.

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 each academic program.

Developmental Program

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
SCIE 1110	General Biology	4
SCIE 1111	General Biology Laboratory	0
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

Students are enrolled in the corresponding developmental courses based on their College Entrance Examination Board test results and/or the placement tests. Each academic program determines the developmental courses required. The US Department of Education only pays federal aid for up to 30 credits of developmental courses to each student.

TUTORING SERVICES

The Tutoring Services division at the 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 their first years of college (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 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. 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, Biology, Physics and some engineering courses as Statics, Dynamics, Fluids, Solids, Computers Programming, Probability and Statistics, Circuits, MatLab, CREO 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 Learn, Tell Me More, and YouTube. In addition, the laboratory facilities have audiovisual equipment, such as a projector and smartboard. It is located in the Pabellon building, room P 305.

STUDENT SUPPORT SERVICES PROGRAMS (SSS)

- **Student Support Services-Regular (Traditional Program)**
- **Student Support Services-ESL (English as a Second Language)**
- **Student Support Services-STEM (Science, Technology, Engineering, and Mathematics)**

Program Description
The Student Support Services Program (SSS) know in Spanish as *Programas de Servicios Educativos* (P.S.E.) are financed by federal funds from the US Department of Education (Title IV). The Programs provide opportunities for academic development, assists students with basic college requirements, and serves to motivate students toward the successful completion of their postsecondary education. Student Support Services Programs also may provide grant aid to current SSS participants who are receiving Federal Pell Grants. The purpose of the Student Support Services Programs is to increase the number of disadvantaged low-income college students, first-generation college students, and college students with disabilities who successfully complete a program of study at the postsecondary level. The goal of SSS Programs is to increase the college retention and graduation rates of its participants and help students make the transition from one level of higher education to next.

Participant Eligibility
To receive assistance, all students must be enrolled or accepted for enrollment in the Polytechnic University of Puerto Rico, meet at least one of these eligibility criteria: low-income status, first-generation status (i.e., students whose parents have not received a bachelor's degree) or disability status, and exhibit academic need. Two-thirds of the participants must be either disabled participants or potential first-generation college students from low-income families. One-third of the disabled participants must also be low-income students.

Program Services
The SSS Programs provide: academic tutoring, which may include instruction in reading, writing, study skills, mathematics, science, engineering, and other subjects; advice and assistance in postsecondary course selection, assist student with information on both the full range of student financial aid programs, benefits and resources for locating public and private scholarship; and assistance in completing financial aid applications. Education or counseling services designed to improve the financial and economic literacy and assist students in applying for admission to graduate and professional programs; and assist students enrolled and applying for admission, and obtaining financial assistance for enrollment in four-year programs.

The SSS Programs offer individualized counseling for personal, career, and academic information, activities, and instruction designed to acquaint students with career options; exposure to cultural events and academic programs not usually available, and mentoring programs. Programs and activities are specially designed for students who are limited English proficient, students from groups that are traditionally underrepresented in postsecondary education or other disconnected students.

Program Grant Aid
To receive SSS Program grant aid, students must be current participants in the SSS project who are in their two years of postsecondary education and receiving Federal Pell Grants. Grant Aid may be offered to students who have completed their first two years of postsecondary education and are receiving Federal Pell Grants if the Institution demonstrates that these students are at high risk of dropping out and it has first met the needs of all its eligible first and second –year students.

Annual Performance Report
All SSS Program grantees are required to submit an annual performance report documenting the persistence and degree attainment of their participants. Since students may take different lengths of time to complete their degrees, multiple years of performance report

data are needed to determine the degree completion rates of SSS Program participants. The Department of Education will aggregate the data provide in the annual performance reports from all grantees to determine the accomplishment level.

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 of 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 organization exist at Polytechnic University of Puerto Rico. The following organizations are certified as such:

- CGE (Consejo General de Estudiantes)
- AIAS (American Institute of Architecture Students)
- SHPE (Society of Hispanic Professional Engineers)
- ASCE (American Society of Civil Engineers)
- IEEE (Institute of Electrical and Electronics Engineers)
- FSAE (Formula Society of Automotive Engineers)
- AIChE (American Institute of Chemical Engineers)
- ACI (American Concrete Institute)
- IIQ (Institute Chemical Engineers)
- Students Chapter of the Chamber of Commerce PUPR
- enatus (Entrepreneurial – Action – Us –)
- CCC (Chess Castors Club)
- ASME (American Society of Mechanical Engineers)
- PRWEA (Puerto Rico Water Environment Association)
- AGC (Association of General Contractors)
- BASA (Business Administration Students Association)
- USGBC (United States Green Building Council)
- IIC (Institute of Civil Engineers)
- ARQ POLI (National League of Architecture Students in Puerto Rico)
- IIAM (Institute of Environmental Engineers)
- IIE (Institute of Industrial Engineers)
- PUPR Veterans
- ITE (Institute of Transportation Engineers)
- CFO (Cross Followers)
- AEMIM (Association of Female Students of Mechanical Engineering)
- WHEPA (Wellness and Health Education Peer Advisor)
- ASQ (American Society for Quality)
- AIAA (American Institute of Aeronautics and Astronautics)
- SCEP (Students Chapter of Engineers in Progress)
- CEIIM-PUPR (Students Chapter of Mechanical Engineers)

PUPR encourages students to join student organizations.

STUDENT REGULATIONS

The Students Regulations document establishes the norms that rule student's behavior. Administrative personnel also use it as a guide to offer students adequate counseling when situations arise. It determines the rights, obligations, and responsibilities of students 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.

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.

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 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. Blackboard System Policy and Procedures
2. Campus and Workplace Violence Prevention Policy
3. Crisis Intervention Protocol
4. Cyberbullying Policy
5. Drug and Alcohol Policy
6. Faculty Change
7. Grade Review Policy
8. Guide for Institutional Policies
9. Harassment Prevention on Online Communication
10. Information Manual
11. Information Technology Acceptable Use Policy
12. Institutional Policy
13. Institutional Security Policy
14. Netiquette Policy
15. Policy and Procedure to Support Academic Integrity of Online Courses
16. Procedures to File a Complaint
17. Sexual Assault Policy
18. Sexual Harassment Policy
19. Student Rules and Regulations
20. Suicide Prevention Protocol

HEALTH SERVICES

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 Plan sponsored by the institution is offered by a physician in his private office located at José Martí Street adjacent to the university campus.

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 equivalency examination, as well as (c) transfer students, (d) USA veterans and beneficiaries and (e) International students, to enroll in PUPR credit courses and programs. Students should avail themselves of the Students Regulations, copies of which are distributed by the Office of the Vice-President of Enrollment Management and Students Services. The institution reserves the right to admit, on a temporary status, or reject, any applicant who fails to meet a single criterion fully. 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:

1. File an application for admission. The application for admission form asks for important information which the applicant is responsible for submitting. 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.
2. Submit an official academic transcript from high school certifying graduation or the results of the high school equivalency examination.
3. Pay a thirty dollar ($30.00) non-refundable application fee.
   The application fee will not be applicable towards the student's registration charges.
4. Submit an Immunization Certificate (for applicants under 21 years of age)

Eligibility Criteria

Applicants to Polytechnic University of Puerto Rico will be admitted based on the eligibility criteria presented in tables A and B.

Table A- Undergraduate Programs Eligibility Criteria:

Discipline	Minimum Grade Point Average (GPA)
Engineering	2.50
Architecture	2.50
Land Surveying	2.50
Business Administration	2.50
Computer Science	2.50

Applicants who do not meet the high school Grade Point Average of 2.50 can request, in writing, reconsideration by the Admissions Committee.

Table B- Associate Degree Programs Eligibility Criteria:

Discipline	Minimum Grade Point Average (GPA)
Associate Degree of Engineering in Software Development	2.00
Associate Degree of Engineering in Supply Chain & Logistics	2.00
Associate Degree in Land Surveying	2.00
Associate Degree in Mechanical Engineering	2.00
Associate Degree in Product Design	2.00

Applicants who do not meet the minimum GPA stated above can request, in writing, reconsideration by the Admissions Committee.

In considering an application, the Director of Admissions at 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.

Course Placement and Exemptions

Students that present the College Board Examination and Advanced Placement tests scores can request course placement and exemptions. Results from the College Board Examination and Advanced Placement tests are used to grant course placement and exemptions to students based on the following tables.

Course Placement Based on College Board Examination

Mathematics Course Placement	College Board Scores
MATH 0102	200-549
MATH 0106	550-649
MATH 0110	650-699
MATH 1330	700-800

Spanish Course Placement	College Board Scores
SPAN 0100	200-549
SPAN 0110	550-749
SPAN 1010	750-800

English Course Placement	College Board Scores
ENGL 0100	200-599
ENGL 0110	600-749
ENGL 1010	750-800

The following table is used for course placement and exemptions, if the student has taken the Advanced Placement Test (CEEB). *SPAN 2020 and ENGL 2020 are for business administration students.

Course Exemptions Based on Advanced Placement Tests (CEEB)

Level	Score	Courses	Course Exemptions	Course Placement
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*

These criteria are also used to evaluate transfer applications.

In addition, Mathematics and Sciences Department, and Socio-Humanistic Studies Department offer Placement Tests for students who would like to request exemption from courses in these areas. The following table presents the exemption criteria.

Course Exemption Based on Departmental Placement Tests

Mathematics Course	Minimum Required Score
MATH 0102	80%
MATH 0106	80%
MATH 0110	80%
MATH 1330	80%

Spanish Course	
SPAN 0100	80%
SPAN 0110	80%
SPAN 1010	80%

English Course	
ENGL 0100	80%
ENGL 0110	80%

The minimum score to pass the placement test is 80%. The student who meets this criterion will receive a course exemption and will be awarded placement in the next course, according to the curricular sequence of the corresponding department. Failure to meet the minimum score the student will have to enroll in the corresponding course.

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 the 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 official transcript from each institution of higher education previously attended. The transcript should be mailed directly from the institution(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.
2. Payment of $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.
3. A letter of recommendation signed by the Dean of Student Affairs of the previous institution. (Optional)
4. An Immunization Certificate (applies only to applicants under 21 years of age)

Candidates from institutions of higher education, who would have met the admission requirements for high school applicants prior to their university experience, will be taken into consideration for transfer admission. **PUPR reserves the right to refuse applications for admission once enrollment limits are reached.**

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, applicants who are not interested in obtaining an academic degree from PUPR or a grade, except for professional development coursework, are classified as special students. An applicant desiring to enroll as a special student must submit:

1. A completed application for admission form.
2. Payment of $30.00 non-refundable application fee with the application form.
3. Submit an authorization as Special Student.

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 courses and obtain a grade of C or higher in each one. 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 the authorization of the Faculty Dean and Registrar, but will not receive grades or credit for work done on any subject.

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)

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 the 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

<u>Secondary School Graduates</u>

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.

<u>International Students</u>

International Undergraduate Applicants

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

- Complete the application for admission.
- Pay a $150.00 non-refundable admission fee.

Non-Resident Applicants/Students Visa

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.

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 Services, Academic Credentials Evaluation, Josef Silny, Inc.**

Transfer Student with Form I-20

1. An application for admission.
2. Payment of one hundred fifty dollars ($150.00) 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 Students 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.

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.

Initial Orientation for Newly Admitted Students

After the student is admitted, the next step is to coordinate the initial orientation with the Enrollment Coordinator. During this orientation, the student is guided on the processes of getting acquainted with Polytechnic University rules and regulations and is given a package with the Student Guide, Description of Placement Tests, Informative Bulletin, information regarding tuition, fees and costs per credit-hour, and Online Manuals Sheet that includes links to access the following:

- Student Information Manual
- Student Regulation
- Security Policy
- Qualification Review Procedures
- Credit Transfer Validation Policy
- Policy on the Use and Abuse of Controlled Substances
- Sexual Assault Policy
- Agreements between PUPR and other Institutions (MOU)

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 admitted students with academic advising and class scheduling 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.

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. The 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 2018-2019
TAD	Tuition Associate	$185.00
TEN	Tuition Engineering	$215.00
TBA	Tuition Business Administration	$195.00

TED	Tuition Education	$195.00
TGN	Tuition General	$195.00
TAR	Tuition Architecture	$235.00

Tuition and fees are subject to change without notice. Revised April2018

General Fees

Regular Term – 12 Weeks (fall, winter and spring)

Tot Codes	Description	
GEN	Undergraduate General Fees	$290.00

General Fees

Summer Term – 6 Weeks (June and July)

Tot Codes	Description	
GEN	Undergraduate General Fees	$290.00

General Fees

June Term or July Term – 3 Weeks each

Tot Codes	Description	
GEN	Undergraduate General Fees	$145.00

Other Fees

Tot Codes	Description	
ACE	Academic Evaluation Fee	$10.00
ADB	Application for Admission	$30.00
ADF	Application for Admission – International Students	$50.00
ADG	Application for Graduate Admission	$50.00
DSG	Architecture Design	$280.00
IDC	Campus Card	$15.00
CER	Certification Fee	$5.00
333333CMP	Change for Academic Concentrations or Programs	$20.00
PCOL	Collection Fee	$50.00
RRC	Copy of Registration Report	$4.00
DPC	Deferred Payment Charge	$65.00
PFE	Design Project Fee	$235.00
ADC	Drop Fee/Partial and Total Withdrawal (Per Course)	$15.00
DDI	Duplicate Diploma	$65.00
DID	Duplicate ID Card	$16.00
GRA	Graduation Fee	$185.00
GRA	Graduation Fee (Late)	$205.00
IIF	International Infrastructure Fee (Per Term)	$400.00
IFC	Interest Finance Charge (Monthly)	2%
LAB	Laboratories	$280.00
LRE	Late Registration Fee	$60.00
PAK	Parking Access	$65.00
REA	Readmission	$25.00
RCF	Return Check Processing	$50.00
TRA	Transcript Fee	$9.00

Graduation candidates will pay the graduation fee 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 or the 50% of tuition and fees. The validation process of registration can be through Polytechnic University portal mypoly.pupr.edu or in person.

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 tuition and fees, and outstanding balances can be made:

- Through Polytechnic University's Portal: mypoly.pupr.edu (online service) using Banco Popular's ATH, Visa, MasterCard, American Express, Discover, and personal checks.
- In person, with cash, debit cards, Visa, MasterCard, American Express, Discover, money order, manager's checks, and certified or personal checks. Checks should be made payable to Polytechnic University of Puerto Rico or PUPR. (Returned checks will incur additional charges, and the student loses the privilege of using this payment method).
- 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 requires reimbursement, 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 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 2% 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.
5. Debtors will be subject to the jurisdiction of the Court of First Instance, San Juan Municipal Division.
6. Debtor students may be excluded from graduation ceremonies. The University may also withhold grades, issuance of transcripts, degrees, diplomas, certificates of good standing or other official documents 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 fail to comply with the payment plan, they may be referred to legal divisions or collection agencies. 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.

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 withdrawal (partial or total) requested by a student

Regular Term – 12 Weeks (FALL, WINTER AND SPRING)

	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 Fees
Census Date calculated on the last day of week 2**	
During the third week of classes through the withdraw deadline of each term	0.00%

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

Summer Term – 6 Weeks (June and July)

	Percentage of Refund
During regular registration process	100%
During first 3 days of classes	100%
During next 3 days of classes*	33% Tuition and Laboratory Fees
Census Date calculated on the last day of week 1**	
During the second week of classes through the withdraw deadline of each term	0.00%

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

June Term or July Term – 3 Weeks each

	Percentage of Refund
During regular registration process	100%
During first 1 day of classes	100%
During next 2 days of classes*	33% Tuition and Laboratory Fees
Census Date calculated on the 3rd day of classes**	
After the 3rd day of classes through the withdraw deadline of each term	0.00%

*General Fees are non-refundable.
**Census date is the cutoff date for aid calculation.

FINANCIAL AID OFFICE
The Financial Aid Office provides information to students and their families regarding the available financial aid programs as well as the application process and eligibility requirements. Its mission is to provide accurate and clear consumer information to help students explore the different financial aid resources that can help them obtain the necessary funding to reach their academic goals.

Polytechnic University of Puerto Rico participates in the following financial aid programs from federal, state, institutional and private sources:

- Federal Pell Grant
- Federal Supplemental Educational Opportunity Grant (FSEOG)
- State Merit Grant
- State Grant for Honor Students (PROGRESAH)
- State Grant for Specific Academic Areas
- Federal Work-Study
- Institutional Honor Scholarship
- Institutional Corus Scholarship
- Institutional Athletic Scholarship
- Federal Direct Loan Program

- Federal Direct Loan Program for Parents of Undergraduate Students (PLUS)
- Federal Direct Loan Program for Graduate Students (Graduate PLUS)
- Private Scholarships

The availability of the above programs will depend on the total funds allotted to the institution each academic year.

GENERAL ELIGIBILITY REQUIREMENTS

To be eligible to receive financial aid from most federal, state and institutional programs, the student must:

- Be enrolled as a regular student
- Be working towards a degree in an eligible program
- Be a U.S. citizen or eligible non-citizen with valid Social Security Number
- Have a high school diploma or its equivalent
- Meet the Standards of Satisfactory Academic Progress
- Demonstrate financial need (except for some loans)
- Register with the Selective Service, if male between the ages of 18 and 25
- Certify that the federal student aid will only be used for educational purposes. The student must also not be in default or owe money on a federal grant.
- Have no history of certain drug convictions

In addition to the above basic eligibility requirements, the student could be required to meet additional requirements such as minimum enrollment credits, minimum GPA, state residency status among others, depending on the financial aid program. For the eligibility requirements of a specific program, contact the Financial Aid Office.

STUDENT CONSUMER INFORMATION

The University conforms to the Student Consumer Information Requirements established by the United States Department of Education, and hereby notice that the Director of Student Financial Aid and office staff are the persons designated under those requirements to assist the student or prospective student in obtaining information regarding student financial assistance.

APPLICATION PROCESS

To determine student's eligibility for federal aid, the student must complete the Free Application for Federal Student Aid (FAFSA). Some financial aid programs, such as state grants, student loans, and federal work-study require an additional application.
The student must reapply for financial aid every year. Since some federal and state funds are limited, students are encouraged to apply as soon as possible after October 1 of every year. New students should apply for financial aid at least two months before the first day of classes for the period for which they will enroll. Regular students must submit their application before the end of December.

Follow these steps to complete your FAFSA:

1. Obtain an FSA Id for yourself at www.fsaid.ed.gov. If you are a dependent student, one of your parents will need an FSA Id to sign the FAFSA. If you already have an FSA Id, you will use it to renew your FAFSA every year.
2. Collect the following information:
    - Your social security number. If you are a dependent student, you would also need your parents' social security numbers and dates of birth.
    - Your driver's license number (if applicable).
    - Prior Year Income tax returns, W-2 forms and other records of income earned for yourself and your parents (if dependent) or your spouse (if married).
    - Evidence of untaxed income during the prior year such as Child Support, veteran's non educational benefits, among others.
    - Information about savings, investments as well as business and farm assets for yourself and your spouse/parents, if applicable
    - PUPR's School Code: 014255
3. Complete the FAFSA at www.fafsa.gov. FAFSA is free! You should not pay for completing this application. If you need assistance to complete the FAFSA, contact the Financial Aid Office.
4. After the FAFSA application is processed by the Department of Education, the Financial Aid Office will receive a report with the student and parent information. If your application is selected for verification, the Financial Aid Officer will

request the student to provide documents to confirm the information submitted in your FAFSA. No financial aid disbursement will be processed until the verification process is completed.

5. If you are going to apply for Federal Loans, you may complete your loan application at http://www.pupr.edu/services/solicitud-de-prestamo/. Be sure to complete your FAFSA also.

TRANSFER STUDENTS

Financial aid awards cannot be transferred automatically from one post-secondary institution to another. The student must correct the FAFSA application to include Polytechnic University's Cod: 014255. After the Financial Aid Office receives your FAFSA results, we can determine your eligibility for the available financial aid programs.

Transfer students with previous student loans can defer paying loan payments if enrolled at least half-time. The deferment will not be automatically granted with enrollment. To defer a student loan, the student must complete an In-School deferment form and submit it to the Registrar's Office. The deferment form is available at www.pupr.edu.

AWARDING PROCESS

The student's eligibility for financial aid programs will be determined after the FAFSA application is received, and the verification process is completed, if selected. The student's Expected Family Contribution (EFC), and the cost of attendance (COA), will be considered when preparing the award package. The student will not be considered for a Student Loan or the Federal Work-Study program unless proper program application has been completed. For supplemental aid programs, priority will be given to students with economic need, in order of application processing date.

The student will receive an Award Letter listing the student aid programs awarded for the academic year. Initial student aid awards are offered based on full-time enrollment. Awards may be then adjusted, if applicable, to actual enrollment after the add/drop period for each trimester. Other sources of assistance such as merit awards and private and institutional scholarships will be taken into consideration when preparing the student's award package.

**Students repeating a course may not be eligible for financial aid for that specific course.

FINANCIAL AID DISBURSEMENTS

Financial aid funds are credited to the student's institution account to cover tuition costs and fees. The student's enrollment status and eligibility for the financial aid program will be verified every trimester before disbursing any money. If there is an excess after funds are paid, a check will be issued to refund the student. If the financial aid is not sufficient to cover all charges, the students is responsible for paying the outstanding balance.

The following are some of the reasons why the student's aid disbursement may be delayed or cancelled:

- Application submitted after deadline
- Not providing all required documentation before deadline
- Not completing the Entrance Counseling and/or Master Promissory Note for Direct Loan borrowers
- Not keeping the minimum academic workload
- Not making Satisfactory Academic Progress towards the program degree
- Being in default on a student loan or owing an overpayment to any Title IV financial aid program

STUDENT AID CANCELLATION AND REFUSALS

Students may refuse to accept any financial aid awarding. For this purpose, the student may notify the Financial Aid office in writing to refuse an awarded aid prior to it being disbursed. If the student aid has already been disbursed, the student is required to notify in writing within fourteen days of the credit.

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.

STANDARD OF SATISFACTORY ACADEMIC PROGRESS FOR STUDENTS WITH FINANCIAL AID

The Standard of Satisfactory Academic Progress of the Financial Aid Office establishes the evaluation criteria to determine the student's academic progress, which is one of the eligibility requirements to participate in student financial aid from Federal, State, Institutional and Private Programs.

The minimum federal components to measure the satisfactory academic progress require three specific measures: qualitative, quantitative, and maximum timeframe to receive Federal aid. These three components provide a measure of the reasonable progress the student should have to complete the academic career successfully.

Evaluation Criteria for Undergraduate Students

- Qualitative Measure – One of the elements of the Satisfactory Academic Progress Standard is the qualitative measure. This component consists of the grade point average (GPA) and the total accumulated credits at the end of the academic year. Polytechnic University of Puerto Rico adopts the retention rate (qualitative measure) according to the following chart:

Bachelor's Degrees

Total Earned Credits*	Minimum Required GPA
0 – 36	1.50
37 – 72	1.65
73 – 108	1.80
109 +	2.00

*Total Earned Credits includes transferred credits and completed credits at PUPR.

Associate Degrees

Total Earned Credits*	Minimum Required GPA
0 – 18	1.50
19 - 36	1.65
37 - 54	1.80
55 +	2.00

*Total Earned Credits includes transferred credits and completed credits at PUPR.

Credits transferred from other colleges or universities are not taken into consideration to calculate the GPA, but they are considered to calculate the student's level or year.

- Quantitative Measure – The second element of the Satisfactory Academic Progress Standard is the quantitative measure. This component compares the number of credits attempted by students in the institution, versus the number of approved credits. The student must approve at least 66% of all credits attempted at PUPR. This measure will be cumulative.
- Maximum timeframe to receive payments from federal financial aid – All students must complete the graduation requirements within a maximum equivalent to 1.5 times (150%) of the program degree credits required. Developmental courses will not be considered in the evaluation of the maximum time, but all courses attempted at our institution will be included. Transfer credits are also included in this measure. Students who will be unable to complete their degree within the maximum 150% timeframe, will not be eligible to receive financial aid at the moment the school determines that the student will not comply with this provision, not when the student arrives at the 150% timeframe.
  - Maximum timeframe will be determined using credit-hours
    - The maximum time must be 150% of the credit-hours required to complete the program degree.
    - All attempted credits, even those in which the student did not receive financial aid, count towards the established maximum.
    - This policy includes and measures students who are enrolled half-time or less than half-time
    - All courses attempted in the institution, except for developmental courses, will be included. Transferred courses will also be included to measure the maximum timeframe.
    - Changes of Major or School (e.g. from Engineering to Architecture), will be measured with the new concentration requirements (total required credits). All courses taken at PUPR, including credits from previous Major/School and credits from the new Major/School will be included.

      Example:
      - The Accounting Program requires 120 credits to complete the curriculum.
        Maximum timeframe (120 credits x 150% = 180 attempted credits)

The student will receive payment of federal financial aid for preparatory courses up to a maximum of 30 credits.

PROBATION OR SUSPENSION
The student Satisfactory Academic Progress process is evaluated once a year, at the end of the academic year (June).
If the student does not meet one of the evaluation criteria of the Satisfactory Academic Progress policy, the student will be classified with a status of probation or suspension. The Financial Aid Office will notify the student about the status.

Probation Status
A student which does not satisfy the Satisfactory Academic Progress policy for the first time is put on a probation status. While on probation, the student does not qualify for any Federal, State, or Institutional aid programs. Students on probation are able to appeal the probation status, and if approved, could be eligible to receive Federal, State and Institutional aid.

Procedure for Appealing a Probation Status
1. To complete the Appeal Form, the student must visit www.pupr.edu. The form must be completed in all its sections.
2. The Academic Progress Appeal Form and supporting documentation must be received in the Financial Aid Office before the stated deadline.
3. Once submitted, the appeal will be evaluated by the Satisfactory Academic Progress Committee.
   a. If approved continue to step #4
   b. If denied, the student will not be eligible for Federal, State nor Institutional aid, until the student complies with the Satisfactory Academic Progress Standard.
4. Plan to improve your academic progress:
   a. Once the appeal is approved, the student will be referred to meet with the Mentor, Academic Dean or Counselor, to establish an academic plan for the following term. The academic plan will be established at the beginning of each trimester.
   b. Sign the academic plan agreement with the Mentor, Academic Dean or Counselor.
   c. Submit the established academic plan to the Financial Aid Office, to reactivate you financial aid.
5. The academic plan will be evaluated every trimester by the Financial Aid Office personnel. While the student complies with the academic plan, the student can continue to be eligible to receive Federal, State and Institutional aid as long as the student meets the other requirements to receive financial aid. If the student does not meet any of the terms set forth in the academic plan, the student will lose all the Federal, State and Institutional aid until the student complies with the Satisfactory Academic Progress Standard.

Suspension Status
A student that does not overcome the probation status, falls in a suspension status. A student in a suspension status does not qualify for Federal, State nor Institutional aid. Students in suspension status cannot appeal to the Satisfactory Academic Progress Committee. A student in a suspension status may be eligible to receive Federal, State, and Institutional aid funds when the student complies with the Satisfactory Academic Progress Standard.

DEFINITIONS
Attempted Credits – Enrolled credits at PUPR in which the student has obtained grades of I (with grades), A, B, C, D, F or W, WF, NR, including all courses repetitions.

Academic Progress – Is the measure which shows whether a student is complying with the three criteria of the Satisfactory Academic Progress Standard (Qualitative, Quantitative, and Timeframe).

Academic Term – Typical academic term during which regular courses are offered, and which consists of 12 weeks, beginning on the first day of school and ending on the last day of final examinations. In summer, the academic term is reduced to 6 weeks, doubling the weekly contact hours.

Academic Year – Consists of three academic terms that begin in August and end in May. The summer term is optional.

Developmental Courses (Preparatory or Remedial) – These are basic courses required by the program (includes courses in MATH, SCIE, ATUL, SPAN, and others starting with 01xx). These courses will be covered by federal financial aid up to a maximum of 30 credits.

Expired credits – Courses approved seven or more years ago in this or other institution will expire at the date of applying for readmission with the exception of those validated by the Department Director and the Faculty Dean. The student must repeat all courses declared outdated or must take other equivalent courses of the existing curriculum, with the approval of the Department Director and the Faculty Dean. These courses are considered for the calculation of the quantitative measure.

Financial Aid Suspension – Students who at the end of the probation period, do not overcome deficiencies with the qualitative or quantitative measure, or who do not comply with the established academic plan, will have their financial aid suspended (this includes any Federal, State or Institutional aid). Also, all aid will be suspended if it would be mathematically impossible for a student to complete his program before reaching the maximum timeframe of 150%. All attempted credits and transferred courses will be taken into consideration.

Grade Point Average (GPA) – The measure of academic merit achieved by the student. It is calculated by dividing the total number of accumulated honor points by the number of credits in which the student has received final grades, including F's and WF's, which have not been removed.

No Satisfactory Academic Progress (NPAS – suspension) – Classification that is given to the student who at the end of his Financial Aid Probation period does not overcome the academic deficiencies or has not completed the Academic Plan as agreed. The student does not qualify for any Federal, State or Institutional aid.

Provisional Grades (Incompletes) – If the Professor gives an incomplete in a course, the student must complete the requirements of the course within the established date in the next academic term. The Professor will remove the incomplete within the established date. If the incomplete is not removed, it will become the provisional grade until the professor changes the grade. Provisional grades are considered in the calculation of the qualitative and the quantitative measures of the Satisfactory Academic Progress Standard.

Courses with W Grade – Course from which the student officially and voluntarily withdraws. These courses will be considered in the calculation of the quantitative measure.

Repeated Courses – Courses that the student has been enrolled two or more times. For the purpose of determining the Grade Point Average, only the highest grade will be used. Repeated courses will be considered in the quantitative measure of the Satisfactory Academic Progress Standard.

Transferred Credits – Credits taken at other institutions of higher education recognized by accrediting agencies, that were approved with A, B, or C, and which are accepted by the Department Director or by the authorized Dean, in compliance with the standards of PUPR

STUDENT'S RIGHTS AND RESPONSABILITIES

The student has the right to receive the following information from the Financial Aid Office:

- Available financial aid programs.
- Application process, deadlines and eligibility requirements.
- Awarding and disbursement procedures.
- What financial aid must be repaid, the terms and schedules for repayment.
- The terms and conditions of any employment that is part of the financial aid award.
- What is the criterion of maintaining Satisfactory Academic Progress and how to reestablish eligibility?
- Institution's refund policy for the students that withdraw from school.

It will be the student's responsibility to:

- Comply with deadlines.
- Provide all required documents in a timely manner.
- Provide the Financial Aid Office with information on changes in family's household, income or enrollment status.
- Inform the Financial Aid Office of any outside scholarships, tuition assistance, VA benefits or any other benefits that the student will be receiving during the academic year.
- Use any financial aid received from Federal, State or Institutional funds, for expenses related to their education.
- Notify any change in name, social security, citizenship status, address, phone number or email address.
- Understand and comply with the policies regarding refunds, repayments and satisfactory academic progress.
- Complete the Exit Counseling for Federal Student Loan program, before departure from college or if registering as less than half time student in any term.

PRIVACY NOTICE

The Financial Aid Office ensures the confidentiality of students' records. For this reason, confidential information will not be released by email or phone to students. In addition, no information will be released to any third party, unless legally required to do so, without written authorization from the student. This includes parents, spouses, siblings or friends.

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 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 timeframe. 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 comply 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 ensure 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 a.m. to 10:30 p.m., Monday through Thursday, and from 8 a. m. to 5 p. m., 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 class, 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 of 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.

Withdrawals
The process for partial and total withdrawals is the same; both must be completed online through the student portal on or before the deadline stipulated in the Academic Calendar.

Polytechnic University of Puerto Rico does not encourage withdrawals from courses. However, if a student considers withdrawing from a course or all courses, consultation with a professor, counselor or mentor is recommended to discuss possible options rather than withdrawal. The W is a grade, and it will stay permanently on the academic transcript.

Students cannot withdraw from any course identified with "NR." (See: Class Attendance section for NR explanation).
Remember that withdrawing from a course does not exempt the student from paying the cost of it.

Veteran students must present evidence of activation or mobilization orders to the Veterans Coordinator at the Registrar's Office.

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 responsibility 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. (Honor points are the equivalences assigned arbitrarily to a letter grade.) The grades that must appear on the midterm 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 point per credit-hour)
WF	Student abandoned course without authorization (0 honor point per credit-hour)
I (with Grade)	Incomplete with a grade (Points will be equivalent to the grade that accompanies the Incomplete)

Grade Point Average

Grade Point Average is the measure of academic achievement. It is computed as follows: 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**).

The credit-hours of each course is multiplied by 4, 3, 2, 1 or 0, according to grades A, B, C, D, F or WF, respectively.
These products are added (**S**) and identified as honor point.
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 Grade Point Average, 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	(Withdrawals) 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

Face-to-Face 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 (2) weeks of the academic term are automatically disqualified from charging tuition fees to federal funds and are responsible for their payment. This course will be identified with an "NR" (No Record/Show). The instructor via email the names of all such students to the Registrar's Office. (Policy of Class Attendance)

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 or other reasons. In this case, the student is responsible for contacting the instructor and for all work, completed or assigned.

Online Class Attendance

Student attendance in online courses is defined as active participation in the course as described in each course syllabus. The faculty members must certify that students are actively attending an online course, or a hybrid course according to the procedures established by the Center for Distance Education. Students will be required to complete at least one (1) of the following activities during the first two (2) weeks of the academic term for each online or hybrid course.

1. Submit an assignment online;
2. take an online assessment;
3. participate in an online discussion about academic matters;
4. complete an online interactive tutorial or computer-assisted instruction that is trackable; or
5. initiate contact with the faculty member to ask a question about the academic subject studied in the course.

Students who fail to complete any of these activities during the first two (2) weeks of the academic term are automatically disqualified from receiving federal funds for tuition and fees and are responsible for their payment. This course will be identified with an "NR" (No Record/Show). The instructor will submit via email the names of all such students to the Registrar's Office.

On occasions the student may not be able to access the online/hybrid course for health or other reasons. In this case, the student is responsible for contacting the instructor, provide documentation that supports the need for late submission of a graded activity.
As a component of course attendance, students are expected to check their course email regularly (preferably daily), course announcements, and discussion forums. The student is responsible for checking updates related to the course. Log on at least three (3) times a week – it is recommended to complete weekly assignments, assessments, discussions, or other weekly deliverables as directed by the instructor and outlined in the course syllabus.

STUDENTS WITH VETERAN'S BENEFITS

Students with veteran's benefits should provide the Certificate of Eligibility and the DD-214 form. If the student needs assistance to complete this document, he/she must contact the Veterans Coordinator in the Registrar's office.

Students eligible for Veterans benefits are required to make their financial arrangements in line with the policies of the University for all students.

MILITARY TRAINING

Polytechnic University students may request consideration of credit award for documented military training. The Academic Director has the responsibility of working with the student to evaluate the request and to determine if the credit option is appropriate.

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 600.02 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 fifteen (15) contact hours per term for a lecture course, and thirty (30) to forty-five (45) contact hours per term for a laboratory of practicum course. Additionally, it includes a minimum of 2.5 hours of out-of-class student work each week for the twelve-week term.

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 of 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 (GPA)
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 and WF'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. 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. Academic Term refers to the twelve (12) weeks period during running from the first day at classes to the last day of final tests as defined on Page 11. The summer academic period is optional, and the grades will be added to the previous academic period of study. There are three academic periods in summer: one six-week summer session, and two three-week summer sessions.

Expired Credits
Courses approved seven or more years ago in this, or other institution will expire at the date of applying for readmission with the exception of those validated by the Department Director and the Dean of Faculty.
The student must repeat all courses declared outdated or must take other equivalent course of the existing curriculum with the approval of the Department Director or the Dean of Faculty. These courses are considered for the calculation of the quantitative measure.

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 purpose. This constitutes the Institutional Policy, administered by the Registrar's Office.

Retention Index (Qualitative Measure)
The institutional policy applicable to students without Federal Financial Aid is shown in the following table:

Table A. – Retention Index (Qualitative Measure) for Undergraduate Programs

Transferred Credit-Hours	Passed Credit-Hours at PUPR	Total Accumulated Credit- Hours Range	Minimum Grade Point Average (MGPA)
(1)	(2)	(1+2)	
		0 – 36	1.50/4.00

Table A. – Retention Index (Qualitative Measure) for Undergraduate Programs (continued)

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

Table B. – Retention Index (Qualitative Measure) for Associate Degree Program

Transferred Credit-Hours	Passed Credit-Hours at PUPR	Total Accumulated Credit- Hours Range	Minimum Grade Point Average (MGPA)
(1)	(2)	(1+2)	
		0 – 18	1.50/4.00
		19 – 36	1.65/4.00
		37 – 54	1.80/4.00
		55 and more	2.00/4.00

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

Maximum Time Allowed to Complete Academic Degree while Receiving Federal Financial Aid

Quantitative Measure

The second element of the Standard of Satisfactory Academic Progress is the quantitative measure. This component compares the number of credits attempted by the student in the institution, versus the number of approved credits. The student must approve at least 66% of all the credits attempted at PUPR. This measure will be cumulative.

Maximum Time to Receive Payments from Federal Financial Aid

All students must complete the graduation requirements within a maximum equivalent to 1.5 times (150%) of the program degree credits. Preparatory courses will not be considered in the evaluation of the maximum time, but all courses attempted at our institution will be included. Transfer credits are also included in this measure.

Students who will be unable to complete their degree within the maximum 150% timeframe, will not be eligible to receive financial aid.

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. Students who will be unable to complete their degree within the maximum 150% timeframe, will not be eligible to receive financial aid at the moment the school determines that the student will not comply with this provision, not when the student arrives at the 150% timeframe.

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 schedules 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 veteran's 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 begin a probationary period that will not exceed two consecutive academic years before being suspended for one year. After the 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) with a Grade

A professor may deem necessary to give the student an incomplete (I) with a 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 “0” 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.

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.
4. After the one (1) academic year suspension, the student may be readmitted in a third probationary period (P3) for one academic year. In the event a student fails to raise the GPA above the retention index after the third probationary period (P3), the student suspended for a period of three (3) academic years; afterward, the student may request readmission. A student may be admitted again under a fourth probationary period (P4) for one academic year. In the event he/she does not succeed, he/she will be permanently dismissed.

RIGHT TO APPEAL

Every student has the right to appeal the probation or suspension, issued by the Registrar’s Office. The student may send an online request for reconsideration to the Academic Achievement Committee, within ten (10) labor days after notification of the decision. The student must go to www.pupr.edu, to complete the Appeal for Probation Form and supporting documentation, if needed, and carefully follow the instructions.

The request for reconsideration should state clearly the decision referred to, give a brief statement of facts, and, state and justify the basis for the requested change or restitution. Once the Academic Achievement Committee makes the decision, it will be final.

ACADEMIC PROGRESS REVIEW PROCEDURES FOR STUDENTS WITH FINANCIAL AID

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

1. Retention Index (Qualitative Element) - This index is defined as shown in Table A.
2. Retention Index (Quantitative Element) - The minimum percentage of passed credit-hours required from each student receiving financial aid is not less than 66% of all credit-hours attempted every academic year. This means that the student must complete all the graduation requirements within the timeframe 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 when the student is unable to complete their degree within the maximum 150% timeframe.

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 with the 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

- The student will complete and submit the readmission application to the Registrar's Office.
- The student will pay a nonrefundable readmission fee.
- Upon payment of the readmission fee, the Finance Office will notify the student of any outstanding debt with the institution.
- If the student is indebted to the institution, the process of readmission is held up until the student pays the debt and receives clearance from Finance Office
- Registrar's Office will apply the following criteria to evaluate the readmission application:
    - Study any evidence of disciplinary measures taken or non-compliance with University regulations, and any stipulations made.
    - Verify that the student complies with the minimum GPA according to Table A (Retention Index)
    - Confirm that the student complies with the required suspension time limit
- A student whose readmission application has been denied may appeal to the Readmission Committee through the Registrar's Office. The student will receive instructions regarding the procedure to follow in order to request reconsideration by the committee.
- 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.
- The conditions of the probation period will be:
    - The student must pass all courses, for which he/she is registered, with a grade of "C" or higher.
    - The academic load will be limited to a maximum of twelve (12) credit-hours per term.
    - The GPA should be increased or improved according to what has been established.
    - The student is obliged to repeat courses with a grade of D, F and/or WF.
- Students who have voluntarily interrupted their studies at PUPR, and during this inactive period have attended other institution (s) without prior permission from the Department Director, will have no right to request the transfer of credit-hours taken at other institution.
- The decision of the Readmission Committee will be sent to the student's email from the Registrar's Office. The decision is final.

APPLICATION FOR GRADUATION
Candidates for 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 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 filling 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 academic department or the Vice President of Enrollment. Students completing requirements during the summer, next year fall and winter terms are invited to participate in next year summer commencement exercises.
4. The student 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 includes 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 no 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 to 3.499 for Cum Laude; 3.500 to 3.899 for Magna Cum Laude; 3.900 to 4.000 for 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 with two weeks after the filling of the request. However, when a request is made at the beginning or the end of the 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 student and are never given to the student or any other individual. Students may also obtain an official copy of the transcript of credits marked as Student Copy. Any alleged errors in the transcript should be reported to the Registrar within ten (10) days of receiving it. A transcript and certification fees are charged for each transcript. All services are denied to debtor students.

DIPLOMAS

Diplomas must be claimed by graduates at the Registrar's Office no early than three (3) months following the graduation ceremony.

CHANGE OF ADDRESS

A student may submit a change of address at any time at the Registrar's Office. If a change of 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 in the records shall be deemed enough notice in case of any claim.

PROGRAMS OF STUDY

SCHOOL OF ARTS, SCIENCES AND EDUCATION

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

- Mathematics and Sciences Department
- Socio-Humanistic Studies Department
- Education Department
- Tutoring Services
- Student Support Services - Regular
- Student Support Services - STEM
- Student Support Services - ESL

The School provides all PUPR's 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 is dedicated to the development of core learning experiences that serve as the basis for advanced education and training in engineering, architecture, business administration, surveying 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, surveying, 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, surveying, and education.
- Offer courses in the fields of humanities and the social sciences to complement the study of 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, geomatics sciences, surveying, and education with a profound sense of social responsibility.

- Provide a coordinated strategy for students' retention that integrates the resources of faculty, academic support personnel, retention staff, and 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.

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 each academic program.

Developmental Program

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
SCIE 1110	General Biology	4
SCIE 1111	General Biology Laboratory	0
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

Students are enrolled in the corresponding developmental courses based on their College Entrance Examination Board test results and/or the placement tests. Each academic program determines the developmental courses required. The US Department of Education only pays federal aid for up to 30 credits of developmental courses to each student.

MATHEMATICS AND SCIENCE DEPARTMENT

Introduction

The Department continually reassesses its standards, encouraging excellence in instruction, academic performance, and service to the surveying, business administration, architecture, and engineering, and education programs. A strong foundation in mathematics and sciences is essential for the study of computer 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 the 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 to the study of surveying, business administration, architecture, and engineering, and education. Mathematics courses provide students the language to express properly based on logical reasoning and reflective thought and promote the use of tools and techniques to solving problems. Science courses, through the promotion of scientific-based knowledge, allow the employment of fundamental principles and the use of elements of the scientific method to explain physical or natural phenomena or behavior.

Department Academic Objectives

The Department of Mathematics and Science will empower 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 methods, technological tools and fundamental principles of science required by the program chosen.
3. Communicate effectively with others orally and in writing, 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 mathematics and science in a global, economic, environmental, and societal context.
6. Recognize the elements of the Scientific methods necessary to develop scientific research.

Department Expected Outcomes

The Department of Mathematics and Sciences is committed to demonstrating that students served will be able to:

1. Apply knowledge of mathematics and science.
2. Conduct research or experiments, as well as to analyze data and draw conclusions.
3. Work as part of a team.
4. Identify, formulate, and solve problems.
5. Communicate effectively in scientific and mathematical terms.
6. Recognize the 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 through 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
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

Course 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	1350	Calculus I	4
MATH	1352	Calculus I-A	2
MATH	1354	Calculus I-B	2
MATH	1355	Probability and Statistics I	3
MATH	1356	Probability and Statistics II	3
MATH	1357	Math Statistics and Probability	3
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
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	1120	Botany	3
SCIE	1130	Biology I	4
SCIE	1131	Biology I Laboratory	0
SCIE	1140	Biology II	4
SCIE	1141	Biology II Laboratory	0
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	1230	Organic Chemistry	4
SCIE	1231	Organic Chemistry Laboratory	0
SCIE	1240	Organic Chemistry II	4
SCIE	1241	Organic Chemistry II Laboratory	0

Course Offerings - Mathematics and Science

Course		Title	Credit-Hours
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	1440	Physics II	4
SCIE	1441	Physics II Laboratory	1
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	2110	Environmental Microbiology	4
SCIE	2111	Environmental Microbiology Laboratory	0
SCIE	2204	Analytical Chemistry	4
SCIE	2205	Analytical Chemistry Laboratory	0
SCIE	2240	Environmental Chemistry	3
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	2270	Inorganic Chemistry	4
SCIE	2271	Inorganic Chemistry Laboratory	0
SCIE	2281	Seminar in Chemistry	2
SCIE	2410	General Physics I	3
SCIE	2420	General Physics II	3
SCIE	2460	Electromagnetic Oscillations and Topics of Modern Physics	3
SCIE	2461	Modern Physics Laboratory	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 - MATHEMATICS AND SCIENCE DEPARTMENT

MATH 0102 – PREPARATORY MATHEMATICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: 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.

MATH 0106 – ELEMENTARY ALGEBRA
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 0102 or equivalent; placement by Admissions Office or 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.

MATH 0110 – ALGEBRA
Three credit-hours. Two two-hour lecture periods per week. Pre-requisites: MATH 0106 or equivalent; Placement by Admissions Office or 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.

MATH 1310 – APPLIED MATHEMATICS FOR BUSINESS I
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 0110 or equivalent; Placement by Admissions Office.

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 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: MATH 1310 or equivalent; Placement by Admissions Office.

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. Prerequisites: MATH 0110 or equivalent; Placement by Admissions Office or at least 80% in the departmental placement test.

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.

MATH 1340 – PRECALCULUS II
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 1330 or equivalent; Placement by Admissions Office or at least 80% in the departmental placement test.

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.

MATH 1350 – CALCULUS I
Four credit-hours. Two two and a half-hour lecture periods per week. Prerequisites: MATH 1340 or equivalent; Placement by Admissions Office or at least 80% in the departmental placement test.

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; differentiation and integration; area between curves, volumes of solids of revolutions; arc length, surfaces of revolution; moments, centers of mass and centroids.

MATH 1352 – CALCULUS I-A
Two credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1340 or equivalent; Placement by Admissions Office or at least 80% in the departmental placement test.

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 or equivalent; Placement by Admissions Office or at least 80% in the departmental placement test.

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 1360 – CALCULUS II
Four credit-hours. Two two and half-hour lecture periods per week. Prerequisite: MATH 1350 or equivalent; Placement by Admissions Office.

This course will acquaint the student with the concepts of: Integration techniques, indeterminate forms and L 'Hospital'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 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, Stoker's, Green's and Gauss's Theorems.

MATH 1371 – SEMINAR IN APPLIED MATH
One credit-hours. One one and half hour lecture period per week. Prerequisite: MATH 1370.

Topics are limited to those which are not part of the 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.

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 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 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 2350.

This course emphasizes 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 valve problems.

MATH 6310 – ADVANCED ENGINEERING MATHEMATICS I
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 2350.

This 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. Prerequisite: 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: Math 0110 or equivalent; Placement by Admissions Office or at least 80% in the departmental placement test.

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. Prerequisite: None. Corequisite: 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 confronts 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. One three-hour laboratory periods per week. Prerequisites: None. Corequisite: 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. Prerequisites: 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 1130 – BIOLOGY I
Four credit-hours. Four hours of lecture per week. Prerequisites: None. Corequisite: SCIE 1131.

This course introduces the students to the basis of life and diversity. It studies the fundamental principles of cell theory, diversity, biological molecules, metabolism, genetics, biotechnology and evolution. It provides and approach to genetic manipulation and discusses the medical applications of control and manipulation of gene expression.

SCIE 1131 – BIOLOGY I LABORATORY
Zero credit-hours. One three-hour laboratory period per week. Prerequisite: None. Corequisite: SCIE 1130.

This course helps the student to become familiar with the use of basic biology laboratory tools while getting a practical experience in the study of the structure and chemical fundamentals of the cell. It emphasizes the use and handling of laboratory equipment according to the new Global Harmonized System (GHS), and introduces the study of the structure of DNA as the basis of biotechnology, medicine and related fields.

SCIE 1140 – BIOLOGY II
Four credit-hours. Four hours of lecture period per week. Prerequisites: SCIE 1130, SCIE 1131. Corequisite: SCIE 1141.

This course introduces the students to the fundamental principles of diversity of life; it covers the study of viruses, bacteria, fungi, plants, and animals with emphasis on human anatomy and its systems. It incorporates elements associated with microbiology and environmental health within the ecology of communities and dynamics of ecosystems in the biosphere.

SCIE 1141 – BIOLOGY II LABORATORY
Zero credit-hours. One three-hour laboratory period per week. Prerequisites: SCIE 1130, SCIE 1131. Corequisite: 1140.

This course helps the students to become familiar with the use of basic laboratory tools while getting practical experience in the study of the structure and morphology of viruses, bacteria, fungi, plants, and animals with emphasis on human being and its systems. It incorporates elements associated with the environmental health within the ecology of communities and dynamics of ecosystems.

SCIE 1210 – PRINCIPLES OF CHEMISTRY
Four credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1330. Corequisite: SCIE 1211.

Introduction to the fundamental principles of chemistry with an emphasis in the principles of matter and its properties, atomic structures, molecular structure, chemical bonding, Stoichiometry, Laws of Gases, chemical reactions, chemical composition of compounds, solutions, gases, acids, and bases.

SCIE 1211 – PRINCIPLES OF CHEMISTRY – LABORATORY
Zero credit-hour. One four-hour laboratory period per week. Prerequisite: MATH 1330, Corequisite: 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. Prerequisite: MATH 1330. Corequisite: SCIE 1215.

This course emphasizes in the Principles of matter and its properties, atomic structures, molecular structures, chemical bonding, Stoichiometry, Laws of Gases, chemical reactions, chemical composition of compounds, solutions, acids and bases, gases, and thermochemistry.

SCIE 1215 – GENERAL CHEMISTRY I LABORATORY
Zero credit-hour. One four-hour laboratory period per week. Prerequisite: MATH 1330. Corequisite: SCIE 1214.

This laboratory course complements the concepts being studied in class. It includes hands-on experience such as safety, 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 1340. Corequisite: SCIE 1221.

This course emphasizes the following topics: intermolecular forces, solution, kinetics, equilibrium, oxidation and reduction reactions, acids and bases; electrochemistry, thermodynamics, and organic principles.

SCIE 1221 – GENERAL CHEMISTRY II – LABORATORY
Zero credit-hour. One four-hour laboratory period per week. Prerequisites: SCIE 1214, SCIE 1215, MATH 1340. Corequisite: SCIE 1220.

This laboratory course complements the concepts being studied in class. It includes hands=on experience in chemical equilibrium and equilibrium constant, solutions, Aspirin synthesis, colligative properties, acids and bases, and titrations.

SCIE 1230 – ORGANIC CHEMISTRY
Four credit-hours. Four hours of lecture per week. Prerequisites: SCIE 1220, SCIE 1221, MATH 1350. Corequisites: SCIE 1231, MATH 1360.

This course emphasizes the study of functional groups and their reactions, conformation, structure, properties, nomenclature, reaction mechanism and synthesis.

SCIE 1231 – ORGANIC CHEMISTRY LABORATORY
Zero credit-hours. One four-hour laboratory period per week. Prerequisites: SCIE 1220, SCIE 1221, MATH 1350. Corequisites: SCIE 1230, MATH 1360.

This laboratory course complements the concepts being studied in class. It includes hands-on experience in molecular structure, synthesis, separation and purification techniques and analysis for product characterization.

SCIE 1240 – ORGANIC CHEMISTRY II
Four credit-hours. Four hours of lecture per week. Prerequisites: SCIE 1230, SCIE 1231. Corequisite: SCIE 1241.

This course emphasizes the study of the conformation, structure, properties, nomenclature, reactions, and method of synthesis of different families of organic compounds. It also covers the study of various instrumental techniques for identification of organic compounds.

SCIE 1241 – ORGANIC CHEMISTRY II LABORATORY
Zero credit-hours. One four-hour session of practice per week. Prerequisites: SCIE 1230, SCIE 1231. Corequisite: SCIE 1240.

This laboratory focuses on the techniques, skills, philosophy involved in organic synthesis and the analysis of organic compound groups.

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, concept and principles of fluid mechanics, oscillations, and waves. Includes kinematic in one, two and three dimensions, Newton's Laws, work and energy, rotation, gravity, static equilibrium of a rigid body, and conservation of momentum. Concepts and principles of fluid mechanics such as density, specific gravity, pressure, Pascal's principles, Archimedes' principles, Continuity Equation and Bernoulli's Equation.
Concepts and principles of simple harmonic oscillation, damped oscillation, forced oscillation, mechanical waves, stationary waves, sound waves, and Doppler's effect.

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. Prerequisites: SCIE 1440, SCIE 1441.

This course explores the elements of implementing a student research program in the secondary school. This 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 1440 – PHYSICS II
Four credit-hours. Two two and a half-hour lecture periods per week. Prerequisites: SCIE 1430, SCIE 1431, MATH 1360. Corequisite: SCIE 1441.

A calculus-based course emphasizing the principles and applications of electricity and magnetism such as electric fields, electric potential, capacitance, dielectrics and electrostatic energy, electric current, direct current circuits, magnetic field Gauss 'Law and sources, and magnetic induction Maxwell's Equations and Electromagnetic Waves. Include also principles and applications of general thermodynamics such as heat, temperature, Zero Law of Thermodynamics, thermal equilibrium, First Law of Thermodynamics, Second Law of Thermodynamics, Thermodynamics process, and Carnot's cycle.

SCIE 1441 – PHYSICS II – LABORATORY
One credit-hour. One three-hour laboratory period per week. Prerequisites: SCIE 1430, SCIE 1431, MATH 1360. Corequisite: SCIE 1440.

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

SCIE 1450 – THERMODYNAMICS AND STATISTICAL MECHANICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1440, SCIE 1441.

This is an introductory course in Thermodynamics and the Principle of Statistic Mechanics. It emphasizes 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 – ELECTRODYNAMIC
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1440, SCIE 1441

This course will develop content knowledge about Electromagnetism. It explores principles of electrodynamics dealing mainly with Time-varying fields, Maxwell's equations, Electromagnetic Waves, and Electromagnetic Spectrum. Also, it includes 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. Prerequisites: SCIE 1440, SCIE 1441.

This is an introductory course in Optics. It emphasizes on: Wave theory and applications, interferences 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 discussed in class.

SCIE 1480 – NUCLEAR PHYSICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1440, SCIE 1441.

This is an introductory course in Nuclear Physics. It emphasizes 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. Prerequisites: 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, Solution 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 half hour lecture periods per week. Prerequisites: SCIE 1440, SCIE 1441. Requires permission from the Department 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 2110 – ENVIRONMENTAL MICROBIOLOGY
Four credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1214, SCIE 1215. Corequisite: SCIE 2111.

A 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 three-hour laboratory period per week. Prerequisites: SCIE 1214, SCIE 1215. Corequisite: 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 2204 – ANALYTICAL CHEMISTRY
Four credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1220, SCIE 1221, MATH 1360. Corequisites: SCIE 2205, MATH 1370, ENGI 2270.

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, SCIE 1221, MATH 1360. Corequisites: SCIE 2204, MATH 1370, ENGI 2270.

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

SCIE 2240 – ENVIRONMENTAL CHEMISTRY
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1214, SCIE 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 2250 – PHYSICAL CHEMISTRY I
Four credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1440, SCIE 1441, SCIE 2204, SCIE 2205, MATH 1370. Corequisites: 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. Include calculations of states function as internal energy, enthalpies, entropies, Gibbs energy and use of phase diagrams.

SCIE 2251 – PHYSICAL CHEMISTRY I – LABORATORY
Zero credit-hour. One four-hour laboratory period per week. Prerequisites: SCIE 1440, SCIE 1441, SCIE 2204, SCIE 2205, MATH 1370. Corequisites: MATH 2350, SCIE 2250.

This laboratory course complements the concepts being studied in class. It includes hands-on experience on the principles and concepts of equilibrium thermodynamics. The laboratory work emphasizes on the determination of enthalpies of different chemical processes using mathematical models.

SCIE 2260 – PHYSICAL CHEMISTRY II
Four credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 2250, SCIE 2251. Corequisite: 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, SCIE 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. Prerequisites: 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 - four hours meeting per week. Prerequisites: 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 in the structure of solids, complexes and further analysis and applications of material already discussed in Physical Chemistry (such as electronic spectra).

SCIE 2281 – SEMINAR IN CHEMISTRY
Two credit-hours. One - two and a half hours meeting per week. Prerequisites: SCIE 1220, SCIE 1221. Requires permission from the Department 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 2410 – 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. A course designed for Surveying and Architecture students only.

SCIE 2420 – GENERAL PHYSICS II
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 2410 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: geometrical optics; mirrors and lenses; optical instruments. Laboratory demonstrations are used in class to provide further explanation of topics. For surveying students only.

SCIE 2460 – ELECTROMAGNETIC OSCILLATIONS AND TOPICS OF MODERN PHYSICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1440, SCIE 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 period per week. Prerequisites: SCIE 1440, SCIE 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, 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 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 deal 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, SCIE 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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SOCIOHUMANISTIC STUDIES DEPARTMENT

The course contents of the Socio-Humanistic Studies Department are suitable, rigorous and span a wide variety of contemporary issues to support Engineering, Surveying and Geomatics Science, Architecture, Management, and Education programs.

Through our program, students will be able to attain college-level proficiency in global culture and literature, oral and written communication skills, critical thinking, ethics, and information literacy competencies.

PUPR is the first university in Puerto Rico to integrate the Social Sciences and Humanities in a single course within the Socio-Humanistic Studies Department.

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 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 in both 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 component 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
SOHU 2010	Socio-Humanistic Studies I	3

SOHU 2020	Socio-Humanistic Studies II (For Architecture, and Business Administration Students)	3
SOHU 2040	Ethics, Global, and Contemporary Issues	3

Languages

Course	Title	Credit-Hours
SPAN 1010	Linguistic Analysis of Literary Genres	3
SPAN 2010	Hispanic Literature	3
SPAN 2020	Business Spanish	3
SPAN 2030	Medical Terminology in Spanish (For Pre Medical Students)	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2010	Analysis of World Literature (For Architecture, and Biomedical Engineering Students)	3
ENGL 2020	Business English and Communication	3
ENGL 2030	Medical Terminology (For Biomedical Engineering Students)	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
ECON 3050	Special Topics in Economic 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

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	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 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
LANG	3060	Intermediate German Language	3
LANG	3070	Introduction to Portuguese Language	3
LANG	3090	Introduction to Mandarin Language	3
ENGL	0101	Conversational English for Absolute Beginners	3
ENGL	0102	Conversational English for Beginners	3
ENGL	0103	Intermediate Conversational English	3
ENGL	0104	Advanced Conversational English	3
SPAN	0101	Conversational Spanish for Non Native Speakers	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 María de Hostos	3

Socio-Humanistic Requirements
Level I 18 Credit – hours
Level II 3 Credit – hours
Total 21 Credit – hours

COURSE DESCRIPTIONS

Socio-Humanistic Courses

SOHU 2010 – SOCIO-HUMANISTIC STUDIES I
Three credit – hours. Two 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: the conceptual framework of the humanities and the social sciences, the human organization in society, the human being and his environment, the 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, subcultural 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 to 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 Courses

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 0101 – CONVERSATIONAL SPANISH FOR NON-NATIVE SPEAKERS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE.

This course is designed for students with no previous experience in the Spanish language. The students will learn the basics skills (speaking, writing, reading, listening and comprehension) that allowed them to communicate in the daily routine. This is also an introductory course to both the Spanish language and culture. The class is conducted in Spanish in order to ensure maximum contact with the language.

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 2030 – MEDICAL TERMINOLOGY IN SPANISH
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: SPAN 2020.

An introduction to the basic principles of medical word building and the organization of the human body.

English Courses

ENGL 0100 – PREPARATORY ENGLISH
Three credit-hours. 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 0101 – CONVERSATIONAL ENGLISH FOR ABSOLUTE BEGINNERS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE.

Conversational English for Absolute and False Beginners is designed for students who have had little or no contact with the English languages and want to learn it for academic, social and/or professional reasons. This course will develop students' oral fluency, confidence and vocabulary through listening, speaking, reading and writing activities.

ENGL 0102 – CONVERSATIONAL ENGLISH FOR BEGINNERS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGL 0101.

Conversational English for Beginners is designed for students who want to learn English for academic, social and/or professional reasons. This course will develop students' oral fluency, confidence and vocabulary through listening, speaking, reading and writing activities. True and false cognates will be introduced.

ENGL 0103 – INTERMEDIATE CONVERSATIONAL ENGLISH
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGL 0102.

The course is designed for students who want to improve their English for academic, social and/or professional reasons. It focuses on students' oral and listening skills, pronunciation and accent reduction. This course will develop students' oral fluency, confidence, vocabulary and grammar through listening, speaking, reading, and writing activities. Idiomatic expressions and false cognates are introduced. Students are required to give oral presentations.

ENGL 0104 – ADVANCE CONVERSATIONAL ENGLISH
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGL 0103.

Advanced Conversational English is designed for professionals who want to enrich their English for academic, social and/or professional reasons. It focuses on students' oral and listening skills, pronunciation and accent reduction. This course will develop students' oral fluency, confidence, vocabulary and grammar through listening, speaking, reading, and writing activities. Oral presentations are required.

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 on increasing student's capability of developing logical thinking both in speaking and writing.

ENGL 1010 – THE STUDY OF THE ESSAY
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: ENGL 1010.

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.

ENGL 2030 – MEDICAL TERMINOLOGY
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ENGL 2020.

An introduction to the basic principles of medical word building and the organization of the human body.

ENGL 3010 – CONVERSATIONAL ENGLISH
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: None

This is a course in conversational English. It focuses on improving the learner's oral communication and listening skills in English.

Economics Courses

ECON 3010 – MICROECONOMICS
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 microeconomics.

ECON 3020 – MACROECONOMICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ECON 3010.

Study of monetary indicators of economic 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 Courses

POSC 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.

A 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 Courses

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 workplace.

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 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 periods per week. Prerequisite: None.

Intensive analysis of special topics related to psychology.

Philosophy Courses

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 MARÍA DE HOSTOS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: None.

Analysis of the main work of Puerto Rican philosopher Eugenio María de Hostos, based on selected topics: the 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.

PHIL 3050 – 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-hour lecture periods per week. Prerequisite: None.

Basic foundations of astrophysics and the creation of the physical universe.

PHIL 3060 – 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 Courses

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.

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 19^{th} and 20^{th} 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 periods 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 Courses

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 Courses

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 languages 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.

LANG 3070 – INTRODUCTION TO PORTUGUESE LANGUAGE
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: None.

Comprehensive study of the Portuguese languages 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 3090 - INTRODUCTION TO MANDARIN LANGUAGE
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: NONE.

The course will introduce students to the basics of Mandarin. In this course, students will learn pronunciation (pinyin), reading and writing Chinese simplified characters, vocabulary and how to hold conversations. In addition to language skills, students will also learn about Chinese culture.

DEPARTMENTAL FACULTY

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ORTIZ NEVAREZ, BRENDA – Lecture IV; Spanish; PhD, Funiber, 2018; PhD, Universidad de Alcalá, Alcalá de Henares, España, 2016; MA, Universidad de Alcalá de Henares, España, 2013; BA, Management School, Universidad Católica de Bayamón, PR, 2008. E-mail: blopez@pupr.edu

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SCHOOL OF ARCHITECTURE

ARCHITECTURE PROGRAM

The School of Architecture, ARQPOLI, provides students 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 graphic, written and oral communication skills. The field of architecture requires the command of programmatic and pragmatic aspects related to practice through the following components: design studio, theory/history, practice, structures, technology, and architectural representation.

The curriculum integrates concepts related to Architectural Conservation, Sustainability, Community Outreach, Urban Planning, Interior Design, and Landscape Architecture. Our program prepares students to face situations of considerable complexity, comprehensiveness and social responsibility, at the same time allowing for particular interests to mature in individually chosen fields. Upon completion of the minimum graduation requirements, ARQPOLI provides a broad social, cultural and technical foundation.

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 and 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 (PEG)

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 a driven force for innovation myth, discourse, resource and possibility, given the Caribbean/realm 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 (PEO)

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 shall meet the Student Performance Criteria (SPC) required by the National Architectural Accrediting Board, Inc. (NAAB):

Realm A: Critical Thinking and Representation:

- A.1 Communication Skills: Ability to read, write, speak and listen effectively.
- A.2 Design Thinking Skills: 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.
- A.3 Visual Communication Skills: 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.
- A.4 Technical Documentation: 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.
- A.5 Investigative Skills: Ability to gather, assess, record, apply, and comparatively evaluate relevant information within architectural coursework and design processes.
- A.6 Fundamental Design Skills: Ability to effectively use basic architectural and environmental principles in design.
- A.7 Use of Precedents: 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.
- A.8 Ordering Systems Skills: Understanding of the fundamentals of both natural and formal ordering systems and the capacity of each to inform two-and-three-dimensional design.
- A.9 Historical Traditions and Global Culture: 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.
- A.10 Cultural Diversity: 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.
- A.11 Applied Research: Understanding the role of applied research in determining function, form, and systems and their impact on human conditions and behavior.

Realm B: Integrated Building Practices, Technical Skills and Knowledge:

- B.1 Pre-Design: 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.
- B.2 Accessibility: Ability to design sites, facilities, and systems to provide independent and integrated use by individuals with physical (including mobility), sensory, and cognitive disabilities.
- B.3 Sustainability: 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 of future generations through means such as carbon-neutral design, and bioclimatic design, and energy efficiency.
- B.4 Site Design: Ability to respond to site characteristics such as soil, topography, vegetation, and watershed in the development of a project design.
- B.5 Life Safety: Ability to apply the basic principles of live-safety systems with an emphasis on egress.
- B.6 Comprehensive Design: Ability to produce a comprehensive architectural project that demonstrates each student's each 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

B.7 Financial Considerations: 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.

B.8 Environmental Systems: 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.

B.9 Structural Systems: 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.

B.10 Building Envelope Systems: 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.

B.11 Building Service Systems: Understanding of the basic principles and appropriate application and performance of building service systems such as a plumbing, electrical, vertical transportation, security, and fire protection systems.

B.12 Building Materials and Assemblies: 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

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

C.2 Human Behavior: Understand of the relationship between human behavior, the natural environment and the design of the built environment.

C.3 Client Role in Architecture: 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.

C.4 Project Management: Understanding of the methods for competing for commissions, selecting consultants and assembling teams and recommending project delivery methods.

C.5 Practice Management: 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.

C.6 Leadership: 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.

C.7 Legal Responsibilities: 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.

C.8 Ethics and Professional Judgment: Understanding of the ethical issues involved in the formation of professional judgment regarding social, political and cultural issues in architectural design practice.

C.9 Community and Social Responsibility: 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, Inc.*

(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 8-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)
Polytechnic University School of Architecture/ARQpoli was granted an 8-year term in 2015.
Next accreditation visit: 2023

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, Materials and Digital Fabrication Laboratory, Ceramics Laboratory and Photograph Laboratory for student and faculty use. An Architectural Conservation Laboratory provides mechanisms to explore related subjects with a primary focus on the Caribbean Region. In addition, the School benefits from the availability of additional laboratories in the Engineering Departments on campus: Environmental Engineering Laboratory, Soils Mechanics Laboratory, Construction Materials Laboratory, GIS and Cartography Laboratory and Plasma Engineering Laboratory among others. These strengthen the Technology and Structures components A Digital Media Archive serves primarily as the School's digital memory and database for research. Students have opportunities to participate on workshops on Sustainable Explorations, Community Outreach, and Housing, Urbanism and Planning.

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 Board Examination, Advanced Placement Tests, SAT, and 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

Three student organizations of national and international reach are in operation:

1. American Institute of Architecture Students (AIAS)
2. Coordinadora Latinoamericana de Estudiantes de Arquitectura (CLEA)
3. Organización Internacional Línea Puerto Rico

Students may participate in one or more student organizations. All of them provide opportunities to participate in events, symposia, seminars, and field trips in and outside Puerto Rico.

SCHOOL OF ARCHITECTURE CURRICULUM

(213 Credit-Hours)

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 3510	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)

ARCC-Architectural Representation

(6 Credit-Hours)

Course	Title	Credit-Hours
ARCC 1010	Architectural Representation I	3
ARCC 2010	Architectural Representation II	3

ARCH-Design

(60 Credit-Hours)

Course	Title	Credit-Hours
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	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

(3 Credit-Hours)

Course	Title	Credit-Hours
ARCT 1010	Introduction to Architectural Theory	3
ARCT 1011	Architectural Theory Recitation	0

ARHH-History

(9 Credit-Hours)

Course	Title	Credit-Hours
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 Architectural Contemporary Scene	3

ARPP-Practice

(12 Credit-Hours)

Course	Title	Credit-Hours
ARPP 3010	Practice / Experience	3
ARPP 5010	Ethics	3
ARPP 5020	Construction Documents	3
ARPP 5030	Office Management & Finances	3

ARST-Structures

(12 Credit-Hours)

Course	Title	Credit-Hours
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

(15 Credit-Hours)

Course	Title	Credit-Hours
ARTE 1010	Introduction to Technology	3
ARTE 2010	Materials & Methods	3
ARTE 3010	Site Planning	3
ARTE 4010	Electricity, Acoustics & Telecommunications	3
ARTE 4020	Environmental & Mechanical Systems	3

Electives 0400-L

(9 Credit-Hours)

Course	Title	Credit-Hours
ARCC	Advanced Topics in Architectural Representation	3
ARHH/ ARCT	Advanced Topics in History or Theory	3
ARTE / ARST	Advanced Topics in Technology or Structures	3

Architectural Program Electives
(24 Credit-Hours)

Course	Title	Credit-Hours
ARCC 0100	Spatial Visualization	3
ARCC 0120	Cyberpublications	3
ARCC 0130	Photoshop & Digital Imaging	3
ARCC 0140	Collage Making + Design Studio	3
ARCC 0150	Drawing	3
ARCC 0160	Anthropomorphic Awareness	3
ARCC 0170	Perspective	3
ARCC 0180	3D Exploration	3
ARCC 0190	Architecture and Social Media	3
ARCC 0191	Visual Communication in Architecture	3
ARCC 0210	Photography Fundamentals	3
ARCC 0211	Photography Laboratory	3
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 0401	Color & Rendering	3
ARCC 0403	Computer Aided Design II	3
ARCC 0403A	Computer Aided Design II-Revit	3
ARCC 0404	3D Studio	3
ARCC 0410	Digital Fabrication	3
ARCC 0420	Parametric Modeling & Digital Fabrication	3

Electives in Design

Course	Title	Credit-Hours
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

Course	Title	Credit-Hours
ARHH 0400E	Introduction to Urban Planning	3
ARHH 0400F	Structure and Form of Urban Settlements	3
ARHH 0400G	Sustainable Urban Mobility Planning and Management	3
ARHH 0400H	Land Use Regulation and its Impact on the City	3
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

Course	Title	Credit-Hours
ARPP 0310	The Architect as Entrepreneur	3
ARPP 0320	Ecology and Tourism	3
ARPP 1010	Introduction to Architecture	3

Electives in Technology

Course	Title	Credit-Hours
ARTE 0302	Architecture and Industry	3
ARTE 0403	Sustainable Technologies in Landscape Architecture	3
ARTE 0430	Ecological Terraces	3
ARTE 0400A	Construction Details	3
ARTE 0400B	Architecture & Interior Design	3
ARTE 0410	Preservation Technology	3
ARTE 0401	Wood Technology	3
ARTE 0440	Architectural & Light	3
ARTE 0451	Architectural Conservation Laboratory	3

Electives in Technology

Course	Title	Credit-Hours
ARCT 0110	Visual Culture	3
ARCT 0430	Preservation Theory	3
ARCT 0440	Advanced Topics on Theory	3

Electives in Landscape Architecture

Course	Title	Credit-Hours
ARCL 0100	City & Environment	3
ARCL 0315	Geography	3
ARCL 0391	Landscape Architecture	3

Architecture-Related
In Socio-Humanistic Studies and Languages

Course	Title	Credit-Hours
LITE 3040	Writing About Architecture	3
SOHU 3030	Archeology for Architects	3
ARHH 2010	History of Puerto Rico in the Caribbean Context	3
HIST 3510	Historiography	3

ARCHITECTURE CURRICULUM SEQUENCE

(213 Credit-Hours)

First Year

First Quarter

Course	Title	Credit-Hours
	Developmental Program Pre-requisites	6
ARCH 1010	Basic Design I	4
ARHH 1010	History of Architecture	3
ARHH 1011	History of Architecture Laboratory	0
ATUL 0100	Adjustment to University Life	3
MATH 0106	Elementary Algebra	3
		Total 19

1st Year - 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 or	Preparatory English	3
SPAN 0100	Preparatory Spanish	3

MATH 0110	Intermediate Algebra	3
		Total 16

1st year - Third Quarter

Course	Title	Credit-Hours
ARCH 1030	Basic Design III	4
ARCT 1010	Introduction to Architectural Theory	3
ARCT 1011	Architectural Theory Recitation	0
ENGL 0110	English Grammar	3
SPAN 0110	Spanish Grammar	3
		Total 13

Second Year

First Quarter

Course	Title	Credit-Hours
ARCH 2010	Design Fundamentals I	4
HIST 2010	History of Puerto Rico in the Caribbean Context	3
SCIE 0110	Introduction to Physics	3
MATH 1330	Precalculus I	3
		Total 13

2nd Year- 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
		Total 13

2nd Year - Third Quarter

Course	Title	Credit-Hours
ARCH 2030	Design Fundamentals III	4
ARCC 2010	Architectural Representation II	3
ARHH 2010	History of Modern Architecture	3
ARHH 2011	History of Modern Architecture Laboratory	0
SCIE 2410	General Physics I	3
		Total 13

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	3
		Total 13

3rd Year - Second Quarter

Course	Title	Credit-Hours
ARCH 3020	Intermediate Design II	4
ARST 3010	Structural Concepts I	3
ARHH 3010	Neo Avant-Garde and the Architectural Contemporary Scene	3
SPAN 1010	Linguistic Analysis of Literary Forms	3
		Total 13

3rd Year - Third Quarter

Course	Title	Credit-Hours
ARCH 3030	Mid-Career Research	4
ARST 3020	Structural Concepts II	3
ARTE 3010	Site Planning	3
SPAN 2010	Hispanic Literature	3
	Open Elective	3
		Total 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
		Total 13

4th Year - 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 of History 0400 Level	3
		Total 13

4th Year - Third Quarter

Course	Title	Credit-Hours
ARCH 4030	Advanced Design III	4
ENGL 2010	Analysis of World Literature	3
HIST 3510	Historiography	3
	Open Elective	3
	Elective Representation of History 0400 Level	3
		Total 16

Fifth Year

First Quarter

Course	Title	Credit-Hours
ARCH 5010	Capstone Design I	4
ARPP 5010	Ethics	3
	Elective Technology or Structure 0400L	3
	Open Elective	3
		Total 13

5th Year - Second Quarter

Course	Title	Credit-Hours
ARCH 5020	Capstone Design II	4
ARPP 5020	Construction Documents	3
	Open Elective	3
	Open Elective	3
		Total 13

5th Year - Third Quarter

Course	Title	Credit-Hours
ARCH 5030	Capstone Design III	4
ARPP 5030	Office Management & Finances	3
	Open Elective	3
	Open Elective	3
		Total 13

COURSE DESCRIPTIONS

Architecture Courses

ARCC 0100 – SPATIAL VISUALIZATION
Three credit-hours. Two two-hour lecture/studio periods per week. Laboratory Fee. Prerequisite: 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 relationship are include as part of the course.

ARCC 0120 – CYBERPUBLICATIONS
Three credit-hours. Two two-hour lecture/studio periods per week. Laboratory Fee. Prerequisite: None

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

ARCC 0130 – PHOTOSHOP & DIGITAL IMAGING
Three credit-hours. Two two-hour lecture/studio periods per week. Laboratory Fee. 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. Prerequisites: 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 influence 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. Prerequisites: 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 0191 – VISUAL COMMUNICATION IN ARCHITECTURE
Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisite: None

In this introductory course, the student learns the basic knowledge of graphic communication and how it can be integrated to architecture. The course teaches how design and communication serve to inform, guide, stimulate and inspire when it's well combined with developed surroundings, thus resulting in a dynamic relationship between the space and the people. The course also promotes participation, the analysis and exchange of ideas, and the development of a creative and multidisciplinary student.

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 lecture/studio periods per week. Prerequisite: None. Corequisite: ARCC 0211
Introduction to black and 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 ins 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 periods 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 periods 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 – COMPUTER AIDED DESIGN II
Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisites: ARCC 2010, ARCH 2010

Introduction to the concepts for the creation of 3D Architectural Models Database and the extraction of bi-dimensional drawing. The course main focus in on 3D model development, drawing linking and basic rendering techniques using building information modeling (BIM) software.

ARCCC 0403A- COMPUTER AIDED DESIGN II – REVIT
Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisites: ARCC 2010, ARCH 2010

Introduction to the concepts for the creation of 3D Architectural Models Database and the extraction of bi-dimensional drawing. The course main focus in on 3D model development, drawing linking and basic rendering techniques using Building Information Modeling (BIM) software. This course uses Revit's various modeling environments.

ARCC 0404 – 3D STUDIO
Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisites: ARCC 0130, ARCH 2010

Introduction to the concepts of 2D and 3D rendering and animation. The course main focus in on 3D rendering techniques, 3D animation concepts, advanced 2D drawing rendering, 2D animation using the digital tools currently available.

ARCC 0410 – DIGITAL FABRICATION
Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisite: ARCC 2010

This course introduces students to tools, techniques, concepts and design solutions through the non-Euclidean Geometry, digital modeling. The course emphasizes on architectural precedents as a framework for drawing possibilities for the comprehension of non-Euclidian tectonic models. The student engages digital three-dimensional modeling by the analysis of case studies visualizations, architectural components, assembly, structure and virtual simulation.

ARCC 0420 – PARAMETRIC MODELING AND DIGITAL FABRICATION
Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisite: ARCC 0410

This course will provide students the opportunity to enrich their explorations in three-dimensional design with parametric modeling at the same time develop their education in digital technologies in relation to materials properties.

ARCC 1010 – ARCHITECTURAL REPRESENTATION I
Three credit-hours. Two two-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCH 1010, ARHH 1010/1011

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 – ARCHITECTURAL REPRESENTATION II
Three credit-hours. Two two-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCC 1010, ARCH 1020

Introduction to the basic concepts, software and drawing techniques for digital drafting. The course main focus in on bi-dimensional drawings, its representation and basic 3D modeling using the digital tools currently available.

ARCH 0100 – DESIGN ABROAD
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: 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 lecture/studio periods per week. Design 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 lecture/studio periods per week. Design Fee. Prerequisites: 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 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 laboratory period per week. Prerequisites: By approval

The course offers the opportunity to formulate and investigate projects of personal interest, our 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 lecture/studio periods per week. Design Fee. Prerequisites: 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 lecture/studio periods per week. Design Fee. Prerequisites: 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 lecture/studio periods per week. Design Fee. Prerequisites: MATH 0102, and one of two language courses, SPAN 0100 or ENGL 0100; Corequisites: ARHH 1010/1011

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 lecture/studio periods per week. Design Fee. Prerequisites: ARCH 1010; 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 lecture/studio periods per week. Design 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 lecture/studio periods per week. Design Fee. Prerequisites: ARCH 1030, ARCT 1010/1011, ARTE 1010, ATUL 0100

Plan, section and elevation are jointly manipulated to expound architecture's three-dimensional possibilities. Circulation and spatial sequence, structures, enclosure and tectonics are simultaneously considered in the genesis of form.

ARCH 2020 – DESIGN FUNDAMENTALS II
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: 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 lecture/studio periods per week. Design 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 lecture/studio periods per week. Design Fee. Prerequisites: ARCH 2030, ARHH 2010/2011

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 lecture/studio periods per week. Design Fee. Prerequisites: 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 – MID-CAREER RESEARCH
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: ARCH 3020, ARPP 3010, ARHH 3010, SOHU 2010

A project investigation of limited focus in 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 lecture/studio periods per week. Design Fee. Prerequisites: 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 lecture/studio periods per week. Design 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 lecture/studio periods per week. Design Fee. Prerequisites: 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 lecture/studio periods per week. Design Fee. Prerequisites: ARCH 4030, HIST 3012, HISTORY OR THEORY ELECTIVE (0400L); 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 lecture/studio periods per week. Design Fee. Prerequisites: 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 lecture/studio periods per week. Design Fee. Prerequisite: ARCH 5020

The course culminates the Capstone Design sequence with attention to the technical resolution of the project and its attention to the technical resolution of the project and its representation. 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

This 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. Prerequisite: 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 refection, 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. Prerequisites: 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. Prerequisites: 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 and understanding of the different ideologies interweaving with Architecture.

ARCT 1010 – INTRODUCTION TO ARCHITECTURAL THEORY
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: 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 RECITATION
Zero credit-hours. One one-hour lecture periods per week. Prerequisites: ARCC 1010, 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 0400E – INTRODUCTION TO URBAN PLANNING
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARHH 2010/2011

This course will examine the role of urban and economic planning as tools of physical-spatial changes that cities have taken to serve as a first experience for future architects into the decision-making processes in physical, economic and environmental. The need to integrate planning processes for different profession, reflects the rapid changes that are happening in our development as a global society.

ARHH 0400F – STRUCTURE AND FORM OF URBAN SETTLEMENTS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARHH 2010/2011, ARHH 0400E

Is a Studio/field project of a comprehensive nature. Utilizing a local study area, students apply professional planning to examine the realities of problem solving in situations of functional and normative conflict.

ARHH 0400G – SUSTAINABLE URBAN MOBILITY: PLANNING AND MANAGEMENT
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARHH 2010/2011, ARHH 0400E

Is an introductory course to the transportation planning in the metropolitan area. This course is aimed at students in the field of architecture an engineering interested in mobility, traffic, environmental management, urban and regional planning.

ARHH 0400H – LAND USE REGULATION AND ITS IMPACT ON THE CITY
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARHH 0400E

This course will focus on the impact land use codes have on city form and the territory. Codes regulate, condition and promote a myriad of activities in the city and it's hinterland having a direct or indirect impact on development, conservation, land values and landscape. It is therefore a political issue, or at least, it has the potential of having political impact.

ARHH 0410 – SELECTED TOPICS ON MODERN ARCHITECTURE
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: 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 periods per week. Prerequisites: 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 ARCHITECTURAL SPACE LABORATORY
Zero credit-hours. One one-hour lecture periods per week. Prerequisites: MATH 0102 and one of two language courses, SPAN 0100 or ENGL 0100. Corequisite: ARHH 1010

Small-group discussion sessions allow students to expand and debate upon the subjects addressed at lectures in co-required course. Written submittals and oral presentations are individually commented in these meetings.

ARHH 2010 – HISTORY OF MODERN ARCHITECTURE
Three credit-hours. Two two-hour lecture periods per week. Prerequisites ARHH 1010, ARHH 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-lineal history.

ARHH 2011 – HISTORY OF MODERN ARCHITECTURE LABORATORY
Zero credit-hours. One one-hour lecture periods per week. Prerequisites: ARHH 1010/1011. Corequisite: 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.

ARHH 3010 – NEO AVANT-GARDE AND THE ARCHITECTURAL CONTEMPORARY SCENE
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARHH 2010/2011.

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 and unusual cultural role.

ARPP 0310 – THE ARCHITECT AS ENTREPRENEUR
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: None

Pursuing and 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. Two two-hour lecture periods 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. Two two-hour lecture periods per week. 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 & 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 SOPICS ON STRUCTURES
Three credit-hours. Two two-hour lecture periods 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 periods per week. Prerequisite: 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 0400B – ARCHITECTURE & INTERIOR DESIGN
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: None

This course is an introduction to the profession of interior architecture and its importance within the construction 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 architecture, 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 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 periods per week. 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 periods per week. Prerequisites: 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.

ARTE 0440 – ARCHITECTURE & LIGHT
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARCH 3030, 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 0451 – ARCHITECTURAL CONSERVATION LABORATORY
Three credit-hours. Two two-hour lecture periods per week. 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. Prerequisites: 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 system.

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 manmade world impacting the natural realm as, it pertains, specifically, to site infrastructure

ARTE 4010 – ELECTRICITY, ACOUSTICS & 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. Prerequisites: 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

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INTERIOR DESIGN PROGRAM

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 to 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 interior designers possible.

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, sustainable and adaptive reuse of buildings design through the creation of professional working teams that collaborate to meet health, safety, societal and industrial standards in general.

Program Expected Goals

1. To contribute to the social, cultural and economic development of Puerto Rico through the formation of socially and professionally responsible Interior Designers.
2. To foster cultural and professional exchange of ideas within countries with similar traditions regardless of its geographic locations.
3. To achieve long-term interest in continuous learning, exchange of ideas and research.

4. To promote communication and working relation with related professionals and industry partners, government, commerce and professional associations.
5. To develop critical thinking and a scientific approach in the analysis of Interior Design projects and life's queries.
6. To nurture the development and perfecting bilingual language reading and writing skills.
7. To utilize technology to create and provide for safe, aesthetic, functional and healthy surroundings.
8. To instill in students a profound ethical commitment and a sense of social and ecological responsibility.
9. To promote unity of purpose and collaboration between the different academic units and university components

Program Educational Objectives

1. To explore the intricacies of the Interior Design profession, laws, codes and regulations that set constraints on design.
2. To expand studies through information research.
3. To rethink the life of existing buildings, through design alterations, rehabilitation, and adaptive reuse.
4. 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.
5. To encourage philosophical explorations, ethical responsibility, aesthetic expressions, and practical applications in line with professional standards.
6. To maintain continuous evaluation of our services in association with public and private enterprises pertaining to the profession.
7. To stimulate the exchange of ideas and respect for other opinions and their creative capabilities.
8. 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 138 credits. This program started in August 2014 and will be applying for Accreditation of CIDA the Council for Interior Design Accreditation, thus the program has been developed following its educational standards, having a strong architectural technical base to ensure 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, Materials and Digital Fabrication Laboratory, 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 developmental courses to overcome the deficiencies in Languages, Mathematics and Science. These developmental courses (equivalent to an 18 credit-hours maximum) are part of the 138 credits required by the Interior Design Program. The developmental courses are awarded their corresponding to contact hours, as follows:

Developmental Studies Component
(Maximum of 18 Credit-Hours)

Course	Title	Credit-Hours
ATUL 0100	Adjustment to University Life	3
ENGL 0110	English Grammar	3
SPAN 0110	Spanish Grammar	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
SCIE 0110	Introduction to Physics	3
		Total 18

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.

Students Organizations

This program started in fall 2014, has a student chapter of CODDI, the College of Interior Designers of Puerto Rico, the professional association for Interior Designers in Puerto Rico.

I
NTERIOR DESIGN CURRICULUM
(138 Credit-Hours)

Socio-Humanistic Studies
(15 Credit-Hours)

Course	Title	Credit-Hours
ENGL 1010	The Essay as Literary Genre	3
PSYC 3020	Human Development	3
SPAN 1010	Linguistic Analysis of Literary Form	3
SOHU 2010	Socio Humanistic Studies I	3
SOHU 2020	Socio Humanistic Studies II	3

Professional Core
(93 Credit-Hours)

ARCC-Architectural Representation
(12 Credit-Hours)

Course	Title	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)

Course	Title	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 I	4
ARIN 3020	Capstone Design I	4
ARIN 3030	Capstone Design II	4

ARHH-ARIN History
(12 Credit-Hours)

Course	Title	Credit-Hours
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
ARIN 2210	Furniture History I	3
ARIN 3220	Furniture History II	3

ARPP-Practice
(12 Credit-Hours)

Course	Title	Credit-Hours
ARTE 0400A	Construction Details	3
ARPP 5010	Ethics	3
ARPP 5020	Construction Documents	3
ARPP 5030	Office Management and Finances	3

ARTE-ARIN Technology
(21 Credit-Hours)

Course	Title	Credit-Hours
ARTE 1010	Introduction to Technology	3
ARTE 2010	Materials and Methods	3
ARTE 0440	Lighting	3
ARIN 2310	Color (Theory and Psychology)	3
ARIN 2320	Materials (Textiles)	3
ARTE 4010	Building Systems (Electricity, Acoustics & Telecommunications)	3
ARTE 4020	Environmental Systems (Mechanical and Plumbing)	3

Electives

(12 Credit-Hours)

Architectural Program Electives

Course	Title	Credit-Hours
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 0191	Visual Communication in Architecture	3
ARCC 0210	Photography Fundamentals	3
ARCC 0211	Photography Laboratory	3
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

Course	Title	Credit-Hours
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

Course	Title	Credit-Hours
ARHH 0400E	Introduction to Urban Planning	3
ARHH 0400F	Structure and Form of Urban Settlements	3
ARHH 0400G	Sustainable Urban Mobility Planning and Management	3
ARHH 0400H	Land Use Regulation and its Impact on the City	3
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

Course	Title	Credit-Hours
ARPP 0310	The Architect as Entrepreneur	3
ARPP 0320	Ecology and Tourism	3
ARPP 1010	Introduction to Architecture	3

Electives in Technology

Course	Title	Credit-Hours
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 Technology

Course	Title	Credit-Hours
ARCT 0110	Visual Culture	3
ARCT 0430	Preservation Theory	3
ARCT 0440	Advanced Topics on Theory	3

Electives in Landscape Architecture

Course	Title	Credit-Hours
ARCL 0100	City & Environment	3
ARCL 0315	Geography	3
ARCL 0391	Landscape Architecture	3

Architecture - Related
In Socio-Humanistic Studies and Languages

Course	Title	Credit-Hours
LITE 3040	Writing About Architecture	3
SOHU 3030	Archeology for Architects	3
SPAN 2020A	Business Language & Communication	3
ARHH 2010	History of Puerto Rico in the Caribbean Context	3
HIST 4030	Historiography	3

INTERIOR DESIGN CURRICULUM SEQUENCE

(138 Credit-Hours)

First Year

First Quarter

Course	Title	Credit-Hours
	Developmental Program Pre-requisites	9
ARCH 1010	Basic Design I	4
ARCC 1010	Architectural Representation I	3
SPAN 0110	Spanish Grammar	3
ATUL 0100	Adjustment to University Life	3
MATH 0106	Elementary Algebra	3
		Total 16

1st Year - 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	Linguistic Analysis of Literary Forms	3
MATH 0110	Intermediate Algebra	3
		Total 16

1st Year - Third Quarter

Course	Title	Credit-Hours
ARCH 1030	Basic Design III	4
ARHH 1010	History of Architectural Space	3
ARHH 1011	History of Architectural Space Laboratory	0
ENGL 0110	English Grammar	3
SCIE 0110	Introduction to Physics	3
SOHU 2020	Socio-Humanistic Studies	3
		Total 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 Laboratory	0
ARTE 1010	Introduction to Technology	3
ENGL 1010	The Essay as a Literary Genre	3
		Total 16

2nd Year - Second Quarter

Course	Title	Credit-Hours
ARIN 2020	Design Fundamentals II	4
ARTE 2010	Materials & Methods	3
ARTE 4010	Building Service Systems (Electricity, Acoustics & Telecommunications)	3
PSYC 3020	Human Development	3
ARIN 2310	Color (Theory and Psychology)	3
		Total 16

2nd Year - 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	Building Environmental Services	3
		Total 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
		Total 16

3rd Year - Second Quarter

Course	Title	Credit-Hours
ARIN 3020	Capstone I	4
ARPP 5010	Ethics	3

ARHH 3010	Program Elective	3
	Open Elective	3
		Total 13

3rd Year - Third Quarter

Course	Title	Credit-Hours
ARIN 3030	Capstone II	4
ARPP 5030	Office Management & Finances	3
ARHH 3010	Program Elective	3
	Open Elective	3
		Total 13

COURSE DESCRIPTIONS

ARCC 1010 – ARCHITECTURAL REPRESENTATION I
Three credit-hours. Two two-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCH 1010, ARHH 1010/1011

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/studio periods per week. Laboratory Fee. Prerequisites: 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 1010 – BASIC DESIGN I
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: MATH 0102, and one of two language courses, SPAN 0100 or ENGL 0100. Corequisites: ARHH 1010/1011

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 lecture/studio periods per week. Design Fee. Prerequisites: MATH 0102, and one of two language courses, SPAN 0100 or ENGL 0100. Corequisites: ARHH 1010/1011

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 lecture/studio periods per week. Design Fee. Prerequisites: ARCH 1020, ARCC 1010

Notion of contexts is 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 1120 – ANALYZING ARCHITECTURE
Three credit-hours. Two two-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: 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.

ARHH 1010 – HISTORY OF ARCHITECTURAL SPACE
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: 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 ARCHITECTURAL SPACE LABORATORY
Zero credit-hours. One one-hour lecture periods per week. Prerequisites: MATH 0102 and one of two language courses, SPAN 0100 or ENGL 0100. Corequisite: ARHH 1010

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.

ARHH 2010 – HISTORY OF MODERN ARCHITECTURE
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARHH 1010, ARHH 1011, SOHU 2010. 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 one-hour lecture periods per week. Prerequisites: ARHH 1010/1011, SOHU 2010. Corequisite: 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 2010 – DESIGN FUNDAMENTALS I
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: 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 II
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: 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 lecture/studio periods per week. Design Fee. Prerequisites: 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 to the user.

ARIN 2210 – HISTORY OF FURNITURE I
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARHH 1010/1011, SOHU 2010

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 2310 – COLOR (THEORY AND PSYCHOLOGY)
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: 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 2320 – MATERIAL (TEXTILES)
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARHH 1010/1011, SOHU 2010

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 covering, rugs and carpets for both interiors and exteriors in accordance to their use, style, construction, its strength, durability, ornamentation, and code compliance.

ARIN 3010 – ADVANCED DESIGN
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: 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 I
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: 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 II
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design 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 multifunctional 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.

ARIN 3220 – HISTORY OF FURNITURE II
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARHH 2010/2011, ARIN 2210

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.

ARPP 5010 – ETHICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARIN 3010

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: ARTE 4010, 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 5030 – OFFICE MANAGEMENT AND FINANCES
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: 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.

ARTE 0400A – CONSTRUCTION DETAILS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: 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.

ARTE 0440 –LIGHTING
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARIN 2010, ARCC 1010, ARTE 1010

The aim of this course is to inspire creative thinking in regard 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.

ARTE 1010 – INTRODUCTION TO TECHNOLOGY
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARCH 1030, ARHH 1010

An early overview of building technologies (structural, plumbing, HVAC, electricity and site work) that work as a system affecting the 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. Prerequisites: 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 system.

ARTE 4010 – BUILDING SERVICE SYSTEM (ELECTRICITY, ACOUSTICS & TELECOMMUNICATIONS)
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ARTE 1010

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. Prerequisites: ARTE 2010, 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.

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. E-mail: jburgos@pupr.edu

MORALES, MINETTE – Lecturer; MS Interior Design; Pratt Institute, 2014; BA Photography, Plastic Arts School, 2011; Associate Degree, in Interior Design 2000, San Juan School of Interior Design. E-mail: mmorales@pupr.edu

PADRÓ SALVÁ, LUIS – Lecturer; PhD Candidate, History of Puerto Rico and the Caribbean, Centro de Estudios Avanzados de Puerto Rico 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. E- mail: ipadro@pupr.edu

SCHOOL OF ENGINEERING, SURVEYING, AND GEOSPATIAL SCIENCE

BIOMEDICAL ENGINEERING DEPARTMENT

BIOMEDICAL ENGINEERING PROGRAM

Biomedical engineering applies engineering principles and design concepts together with knowledge of biology and medicine, with the aim of providing alternative or improved methods and procedures of health care, either for diagnostic or treatment purposes. As a multidisciplinary field, it involves aspects of other engineering disciplines such as chemical engineering, computer engineering, electrical engineering and mechanical engineering combined with mathematics, chemistry, biology, and medicine which are integrated to improve human quality of life.

Subdisciplines in biomedical engineering are the design of active and passive medical devices (pacemakers, prosthetic limbs, orthopedic implants, etc.,) medical imaging, biomedical signal processing, tissue and stem cell engineering, clinical engineering, and other engineering subspecializations. Other areas include life science industry manufacturing processes, hospital facilities maintenance, bioinformatics, rehabilitation and sports engineering. These areas deliver important breakthroughs that make healthcare and medicine more effective and efficient.

Program Mission

The Biomedical Engineering Program at Polytechnic University of Puerto Rico is designed to "develop graduates from different 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."

Program Educational Objectives

Upon a few years of graduation, PUPR's biomedical engineering graduates are expected to:

1. Work with professionalism and high ethical standards as biomedical engineers in the life science industry, including pharmaceutical and medical devices, or in the healthcare industry, including hospitals, clinics, and rehabilitation, and training centers.
2. Demonstrate competence and leadership in biomedical engineering teams or interrelated areas of industry, government, teaching, and clinical practice.
3. Provide adequate skills to motivate students to pursue studies in biomedical engineering, bioengineering or medicine, or perform graduate studies in related disciplines.

Student Outcomes

Biomedical Engineering Program students upon graduation shall demonstrate the ability to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. Communicate effectively with a range of audiences
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

Career Opportunities

Biomedical engineers have many professional options due to the breadth of their preparation. Biomedical engineers can pursue their careers with local, state, and federal agencies, as well as with private enterprises, or start their own businesses and/or pursue graduate studies. Graduates from this program have found successful careers in a variety of industriews such as medical devices, pharmaceuticals, biotechnology, hospitals, food industry, and biomedical services, among others. Biomedical engineers may pursue graduate studies in biomedical engineering, medicine, and dentistry.

Degree Offered

The Biomedical Engineering Program offers undergraduate instruction leading to the degree of Bachelor of Science in Biomedical Engineering (B.S.B.M.E.). To obtain the degree, the student must complete the following minimum requirements:

Minimum Graduation Requirements

18	Credit-hours in Mathematics
16	Credit-hours in Chemistry
8	Credit-hours in Biology
10	Credit-hours in Physics
6	Credit-hours in Social Science
9	Credit-hours in Spanish
9	Credit-hours in English
9	Credit-hours in Engineering
54	Credit-hours in BME Core
6	Credit-hours in Tech. Electives
6	Credit-hours in Free Electives
151	**Total Credit-hours**

If the student decides to have the necessary credits to pursue further studies in Medicine or Dental School, he/she has to enroll in the following elective courses: 3 credits – Spanish; 3 credits – English; and 6 credits in specific socio-humanistic courses. Free electives can be used to complete the Spanish and English requirements. The specific socio-humanistic courses needed to have the requisites to pursue M.D. are in the areas of economy, psychology, political science, sociology and/or anthropology. There are six credits in the program that students may choose to complete these requirements.

Development Studies

Students admitted to the Biomedical 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 Test, PUPR's placement test, or previous university experience, are required to take developmental courses. These courses are designed to help students overcome deficiencies in languages, mathematics, and science. These courses are required in addition to the 151 credit-hours required by the Biomedical Engineering Program.

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
		Total	**33**

Laboratories

The facilities and laboratories of the Biomedical Engineering Program at PUPR provide students with hands-on experience on several important areas such as computer-aided design, computer programming, biomechanics, biosystems circuits and electronics, and the rehabilitation and industrial automation laboratories. The biomedical engineering experimental facilities are housed on the fourth floor of the Pavilion building. In addition, chemistry, physics, electronics and computers laboratories are also available throughout the campus.

Student Organizations

The Biomedical Engineering Program encourages its students to participate actively in the following student organizations:

a. College of Engineers and Land Surveyors of Puerto Rico (CIAPR)
b. Biomedical Engineering Society
c. American Institute of Medical and Biological Engineering (AIMBE)
d. IEEE Engineering in Medicine and Biology (EMB) Society
e. AiCHE Society of Biological Engineering
f. ASME Bioengineering Division
g. Engineering World Health

These organizations provide students with the opportunity to get acquainted with their career and participate in conferences, seminars, and field trips to broaden their professional and social activities and nurture their leadership and communications skills.

BIOMEDICAL 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 3310	Differential Equations	3
	Total	**15**

Science Component
(34 Credit-Hours)

Course	Title	Credit- Hours
SCIE 1130	Biology I	4
SCIE 1131	Biology I Laboratory	0
SCIE 1140	Biology II	4
SCIE 1141	Biology II 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 1230	Organic Chemistry I	4
SCIE 1231	Organic Chemistry I Laboratory	0
SCIE 1240	Organic Chemistry II	4
SCIE 1241	Organic Chemistry II Laboratory	0
SCIE 1430	Physics I, Mechanics	4
SCIE 1431	Physics I Laboratory I	1
SCIE 1440	Physics II	4
SCIE 1441	Physics II Laboratory	0
	Total	**34**

Socio-Humanistic Studies and Languages 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
ENGL 2030	Medical Terminology	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SPAN 2010	Hispanic Literature	3
SPAN 2020	Business Spanish	3
	Total	**18**

Socio-Humanistic Studies and Languages
Pre-Med Electives Component
(6 Credit-Hours)

Course		Title	Credit-Hours
ECON	3010	Micro-Economics	3
ECON	3020	Macro-Economics	3
PSYC	3020	Human Development	3
PSYC	3040	Abnormal Psychology	3
PSYC	3050	Theories of Personality	3
		Total	**6**

Engineering Science Component
(12 Credit-Hours)

Course		Title	Credit-Hours
ENGI	2910	Engineering Mechanics, Statics and Dynamics	3
ENGI	3440	Thermo-Fluid Mechanics	3
EE	2000	Circuit Analysis I	3
ENGI	2270	Engineering Probability and Statistics	3
		Total	**12**

Biomedical Engineering Component
(54 Credit-Hours)

Course		Title	Credit-Hours
BME	1010	Introduction to Biomedical Engineering	3
BME	2110	Computer Aided Drafting and Design for BME	3
BME	3010	Computer Programming for BME	3
BME	3120	Biomaterials	3
BME	3130	Fundamentals of Biomechanics	3
BME	3220	Fundamentals of Electronics	3
BME	3140	Transport Phenomena in Biological Systems	3
BME	3230	Biomedical Signals and Systems	3
BME	3150	Life Science Industry Manufacturing Processes	3
BME	3020	Physiological Modeling and Control Systems	3
BME	3131	Fundamentals of Biomechanics Lab.	1
BME	4020	Regulations in the Life Science Industry	3
BME	3221	Bio-system Circuits and Electronics Lab	1
BME	4230	Bioinstrumentation	3
BME	4011	Rehabilitation Engineering Lab	1
BME	4210	Health Care Information Systems	3
BME	4030	Clinical Engineering	3
BME	4992	Biomedical Engineering Capstone Design I	3
BME	4994	Biomedical Engineering Capstone Design II	3
		Total	**54**

Elective Courses Component
(12 Credit-Hours)

Course		Title	Credit-Hours
BME	XXXX	Biomedical Engineering Electives	6
		Free Electives	6
		Total	**12**

Minimum Total Program Credit-Hours: 151

Biomedical Engineering Elective Courses

Course		Title	Credit-Hours
BME	4120	Bio-fluid Mechanics	3
BME	4110	Biomechanics of Sport	3
BME	4130	Hospital Facilities and Maintenance	3
BME	4140	Medical Implants	3
BME	4220	Bioinformatics	3
BME	4240	Biomedical Data Acquisition and Analysis	3
BME	4250	Medical Imaging	3
BME	4040	Fundamental Concepts in Biomedical Engineering	3
BME	4050	Biostatistics	3
BME	4970	Biomedical Engineering Practice	3
BME	4980	Undergraduate Research in Biomedical Engineering	3
BME	4990	Special Topics in Biomedical Engineering	3

BIOMEDICAL ENGINEERING PROGRAM CURRICULUM SEQUENCE

(151 Credit-Hours)

First Year

First Quarter

Course		Title	Credit-Hours
BME	1010	Introduction to Biomedical Engineering	3
SPAN	1010	Linguistic Analysis of Literary Genres	3
ENGL	1010	The Study of the Essay as a Literary Genre	3
SCIE	1214	General Chemistry I	3
SCIE	1215	General Chemistry I Lab.	3
		Total	**13**

1st Year - Second Quarter

Course		Title	Credit-Hours
SPAN	2010	Hispanic Literature	3
ENGL	2030	Medical Terminology	3
SCIE	1130	Biology I	4
SCIE	1131	Biology I Lab.	0
SCIE	1220	General Chemistry II	4
SCIE	1221	General Chemistry II Lab.	0
		Total	**14**

1st Year - Third Quarter

Course		Title	Credit-Hours
MATH	1350	Calculus I	4
SCIE	1140	Biology I	4
SCIE	1141	Biology I Lab.	0
SPAN	2020	Business Spanish	3
ENGL	2020	Business English and Communication	3
		Total	**14**

Second Year

First Quarter

Course		Title	Credit-Hours
MATH	1360	Calculus II	4
SCIE	1230	Organic Chemistry I	4

SCIE	1231	Organic Chemistry I Lab.	0
		Social Science Elective	3
BME	2110	Computer Aided Drafting and Design for BME	3
		Total	**14**

2nd Year - Second Quarter

Course		Title	Credit-Hours
SCIE	1430	Physics I	4
SCIE	1431	Physics I Lab.	1
SCIE	1240	Organic Chemistry II	4
SCIE	1241	Organic Chemistry II Lab.	0
		Free Elective: (Pre-Med SPAN 2030 – Medical Terminology)	3
MATH 1370		Calculus III	4
		Total	**16**

2nd Year - Third Quarter

Course		Title	Credit-Hours
SCIE	1440	Physics II	4
SCIE	1441	Physics II Lab.	1
		Social Science Elective	3
		Free Elective (Pre-Med ENGL 2010 – Analysis of World Literature)	3
ENGI	2910	Engineering Mechanics: Statics and Dynamics Eng.	3
		Total	**14**

Third Year

First Quarter

Course		Title	Credit-Hours
BME	3010	Computer Programming for BME	3
EE	2000	Circuit Analysis I Eng.	3
ENGI	3440	Thermo-Fluid Mechanics	3
MATH	2350	Differential Equations	3
BME	3120	Biomaterials	3
		Total	**15**

3rd Year - Second Quarter

Course		Title	Credit-Hours
BME	3130	Fundamental of Biomechanics	3
BME	3220	Fundaments of Electronics	3
BME	3140	Transport Phenomena in Biological Systems	3
ENGI	2270	Engineering Probability and Statistics Eng.	3
		Total	**12**

3rd Year - Third Quarter

Course		Title	Credit-Hours
BME	3230	Biomedical Signal and Systems	3
BME	3150	Life Science Industry Manufacturing Processes	3
BME	3020	Physiological Modeling and Control Systems	3
BME	3131	Fundamentals of Biomechanics Lab.	1
		Total	**10**

Fourth Year

First Quarter

Course		Title	Credit-Hours
BME	4010	Rehabilitation Engineering and Industrial Automation	3
BME	4020	Regulations in the Life Sciences Industry	3
BME	3221	Biosystems Circuits and Electronics Lab.	1
BME	4030	Clinical Engineering	3
		Total	**10**

4th Year - Second Quarter

Course		Title	Credit-Hours
BME	4992	Capstone Design I	3
BME	4011	Rehabilitation Engineering Lab.	1
BME	4210	Health Care Information Systems	3
BME	4230	Bioinstrumentation	3
		Total	**10**

4th Year - Third Quarter

Course		Title	Credit-Hours
BME	4994	Capstone II	3
BME	XXXX	Technical Elective	3
BME	XXXX	Technical Elective	3
		Total	**9**

COURSE DESCRIPTIONS

BME 1010 – INTRODUCTION TO BIOMEDICAL ENGINEERING
Three credit-hours. Two two-hour lecture period per week. Prerequisites: None. Corequisite: None.

This course introduces the biomedical engineering field to freshman engineering students. The course focuses in teaching the main scope of the profession in the medical devices industry, healthcare industry, and research and development.

BME 2110 – COMPUTER AIDED AND DRAFTING AND DESIGN FOR BME
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: None. Corequisite: None.

Introduction to Computer Aided and Drafting and Design (CADD), Engineering design process: drafting solid modeling dimensioning and tolerances. Graphics communication in biomedical engineering. 2D and 3D construction, visualization, sketching and standard lettering techniques using CADD. Orthographic Projections. Multi-view drawings for engineering design and production. Basic Dimensioning and tolerancing.

BME 3010 – COMPUTER PROGRAMMING FOR BME
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: BME 2110, MATH 1350. Corequisite: None.

This course is designed to be the first experience in computer programming and is intended for the biomedical engineering students. The students will learn how to design, write and implement MATLAB scripts and subroutines to solve simple engineering problems. Topics include MATLAB environment selection and repetition structures, used defined functions, Data input and output, 2D Plotting and how to create simple Graphical User Interface (GUI). Students are required to complete a series of computer programming projects.

BME 3020 – PHYSIOLOGICAL MODELING AND CONTROL SYSTEMS
Three credit-hours. Two Two-hour lecture periods per week. Prerequisites: BME 3130, BME 3140, BME 3220. Corequisite: None.

A wide variety of biomedical processes behave as dynamic systems where the system states vary in time, often in response to external stimuli or interventions. The aims of this module are to introduce techniques and computer tools for modeling, predicting, analyzing and understanding dynamic behavior in biomedical systems.

BME 3120 – BIOMATERIALS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1240/1241. Corequisite: None.

This course introduces biomaterials of synthetic as well as natural origin that can be in contact with tissue, blood, and biological fluids with the intended use for prosthetic, diagnostic, therapeutic, and storage applications without adversely affecting the living organism or its components. The course emphasizes the selection and application of biomaterials to the design of bioengineering applications.

BME 3130 – FUNDAMENTALS OF BIOMECHANICS
Three credit-hours. Two two-hour lecture periods per week Prerequisites: BME 3120, ENGI 3440. Corequisite: None.

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 applications.

BME 3131 – FUNDAMENTALS OF BIOMECHANICS LAB.
One credit-hour. One four-hour laboratory period per week. Prerequisite: BME 3130. Corequisite: None.

This laboratory course provides a hands-on introduction to the experimental analysis of the biomechanics of human motion. Students will learn to use computer software for data acquisition and analysis. Kinematic analysis will be performed using optoelectronic and electromagnetic motion sensors. Movement kinematics will be correlated to muscle activity data provided by electromyography (EMG). Analysis of movement kinetics will be performed using strain gauges and force sensors, including force plates for balance control experiments. The laboratory course emphasizes teamwork and communication skills through the submission of group written reports and oral presentations.

BME 3140 – TRANSPORT PHENOMENA IN BIOLOGICAL SYSTEMS
Three credit-hour. Two two-hour lecture periods per week. Prerequisites: SCIE 1140/1141, ENGI 3440, MATH 2350. Corequisite: None

This course introduces the integrated study of momentum, mass, and energy transfer, as well as thermodynamics and chemical reactions kinetics for the physiological and cellular processes characterization. This course is used for designing and operating medical devices and developing new therapies. Examples include kidney dialysis machines, heart-lung bypass machines, and membrane oxygenators.

BME 3150 – LIFE SCIENCE INDUSTRY MANUFACTURING PROCESSESS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: BME 3130, BME 3220. Corequisite: None.

This course covers typical manufacturing processes in the Pharmaceutical and Medical Devices Industries. Processes such as cleaning in place processes, automation, cnc programming, metal stampings, wiring, among others are covered.

BME 3220 – FUNDAMENTALS OF ELECTRONICS
Three credit-hour. Two two-hour lecture periods per week. Prerequisite: EE 2000. Corequisite: None.

Overview of semiconductors materials, introduction to solid-state devices such as diodes, Bipolar Junction Transistors (BJTs), Metal Oxide Semiconductor Field Effect Transistors (MOSFETs) and their characteristics, operation, circuits and typical applications. The operating principles and understanding of these nonlinear devices are studied to learn their use in electronic equipment. Characteristics of the Operational Amplifier and typical applications such as inverting and non-inverting amplifiers, comparators, summing and differentiating amplifiers, and active filters are studied. Classical applications of OPAMPs in biomedical circuits are discussed.

BME 3221 – BIOSYSTEMS CIRCUITS AND ELECTRONIC LAB.
One credit-hour. One four-hour laboratory period per week. Prerequisite: BME 3220. Corequisite: None.

This laboratory is designed to develop in the students the necessary skills to perform electrical measurements, as well as the necessary skills for the implementation and testing of typical electronic circuits. Experimental verification of the fundamental laws of electric circuits is required for all the experiments. Electrical measuring devices are used in the laboratory such as, the multimeter, the oscilloscope and the RLC meter, and any other equipment like power supplies, function generators and breadboards, which are used in the construction and testing of electric and electronic circuits. Practical electronics circuits that contain diodes, transistors and operational amplifiers are studied and implemented. Use of computer programs to simulate the circuits to be implemented in the laboratory.

BME 3230 – BIOMEDICAL SIGNAL AND SYSTEMS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: BME 3220, ENGI 2270. Corequisite: None.

This course is centered on the theory of signal and systems with focus on the analysis of signals that originate in living systems. In particular, the course emphasizes signal examples related to the human body such as ECG, EEG, EMG, and others. Topics covered include Continuous-Time Signal and Systems, Discrete-Time Signal and Systems, Sampling, Fourier Analysis, z-Transform, Basic Filter Design and Spectral Analysis with applications to biomedical signals.

BME 4010 – REHABILITATION ENGINEERING AND INDUSTRIAL AUTOMATION
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: BME 3230, BME 3131. Corequisite: None

This is the application of science and technology to design, research or improve devices and their ability to work and live as normally as possible. Assistive technology is applicable to musculoskeletal and sensory disabilities. Additionally, the course includes automation and digital control of industrial applications using electrical, electronic, hydraulic, and pneumatic control devices and systems.

BME 4011 – REHABILITATION ENGINEERING LAB.
One credit-hour. One four-hour laboratory period per week. Prerequisites: BME 4010, BME 3221. Corequisite: None.

Laboratory experiences in Rehabilitation Engineering and Industrial Automation using electrical, electronic, hydraulic, and pneumatic systems. The laboratory practices include the selection and implementation of sensors and actuators (i.e., mechanical, pneumatics and hydraulics), along with Programmable Logic Controllers and Microcontrollers. The laboratory emphasizes the application of these technologies in the rehabilitation and/or improvement of the quality of life for individuals with disabilities.

BME 4020 – REGULATIONS IN THE LIFE SCIENCE INDUSTRY
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: BME 3150, ENGI 2270. Corequisite: None.

This course explores the content and interpretation of the FDA pharmaceutical and medical devices regulations. Using the regulations and warning letters the students analyze and apply their knowledge to identify trends and implications to compliance with the FDA regulations.

BME 4030 – CLINICAL ENGINEERING
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: BME 3230, BME 3150. Corequisite: None.

This course focuses on the methodology for administering critical engineering services from facilitation of innovation and technology transfer to the performance of the technology assessment and operations support of clinics and hospitals. Roles of the clinical engineer include supervision of clinical engineering departments, design, repair, purchase, and evaluate new and existing medical equipment, biomedical computer support, input to clinical facilities, and documentation and implementation protocols.

BME 4210 – HEALTH CARE INFORMATION SYSTEMS
Three credit-hours. Two two-hours lecture periods per week. Prerequisite: BME 4020, BME 3230. Corequisite: None.

This course is intended to teach students how to use the information systems to program and maintain hospital information system (HIS), computer-based patient records (CBPR), imaging, communications, standards and other related areas.

BME 4230 – BIOINSTRUMENTATION
Three credit-hour. Two two-hour lecture periods per week. Prerequisite: BME 4030. Corequisite: None.

The course describes the principles, design, and applications of the most used medical instruments in hospitals. Due to the rapid change in the different model of instruments, the course focuses more on the fundamental principles of operation of those instruments that are common to all different models of these kinds of instruments. The course assumes the students are familiar with differential equations, strong knowledge of physics, and some knowledge in electric and electronic courses.

BME 4992 – CAPSTONE DESIGN I
Three credit-hours. Two two-hour lecture period per week. Prerequisites: BME 3020, BME 4010, BME 4020. Corequisite: None.

The team performs a systematic design process to solve a multidisciplinary biomedical engineering problem. Weekly written and oral reports required.

BME 4994 – CAPSTONE II
Three credit-hours. Two two-hour lecture periods per week. Corequisites: BME 4992, BME 4011, BME 4030, BME 4210. Corequisite: None.

Teams perform a systematic design process to solve a multidisciplinary biomedical engineering problem. Weekly written and oral reports are required.

ENGI 2910 – ENGINEERING MECHANICS: STATICS AND DYNAMICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1360, SCIE 1430. Corequisite: None.

Fundamental of statics and dynamics using vector methods in rigid body. The course emphasizes the application of Newton's laws, analysis of force system. Law of equilibrium for rigid body, kinematics and kinetics, angular kinetics and kinematics, work, energy and momentum of rigid bodies.

BME Technical Electives Courses

BME 4040 – FUNDAMENTAL CONCEPTS IN BIOMEDICAL ENGINEERING
Three credit-hour. Two two-hour lecture periods per week. Prerequisites: SCIE 1240, SCIE 1440. Corequisite: None.

This course focuses on the study of miscellaneous important concepts and principles emphatically necessary for pre-medical students and highly recommended for biomedical engineering students. It covers essential topics in applied biology and organic and inorganic chemistry. This course emphasizes the study of compounds of biological importance such as proteins, nucleic acids, carbohydrates, and lipids. Special attention is placed on structure and function of these biopolymers and their constituents as well as the principles of bioenergetics and fuel molecules metabolism and the transmission of genetic information; it also covers enzyme catalysis, including mechanistic considerations, kinetic, models of enzyme-substrate interaction, and regulation.

BME 4050 – BIOSTATISTICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: BME 4020. Corequisite: None.

This course introduces the student to selected topics in biostatistics concepts. Descriptive statistics and graph to analyze variability in data; hypothesis testing to perform inference on population means and proportions using sample data; hypothesis testing to comparison means and proportions; correlation and simpler linear regression concepts will be essential on the analysis of integrated systems, processes, and components.

BME 4110 – BIOMECHANICS OF SPORTS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: BME 3131. Corequisite: None.

Anatomical and mechanical bases of physical activity with emphasis on the analysis of sport and exercise skills. This course focuses upon the development of techniques of human movement analysis from structural and functional points of view and incorporates principles of mechanics as they apply to the analysis of human motion. Examples will be drawn from joint movements and sport skills to illustrate these types of analyses. Applications to baseball swing/pitching, boxing punch, soccer kicking among other will be analyzed.

BME 4120 – BIOFLUID MECHANICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: BME 3130. Corequisite: None.

This course is designed to study fluid mechanics applied in the biological flows. Students will gain an understanding of the basic fluid governing equations in addition to blood rheology and disease. Mathematical models will be used to simulate flows in the cardiovascular, circulatory, and respiratory system. This class includes drug delivery in the human through different systems.

BME 4130 – HOSPITAL FACILITIES AND MAINTENANCE
Three credit-hour. Two two-hour lecture periods per week. Prerequisite: BME 4030. Corequisite: None.

This course presents an introduction to the principles of design, and maintain medical gas, energy and power supply systems used in hospitals such as water, gas, vacuum and steam systems, air conditioning units, heat exchangers and electric generators.

BME 4140 – MEDICAL IMPLANT
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: BME 4020. Corequisite: None.

This course introduces the most relevant and important concepts of medical implants. Therapeutic instrumentation, such as pacemakers, defibrillation, and prosthetic devices, will be reviewed considering the area of placement, the duration of the implant, the safety and efficacy. Each medical implant studied includes an exposition pf appropriate physiology, mathematical modeling or biocompatibility issues, as well as clinical need.

BME 4220 – BIOINFORMATICS
Three credit-hour. Two two-hour lecture periods per week. Prerequisite: BME 4210. Corequisite: None.

The course introduces the student to the bioinformatics field that consists of leveraging computer resources to analyze complex and vast amount of biological data. The course brings together the field of computer science, biology, and mathematics to analyze the DNA, RNA, Protein structure, and metabolic pathways. This information can then be used in applied fields such as drug discovery among other.

BME 4240 – BIOMEDICAL DATA ACQUISITION AND ANALYSIS
Three credit-hour. Two two-hour lecture periods per week. Corequisite: 4011. Corequisite: None.

The course covers the topics such as basic sensors in biomedical engineering, biological signal measurement and conditioning, data acquisition and data analysis. The student will learn the techniques of collecting biological signals using basic sensors. The student must need a previous course that covers digital signal processing and filtering analog signals in other to using simulation software as Mathlab and Labview in their classroom projects.

BME 4250 – MEDICAL IMAGING
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: BME 3230, BME 3131. Corequisite: None.

The course gives an introduction to two-dimensional signal and systems with a focus on the enhancement of biomedical images acquired from human subjects. In particular, the course emphasizes image acquisition techniques and enhancement of biomedical images extracted through Ultrasound imaging, X-Ray imaging, Gamma-Ray imaging, CT-Scans, MRI, and other techniques. Topics covered include, Image Enhancement in the Spatial Domain and in the Frequency Domain.

BME 4970 – BIOMEDICAL ENGINEERING PRACTICE
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: BME 3230, BME 3131, Director/Coordinator Consent. Corequisite: None.

Perform a systematic design process to solve a biomedical engineering problem. Weekly written and oral reports are required.

BME 4980 – UNDERGRADUATE RESEARCH IN BIOMEDICAL ENGINEERING
Three credit hours. Two-two hours lecture periods per week. Prerequisites: BME 3230, BME 3131, Director/Coordinator Consent. Corequisite: None.

Perform a systematic design process to solve a biomedical engineering problem. Weekly written and oral reports are required.

BME 4990 – SPECIAL TOPICS IN BIOMEDICAL ENGINEERING
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: BME 3230, BME 3131, Director/Coordinator Consent. Corequisite: None.

Arrange by individual faculty with special expertise; these courses survey fundamentals in areas that are not covered by the regular Biomedical engineering course offerings. Exact course descriptions are disseminated by the Biomedical Engineering Office well in advance of the offering. Courses may be in Tissue Engineering, Nanotechnology in Biomedical Engineering, Multiphysics Simulation of Biomedical Systems, and Continuous Improvement in Healthcare.

DEPARTMENTAL FACULTY

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CHEMICAL ENGINEERING DEPARTMENT

CHEMICAL ENGINEERING PROGRAM

The Chemical Engineering Program 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 the 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, PUPR Chemical Engineering Program graduates must have achieved the abilities 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.

Student Expected Outcomes

At the time of completing their baccalaureate, PUPR Chemical Engineering Program students are expected to demonstrate that they have attained the following:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

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 Bachelor of Science in Chemical Engineering Program prepares graduates for professional careers in industry, government, private laboratories, in engineering design and construction companies, and for graduate programs.

Degree Offered

The Chemical Engineering Department offers undergraduate instruction leading to the degree of Bachelor of Science in Chemical Engineering (BSChE). To obtain the degree, the student must complete the minimum requirements shown in the table below.

Minimum Graduation Requirements

15	Credit-hours in Mathematics
30	Credit-hours in Basic Sciences
21	Credit-hours in Socio-Humanistic Studies and Languages
18	Credit-hours in Engineering Sciences
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
ATUL	0100	Adjustment to University Life	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	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
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 primary 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. Moreover, 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 PUPR, there are two active student chapters which are especially attractive to chemical engineering students:

1. Student Chapter of the Institute of Chemical Engineers (IIQ) of the College of Engineers and Land Surveyors of Puerto Rico (CIAPR).
2. 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	1
SCIE	1440	Physics II	4
SCIE	1441	Physics II - Laboratory	1
SCIE	2204	Analytical Chemistry	4
SCIE	2205	Analytical Chemistry Laboratory	0
SCIE	2250	Physical Chemistry I	4
SCIE	2251	Physical Chemistry I - Laboratory	0

Socio-Humanistic Studies and Languages Component

(21 Credit-Hours)

Course		Title	Credit-Hours
ENGL	1010	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, and Contemporary Issues	3
SPAN	1010	Linguistic Analysis of Literary Genres	3
SPAN	2020	Business Spanish	3
XXXX	XXXX	Socio-Humanistic Studies or Languages Elective (Students are required to choose one 3-credit-hour course in this area)	3

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 Engineering	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	5120	Chemical Engineering Practice *	3
CHE	5210	Principles of Environmental Engineering	3
CHE	5212	Air Pollution Control *	3
CHE	5214	Water Pollution Control *	3
CHE	5216	Solid Waste Management *	3
CHE	5218	Environmental Laws and Regulations	3
CHE	5220	Nano-Structures in Chemical Processes	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	5320	Fundamentals of Industrial Hygiene	3
CHE	5330	Petrochemical Processes *	3
CHE	5350	Food Technology *	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 elective courses. 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, chosen by the student.

Minimum Total Program Credit-Hours: 146

CHEMICAL ENGINEERING PROGRAM CURRICULUM SEQUENCE
(146 Credit-hours)

First Year

1st Year - First Quarter

Course		Title	Credit-Hours
ENGL	1010	Study of the Essay as a Literary Genre	3
MATH	1350	Calculus I	4
SCIE	1214	General Chemistry I	4
SCIE	1215	General Chemistry I Laboratory	0
SPAN	1010	Linguistic Analysis of Literary Genres	3
		Total	**14**

1st Year - 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	**13**

1st Year - 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
		Total	**13**

Second Year

2nd Year - First Quarter

Course		Title	Credit-Hours
CHE	2010	Introduction to Chemical Engineering	3
ENGI	2270	Engineering Probability and Statistics	3
SCIE	2204	Analytical Chemistry	4
SCIE	2205	Analytical Chemistry Laboratory	0
SPAN	2020	Business Spanish	3
		Total	**13**

2nd Year - Second Quarter

Course		Title	Credit-Hours
ENGI	2110	Engineering Mechanics-Statics	3
ENGI	2310	Computer Programming and Algorithms	3
MATH	2350	Differential Equations	3
SCIE	2250	Physical Chemistry I	4

SCIE	2251	Physical Chemistry I - Laboratory	0
		Total	**13**

2nd Year - 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	**12**

Third Year

3rd Year - First Quarter

Course		Title	Credit-Hours
CHE	3106	Basic Principles of Chemical Engineering II	3
CHE	3116	Fluid Mechanics for Chemical Engineering	3
CHE	3118	Applied Mathematics in Chemical Engineering	3
SOHU	2010	Socio-Humanistic Studies	3
		Total	**12**

3rd Year - 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	Ethics, Global, and Contemporary Issues	3
		Total	**13**

3rd Year - 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	**10**

Fourth Year

4th 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	**13**

4th Year - Second Quarter

Course		Title	Credit-Hours
CHE	4131	Mass Transfer Operations Laboratory	1
CHE	4940	Chemical Engineering Capstone Course I	3
CHE	XXXX	Chemical Engineering Elective	3

XXXX	XXXX	Free Elective	3
		Total	**10**

4th Year - Third Quarter

Course		Title	Credit-Hours
CHE	4141	Reactor Design and Process Control Laboratory for Chemical Engineering	1
CHE	4950	Chemical Engineering Capstone Course II	3
CHE	XXXX	Chemical Engineering Elective	3
XXXX	XXXX	Free Elective	3
		Total	**10**

COURSE DESCRIPTIONS

General Engineering Courses

These courses are intended for students enrolled in the Chemical Engineering Program or 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 material properties required for applications to engineering, and an introduction of methods to modify them for different applications and processes.

ENGI 3520 – THERMAL SYSTEMS ENGINEERING

Four credit-hours. Two two-and-a-half-hour lecture periods per week. Prerequisites: Math 1370, SCIE 1210, and SCIE 1440

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.

Chemical Engineering Courses

CHE 2010 – INTRODUCTION TO CHEMICAL ENGINEERING

Three credit-hours. Two two-hour sessions per week. Prerequisite: SCIE 1220. Corequisite: 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 conceptual design and analyzing chemical processes and process units in order to assess product quality, economics, safety, and environmental impact. The lectures are complemented with 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, ENGI 2310, SCIE 1230, and SCIE 2204. Corequisite: MATH 2350.

This course applies chemical and stoichiometric principles in calculations involving the Law of Conservation of Mass. It develops student abilities for solving mass balance problems using special techniques and computer-based tools. Also, this course comprises the study of basic concepts including: units, dimensional analysis, temperature, and pressure.

CHE 2510 – THERMODYNAMICS
Three credit-hours. Two two-hour sessions per week. Prerequisites: MATH 2350 and SCIE 2250. Corequisite: CHE 2500.
This course comprises the study of the basic concepts of thermodynamics and energy relations, the laws of conservation of mass and energy, volumetric properties of pure fluids, heat effects, entropy and second law analysis of engineering systems, thermodynamic properties of fluids, and the 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 applies the concepts of energy balance and integrates them with mass balance concepts 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 ENGINEERING
Three credit-hours. Two two-hour sessions per week. Prerequisites: CHE 2500, CHE 2510 and ENGI 2110.

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 credit-hour. One four-hour session per week. Prerequisite: CHE 3116.

Experimental study of momentum transfer operations in the context of unit operations. Laboratory experiments in fluid dynamics are planned and performed. Experiment 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: CHE 2500 and MATH 2350.

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 ordinary differential equations (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. Prerequisites: CHE 2500 and CHE 2510.

The course discusses the study of vapor-liquid equilibrium (VLE) in both: (1) pure components, 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 3106, CHE 3116, and CHE 3118.

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 in heat transfer operations are planned and performed. Experiment 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 an introduction to 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. Corequisite: 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. Corequisite: CHE 4930.

This course includes flash vaporization, differential distillation for binary and multicomponent systems, 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 and CHE 4130.

Experimental study of mass transfer operations. Laboratory experiments in various topics in mass transfer operations are planned and performed. 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 3520, 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 in reaction kinetics, reactor design, and process control are planned and performed. 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 students close to graduation with different aspects of the practice of the profession. Topics include an overview of workplace communication and business writing as well as planning, writing, and completing formal reports and oral presentations. Presentations on subjects related to different industry fields such as chemical, 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. Prerequisites: CHE 4130, CHE 4140, 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 actual open-ended chemical engineering problem.

CHE 4950 – CHEMICAL ENGINEERING CAPSTONE COURSE II
Three credit-hours. Two two-hour sessions per week. Prerequisites: 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. At the end of the course, students perform an oral presentation of their completed project and submit a written report together with a poster.

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 5120 – CHEMICAL ENGINEERING PRACTICE
Three credit-hours. By arrangement. Prerequisites: CHE 3520 and CHE 3530.

This course is intended to provide the students with hands-on experience in chemical engineering. It consists of a type 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. Corequisite: 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 – WATER POLLUTION CONTROL
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 5220 – 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 nanoparticles alongside the concepts that drive the assembly of such particles into two-and three-dimensional arrays and organized structures.

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 sessions per week. Prerequisite: CHE 2500. Corequisite: 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. In addition, 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. Corequisite: 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). The knowledge of these levels will let the student understand the structure, synthesis and processing, and the properties of various polymers and their performance in products. The course also examines typical plastics materials and their applications.

CHE 5318 – BIO-BASED POLYMERS AND COMPOSITES
Three credit-hours. Two two-hour sessions per week. Prerequisite: CHE 3530.

Application of several biological materials including plant materials to use them as an 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 5320 – FUNDAMENTALS OF INDUSTRIAL HYGIENE
Three credit-hours. Two two-hour sessions per week. Corequisite: CHE 3320.

An introduction to the principles and practice of industrial hygiene. The course is concerned with the anticipation, recognition, evaluation, and control of workplace hazards to health and safety. Topics covered include anatomy and physiology, especially physiology of lungs, skin, ears, and eyes, chemical and physical principles review, industrial toxicology and chemical exposure including gases, vapors, and solvents, particulate matter, industrial noise, radiation, thermal stress, ergonomic, and biologic hazards, sampling methodology and exposure limits, methods of control of hazards including ventilation, respiratory protection, personal protective equipment, and other engineering controls, and government regulations and their impact.

CHE 5330 – 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 to 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 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 additives 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 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 designed to discuss advanced topics in specific areas of current application and research in chemical engineering. It may include topics in materials processing, nanomaterials fabrication, applied thermodynamics, applied electrochemistry, novel polymers fabrication, transport phenomena, green energy and sustainability, and automatic process control, among others.

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 intended to discuss advanced topics of special interest and actuality, which are relevant for the manufacturing and service environment. The course includes a special chemical engineering design project.

DEPARTMENTAL FACULTY

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CIVIL & ENVIRONMENTAL ENGINEERING AND LAND SURVEYING DEPARTMENT

The Department of Civil & Environmental Engineering and Land Surveying offers three undergraduate programs leading to a bachelor's degree. These are the Bachelor of Science in Civil Engineering, the Bachelor of Science in Environmental Engineering and the Bachelor of Science in Land Surveying and Mapping. The Civil and Environmental Engineering Programs are accredited by the Engineering Accreditation Commission of ABET (www.abet.org). The Land Surveying and Mapping Program is accredited by the Applied and Natural Science Accreditation Commission of ABET. The Department also offers a program that leads to an Associate Degree in Land Surveying.

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 theoretical and conceptual knowledge, capability to use modern technologies effectively, and 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 identify, formulate, analyze, and solve complex engineering problems in at least four civil engineering technical areas (structural, geotechnical, transportation, water resources, environmental, and construction engineering) by applying principles of engineering, basic sciences, mathematics through differential equations, and probability and statistics.
2. An ability to apply engineering principles and basic concepts in project management, business, and public policy to design a system, component, or process in at least two civil engineering technical areas to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional licensure responsibilities in civil engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, societal, and sustainability contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data in at least two civil engineering technical areas, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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, 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 & Environmental Engineering and Land Surveying offers undergraduate instruction leading to the degree of Bachelor of Science in Civil Engineering (BSCE). 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.

Student Organizations

There are five active student chapters at the Department of Civil & Environmental Engineering and Land Surveying, which are especially attractive to civil engineering students:

- Institute of Civil Engineers of the College of Engineers and Land Surveyors of Puerto Rico (CIAPR)
- American Society of Civil Engineers (ASCE)
- American Concrete Institute (ACI)
- Associated General Contractors of America (ACG)
- Puerto Rico Water and Environment Association (PRW&EA)

Students may participate in any or all 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
(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
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 a Land Surveying (SURV) course approved by the Department Head; or a Geomatic Science (GEOM) 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.

Civil Engineering Elective Courses

Course	Title	Credit-Hours
CE 5010	Principles of Architecture for Civil Engineers	3
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 5516	Construction Project Administration	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

CIVIL ENGINEERING PROGRAM CURRICULUM SEQUENCE
(149 Credit-Hours)

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
	Total	**12**

1st Year - 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
	Total	**13**

1st Year - 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
	Total	**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 2310	Algorithms, Programming, and Numerical Analysis	3
CEE 2311	Algorithms, Programming, and Numerical Analysis Laboratory	1
	Total	**13**

2nd Year - 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 2210	Probability and Statistics for Civil and Environmental Engineers	3
	Total	**12**

2nd Year - 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
	Total	**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
	Total	**14**

3rd Year - 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
	Total	**14**

3rd Year - 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
	Total	**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
	Total	**12**

4th Year - 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
	Total	**10**

4th Year - 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
	Total	**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.
4. 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:

1. An ability to identify, formulate, analyze, and solve complex environmental engineering problems by applying principles of engineering, basic sciences, mathematics through differential equations, and probability and statistics.
2. An ability to apply advanced principles and practice to design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts to formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases in order to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional practice responsibilities in environmental engineering situations understanding the concepts of project management and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations, and making informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, societal, and sustainability contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data in at least two environmental engineering focus areas (water supply, wastewater management, air pollution, and solid waste management) and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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 alumni will be much better prepared to successfully pursue graduate degrees in this field if they so desire.

Degree Offered

The Department of Civil & Environmental Engineering and Land Surveying offers undergraduate instruction leading to the degree of Bachelor of Science in Environmental Engineering (BSEnvE). 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 Elective
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
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

(*) 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.

Student Organizations

There are two active student chapters at the Department of Civil & Environmental Engineering and Land Surveying 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

(147 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

(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
(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

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)

Course	Title	Credit-Hours
	Technical Elective Course (*)	3
	Technical Elective Course (*)	3

(*) 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 a Land Surveying (SURV) course approved by the Department Head; or a Geomatic Science (GEOM) 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.

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

ENVIRONMENTAL 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 Lab	0
CEE 1010	Engineering Graphics for Civil and Environmental Engineers	4
	Total	**12**

1st Year - 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
ENVE 1011	Introduction to Environmental Engineering	1
	Total	**14**

1st Year - 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
	Total	**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 2310	Algorithms, Programming, and Numerical Analysis	3
CEE 2311	Algorithms, Programming, and Numerical Analysis Laboratory	1
	Total	**14**

2nd Year - 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 2210	Probability and Statistics for Civil and Environmental Engineers	3
	Total	**12**

2nd Year - 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
	Total	**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
	Total	**12**

3rd Year - 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
	Total	**12**

3rd Year - 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
	Total	**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
	Total	**10**

4th Year - 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
	Total	**11**

4th Year - 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
	Total	**12**

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 an 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.

Student Outcomes

Graduates of the Land Surveying and Mapping Program will have:

1. An ability to apply knowledge of mathematics, science and Applied Sciences.
2. An ability to design and conduct experiments, as well as to analyze and interpret data.
3. An ability to design a system, component or process to meet the desired needs.
4. An ability to function on multi-disciplinary teams.
5. An ability to identify, formulate, and solve applied sciences problems.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.
8. The broad education necessary to understand the impact of surveying solutions in a global and social context.
9. Recognition of the need for, and the ability to engage in lifelong learning.
10. Knowledge of contemporary issues.

11. 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's 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 Department of Civil & Environmental Engineering and Land Surveying offers undergraduate courses leading to the degree of Bachelor of Science in Land Surveying and Mapping (BSLS). In order to get this degree, the student must complete the following minimum requirements:

Minimum Graduation Requirements

4	Credit-hours in Mathematics
9	Credit-hours in Basic Sciences
18	Credit-hours in Socio-Humanistic Studies and Languages
9	Credit-hours in Engineering Science and Management
33	Credit-hours in Surveying
38	Credit-hours in Geomatic Sciences
6	Credit-hours in Department Electives
3	Credit-hours in Free Elective
120	**Total Credit-hours**

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 120 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	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 Land Surveying and Mapping Program 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 the use of our equipment is acquired in the field.

Student Organizations

Students enrolled in the Department can become members of the student chapter of the Institute of Land Surveyors of the College of Engineers and Land Surveyors of Puerto Rico.

LAND SURVEYING AND MAPPING CURRICULUM

(120 Credit-Hours)

Mathematics Component

(4 Credit-Hours)

Course	Title	Credit-Hours
MATH 1350	Calculus I	4

Science Component

(9 Credit-Hours)

Course	Title	Credit-Hours
SCIE 1210	Chemistry Principles	4
SCIE 1211	Chemistry Principles Laboratory	0
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1

Socio-Humanistic Studies and Languages Component

(18 Credit-Hours)

Course	Title	Credit-Hours
SOHU 2010	Socio-Humanistic Studies	3
SOHU 2020	Socio-Humanistic Studies II	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English and Communication	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SPAN 2020	Business Spanish	3

Engineering Science and Management Component

(9 Credit-Hours)

Course	Title	Credit-Hours
ENGI 2260	Engineering Economics	3
CEE 2110	Engineering Geology	3
CE 3520	Construction Project Management	3

Land Surveying Component

(33 Credit-Hours)

Course	Title	Credit-Hours
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 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 4404	Construction Surveying	3

Geomatic Sciences Component
(38 Credit-Hours)

Course	Title	Credit-Hours
GEOM 2102	Introduction to Geomatics	3
GEOM 2800	Information Systems for Land 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 4104	Dendrology	3
GEOM 4108	Senior Project I	1
GEOM 4109	Senior Project II	3
GEOM 4510	Global Positioning System	3
GEOM 4610	Land Development	3
GEOM 5614	Cadastral and Land Information Systems	3

Elective Component
(9 Credit-Hours)

Course	Title	Credit-Hours
	Department Elective Course (*)	3
	Department Elective Course (*)	3
	Free Elective	3

(*) Department Elective Course: any Land Surveying (SURV) elective course; or any Geomatic Sciences (GEOM) elective course; or any Real Estate Appraisal (REA) elective course; 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.

Land Surveying Elective Courses

Course	Title	Credit-Hours
SURV 2304	Legal Aspects in Surveying II	3

Geomatic Sciences Elective Courses

Course	Title	Credit-Hours
GEOM 4504	Surveying Space Techniques	3
GEOM 4612	The Municipal Reform Legal System	3
GEOM 4702	Introduction to Remote Sensing & Image Interpretation	3
GEOM 5600	Geospatial Information Science Fundamentals	4
GEOM 5616	GIS for Site Design	3
GEOM 5624	Special Topics in Geomatic	3

LAND SURVEYING AND MAPPING PROGRAM CURRICULUM SEQUENCE

First Year

First Quarter

Course	Title	Credit-Hours
MATH 1350	Calculus I	4
ENGL 1010	The Study of the Essay as Literary Genre	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
GEOM 2102	Introduction to Geomatics	3
	Total	**13**

1st Year - Second Quarter

Course	Title	Credit-Hours
SCIE 1210	General Chemistry I Principles	4
SCIE 1211	General Chemistry Laboratory	0
SOHU 2010	Socio-Humanistic Studies	3
GEOM 2800	Information Systems for Land Surveyors	3
	Free Elective	3
	Total	**13**

1st Year - Third Quarter

Course	Title	Credit-Hours
SURV 2202	Surveying Analysis	3
ENGI 2260	Engineering Economics	3
SPAN 2020	Business Spanish	3
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
	Total	**14**

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
GEOM 3604	Cartographic Design	3
SOHU 2020	Socio-humanistic Studies II	3
	Total	**13**

2nd Year - 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 3502	Fundamentals of Geodesy	3
GEOM 3606	Digital Cartography	3
	Total	**13**

2nd Year - Third Quarter

Course	Title	Credit-Hours
SURV 3402	Route Surveying	4
SURV 3403	Route Surveying Laboratory	0
GEOM 3608	Geographic Information Systems	3
GEOM 4510	Global Positioning Systems	3
ENGL 2020	Business English and Communication	3
	Total	**13**

Summer

Course	Title	Credit-Hours
SURV 3308	Surveying Practice	3
	Total	**3**

Third Year

First Quarter

Course	Title	Credit-Hours
SURV 3204	Analysis & Adjustment of Survey Measurements	3
GEOM 4610	Land Development	3
SURV 3804	Computer Applications for Land Surveyors	3
GEOM 4104	Dendrology	3
	Total	**12**

3rd Year - Second Quarter

Course	Title	Credit-Hours
SURV 4404	Construction Surveying	3
GEOM 3702	Elements of Photogrammetry	4
GEOM 3703	Elements of Photogrammetry Laboratory	0
CEE 2110	Engineering Geology	3
GEOM 4108	Senior Project I	1
CE 3520	Construction Project Management	3
	Total	**14**

3rd Year - Third Quarter

Course	Title	Credit-Hours
	Dept. Elective	3
	Dept. Elective	3
GEOM 5614	Cadastral & Land Information Systems	3
GEOM 4109	Senior Project II	3
	Total	**12**

COURSE DESCRIPTIONS

General Engineering Courses

ENGI 2110 – ENGINEERING MECHANICS-STATICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH 1360 and SCIE 1430. Corequisite: MATH 1370

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.

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 a 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 2350, CEE 2310 and CEE 2311

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 1370 and CE 1011 or ENVE 1011

An introduction to programming and algorithms applied to the 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.

CEE 2311 – ALGORITHMS, PROGRAMMING, AND NUMERICAL ANALYSIS LABORATORY
One credit-hour. Two two-hour lecture and laboratory periods per week. Prerequisites: MATH 1370 and CE 1011 or ENVE 1011. 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, creative problem solving, and teamwork. Introduction to design issues and practices in the profession. The course includes several design cases. The different areas of Civil Engineering will be discussed, including Structural Engineering, Geotechnical Engineering, Transportation Engineering, Water Resources, Environmental Engineering, and Construction Engineering and Management. Ethical issues will be analyzed.

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, masonry, 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 with 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. Prerequisite: ENGI 2120

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.

CE 3120 – STRUCTURAL ANALYSIS II
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: CE 3110, CEE 2310 and CEE 2311. Corequisite: CE 3121

Analysis of statically indeterminate structures by the Stiffness Method and by the Moment Distribution Method. Determination of deflections using Virtual Work Method. Computer Assisted Structural Analysis.

CE 3121 – STRUCTURAL ENGINEERING LABORATORY
One credit-hour. Two two-hour lecture and laboratory periods per week. Prerequisites: CE 3110, CEE 2310 and CEE 2311. 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

In this course the management process and application of controls in construction projects are discussed. Topics include project administration, organizations, project costs estimates, bidding of contracts and awards, claim and dispute resolution, planning and scheduling techniques, labor relations, 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. Design of spread rectangular footings, combined and strap footings, wall footings, retaining walls, and pile caps.

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

Study of fundamental concepts of environmental engineering applied to civil engineering. 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

In this course technical aspects of the construction process are discussed, and how they can be assessed. Construction methods for heavy and building construction will be compared. Students will learn how to calculate and measure equipment and worker productivity. 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 essential 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. Post tensioning. 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 5516 – CONSTRUCTION PROJECT ADMINISTRATION
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: CE 3520

This course discusses the project lifecycle and the corresponding administration strategies, as well as the project procedures and documents, as developed by American Institute of Architects and the Engineers Joint Contract Documents Committee. It also addresses practical issues related to negotiations, claims, value engineering, safety, risk allocation, and liability.

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. Include 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 microbiological characteristics: fecal and total coliform. Meteorological factors measurements.

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 include Jar test using different coagulants, Air quality measurements and analysis: $CO2$, CO, NOx, and SOx the physical characterization of solid wastes, the measurement of chemical properties of soils, activated carbon adsorption, and magnetic carbon preparation, primary and tertiary wastewater treatment tanks design. Experiments on electrocoagulation are designed. Noise pollution tests and metal measurement in water.

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.

Land Surveying Courses

SURV 2095 – PRINCIPLES OF SURVEYING FOR ENGINEERS LAB ENGINEERS
One credit-hour. Three hours per week and field laboratory. Prerequisites: ENGI 1140, ENGI 2210

Through conferences and field practices, the student will learn the basic surveying concepts applicable for route design and construction of route.

SURV 2202 – SURVEYING ANALYSIS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1340

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

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 2302 – FUNDAMENTALS OF SURVEYING
Four credit-hours. Two two-hour lecture periods per week. Prerequisites: SURV 2202 and MATH 1350. Corequisite: SURV 2303

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 and MATH 1350. Corequisite: SURV 2302

Laboratory practice of land surveying related to course SURV 2302. The practices will concentrate on 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
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: SURV 2300

Aspects of Local legal system related to the professional Surveyor practice. Ethical principles in the surveying profession. Surveying permit regulations applicable.

SURV 2802 – VISUALIZATION OF SPATIAL INFORMATION
Three credit- hours. Two two-hour lecture periods per week. Prerequisites: 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 of 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. Prerequisites: SURV 3402 and SURV 3403

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. Prerequisites: 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. Prerequisites: 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. Prerequisites: SURV 2302, SURV 2303, SURV 2802

Computer applications used for the land surveying professional practice. Computer drafting.

SURV 4404 – CONSTRUCTION SURVEYING
Three credit-hours. Two two-hour lecture periods per week and field laboratory. Prerequisites: SURV 3402, SURV 3204

Principles of construction surveying as used in various types of construction projects.

Geomatic Sciences Courses

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. The course will place special attention to the design, development and management of databases either for office management or Geographic Information Systems.

GEOM 3502 – FUNDAMENTALS OF GEODESY
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SURV 2302 and 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. Prerequisites: GEOM 3606 (Minimum C), SURV 2302 and 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. Prerequisites: SURV 3306 and SURV 3307. Corequisite: 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. Prerequisites: SURV 3306 and SURV 3307. Corequisite: GEOM 3702
Laboratory practice for the GEOM 3702: Elements of Photogrammetry course.

GEOM 4104 – DENDROLOGY
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SURV 2302 and 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 4109 – SENIOR PROJECT II
Four credit-hours. Two two-hour lecture periods per week. Prerequisites: GEOM 4108 and 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 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. Prerequisite: 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 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 emphasizes 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. Prerequisites: 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-hour 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 it the 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 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.

DEPARTMENTAL FACULTY

ALSAADI, BALHAN ALTAYEB – Professor; PhD in Civil Engineering, Polytechnic University of Madrid, Spain, 1988; MSCE and BSCE, Trian Vuia Polytechnic Institute, Timisoara, Romania, 1984. E-mail: balsaadi@pupr.edu

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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 in San Juan and Orlando Campuses 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 communications systems. Students in the Electric Power area of interest are required to take 25 credit-hours from the required area courses and six 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 seven 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 PR or USA integrating rapidly to changing job demands, and gradually obtaining leadership positions.
2. Hold positions of increasing responsibility in an electrical engineering field or related area, demonstrating professional competence and ethical behavior.
3. Contribute to their organization or discipline as an active member of a professional team or as a technical liaison in a bilingual (Spanish-English) environment.
4. Continue their professional development through independent learning, involvement in advanced professional studies in electrical engineering or related areas or enrolling in graduate school.

Student Outcomes
By the time of graduation, students of the Electrical Engineering program at PUPR are expected to have attained the following:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

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 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 four 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 a.m. to 10:30 p.m., Monday through Thursday, and from 8:00 a.m. to 5:00 p.m. 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 and skills will be required to take some of these 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:

a. Electrical Engineering Student Chapter of the board that locally enrolls licensed engineers.
b. 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
3	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 Communication	3
SOHU	2010	Socio-Humanistic Studies	3
SOHU	2040	Ethics, Global and Contemporary Issues	3
SOHU	XXXX	Socio-Humanistic Elective	3
SPAN	1010	Linguistic Analysis of Literary Genres	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 Conversion 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 three credit-hours, except electrical engineering courses offered as service course for non-electrical engineering students.

Program Technical Electives Component
Communications, Signals & Controls Engineering
(Must take 31 Credit-Hours)

Must select seven credit-hours in required courses in the area of interest “Communications, Signals & Controls”, 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 eight credit-hours of design.

Required Area Courses
(Must take seven credit-hours)

Course		Title	Credit-Hours
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)

Course		Title	Credit-Hours
CECS	3302	Data Communications	3
COE	3302	Digital System Design with VHDL	3
COE	4320	Computer Architecture	4
COE	4321	Computer Architecture Laboratory	0
COE	4340	Microcomputer Interfacing	4
COE	4341	Microcomputer Interfacing Laboratory	0
COE	4350	Embedded & Cyber-Physical System Design	3
COE	4351	Embedded & Cyber-Physical System Design Laboratory	1
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	4010	Electromagnetics Theory II	3
EE	4030	Electromagnetic Compatibility (EMC/EMI)	3
EE	4031	Electromagnetic Compatibility (EMC/EMI) Laboratory	1
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	4640	Avionics Systems	3
EE	4706	Fiber Optics System 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 Systems III	3
EE	4902	Undergraduate Research in Electrical Engineering	3
EE	4904	Undergraduate Research in Electrical Engineering II	3
EE	4911	Electrical Engineering Seminar I	1
EE	4912	Electrical Engineering Seminar II	1
EE	4990/4991	Special Topics in Electrical Engineering	3
MATH	2360	Linear Algebra	3

Note: Availability of courses EE 4902, EE 4904 and EE 4990, EE 4991, as well as CS 4990, and COE 4990 for the Electrical Engineering Program students, will be determined by the department head, depending on the specific teaching or research topic.

Program Technical Electives Component
Electric Power Engineering
(Must take 31 Credit-Hours)

Must select all 25 credit-hours of required courses in this area of interest “Electric Power Courses, and other six 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 eight 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.

Required Area Courses
(Must take 25 Credit-Hours)

Course		Title	Credit-Hours
EE	2410	Electromechanical Energy Conversion II	3
EE	2411	Electromechanical Energy Conversion II Laboratory	1
EE	3420	Power Systems Analysis I	3
EE	3440	Electric System Design I	3
EE	3610	Automation Engineering	3
EE	3611	Automation Engineering Laboratory	1
EE	4400	Power Systems Analysis II	3
EE	4401	Power Systems 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 six credits, at least three credits in 4XXX Level Courses)

Course		Title	Credit-Hours
COOP	3010	Professional Practice	3
EE	3220	Software Applications for Electrical Engineering	3

EE	4422	Electric Power Quality	3
EE	4442	Lighting Fundamentals Design	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	4904	Undergraduate Research in Electrical Engineering II	3
EE	4911	Electrical Engineering Seminar I	1
EE	4912	Electrical Engineering Seminar II	1
EE	4990/4991	Special Topics in Electrical Engineering	3

Note: Availability of courses EE 4902, EE 4904 and EE 4990, EE 4991, as well as CS 4990, and COE 4990 for the Electrical Engineering Program students, will be determined by the department head, depending on the specific teaching or research topic.

ELECTRICAL ENGINEERING PROGRAM CURRICULUM SEQUENCE

(144 Credit-Hours)

First Year

1st Year - First Quarter

Course		Title	Credit-Hours
MATH	1350	Calculus I	4
SPAN	1010	Linguistic Analysis of Literary Genres	3
ENGL	1010	The Study of the Essay as a Literary Genre	3
EE	1130	Freshman Design for Electrical & Computer Engineers	3
		Total	13

1st Year - 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
		Total	13

1st Year -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
		Total	13

Second Year

2nd Year - First Quarter

Course		Title	Credit-Hours
MATH	2350	Differential Equations	3
EE	2000	Circuit Analysis	3

CECS	2202	Computer Programming I	4
CECS	2203	Computer Programming I Laboratory	0
SPAN	2020	Business Spanish	3
		Total	13

2nd Year - 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
		Total	12

2nd Year - Third Quarter

Course		Title	Credit-Hours
EE	2001	Electrical Measurements Laboratory	1
EE	2400	Electromechanical Energy Conversion I	3
EE	2500	Electronics I	3
SOHU	2040	Ethics, Global and Contemporary Issues	3
ENGL	2020	Business English and Communication	3
		Total	13

Third Year
(Only for Students in Electric Power Interest Area)

3rd Year - First Quarter

Course		Title	Credit-Hours
EE	3520	Electronics II	3
EE	2401	Electromechanical Energy Conversion I Laboratory	1
EE	3420	Power Systems Analysis I	3
EE	2410	Electromechanical Energy Conversion II	3
EE	3002	Signals & Systems	3
		Total	13

3rd Year - Second Quarter

Course		Title	Credit-Hours
ENGI	2910	Engineering Mechanics, Statics & Dynamics	3
EE	2411	Electromechanical Energy Conversion II Laboratory	1
EE	3521	Electronics Laboratory	1
EE	3440	Electric System Design I	3
EE	3600	Automatic Controls	3
		Total	11

3rd Year - Third Quarter

Course		Title	Credit-Hours
ENGI	3440	Thermo-Fluids	3
EE	4400	Power Systems Analysis II	3
EE	4401	Power Systems Analysis Laboratory	1
COE	2300	Logic Circuits	3
COE	2301	Logic Circuits Laboratory	1
		Total	11

Fourth Year

4th 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
		Total	13

4th Year - Second Quarter

Course		Title	Credit-Hours
EE	4002	Capstone Design Course I	3
EE	4433	Power System Protection Laboratory	1
XXXX	XXXX	Free Elective	3
EE	XXXX	EE Electric Power Technical Elective	3
SOHU	XXXX	Socio-Humanistic Elective	3
		Total	13

4th Year - Third Quarter

Course		Title	Credit-Hours
EE	4022	Capstone Design Course II	3
EE	XXXX	EE Elective Power Technical Elective	3
		Total	6

Third Year
(Only for Students in Communications, Signals & Controls Interest Area)

3rd Year - First Quarter

Course		Title	Credit-Hours
EE	3520	Electronics II	3
EE	2401	Electromechanical Energy Conversion I Laboratory	1
COE	2300	Logic Circuits	3
COE	2301	Logic Circuits Laboratory	1
EE	3002	Signals & Systems	3
		Total	11

3rd Year - 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
		Total	13

3rd Year - Third Quarter

Course		Title	Credit-Hours
ENGI	3440	Thermo-Fluids	3
ENGI	2260	Engineering Economics	3
EE	3521	Electronics Laboratory	1
EE	3700	Communication & Wireless Systems I	3
EE	XXXX	EE Communications, Signals & Controls Technical Elective	3
		Total	13

Fourth Year

4th Year - First Quarter

Course		Title	Credit-Hours
XXXX	XXXX	Free Elective	3
EE	XXXX	EE Communications, Signals & Controls Technical Elective	9
		Total	12

4th Year - Second Quarter

Course		Title	Credit-Hours
EE	4002	Capstone Design Course I	3
EE	XXXX	EE Communications, Signals & Controls Technical Elective	9
		Total	12

4th Year - Third Quarter

Course		Title	Credit-Hours
EE	4022	Capstone Design Course II	3
EE	XXXX	EE Communications, Signals & Controls Technical Elective	3
		Total	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 with VHDL
COE	3320	Microprocessors
COE	3321	Microprocessors Laboratory
COE	4320	Computer Architecture
COE	4321	Computer Architecture Laboratory
COE	4340	Microcomputer Interfacing
COE	4341	Microcomputer Interfacing Laboratory
COE	4350	Embedded & Cyber-Physical System Design
COE	4351	Embedded & Cyber-Physical System Design Laboratory

Electrical Engineering Courses
(Go to the ECECS Department Courses for the Description)

EE	1130	Freshman Design for Electrical & Computer Engineers
EE	2000	Circuit Analysis I
EE	2001	Electrical Measurements Laboratory
EE	2010	Computational Methods in Electrical & Computer 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	Communication & Wireless Systems I
EE	3710	Random Processes
EE	4002	Capstone Design Course I
EE	4010	Electromagnetics Theory II
EE	4022	Capstone Design Course II
EE	4030	Electromagnetic Compatibility (EMC/EMI)
EE	4031	Electromagnetic Compatibility (EMC/EMI) Laboratory
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	4442	Lighting Fundamentals 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 Engineering Design Laboratory
EE	4630	Selected Topics in Control
EE	4640	Avionics Systems
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 Digital Signal Processing
EE	4730	Radio Frequency Circuit Design
EE	4740	Communication & Wireless Systems III
EE	4902	Undergraduate Research in Electrical Engineering
EE	4904	Undergraduate Research in Electrical Engineering II
EE	4911	Electrical Engineering Seminar I
EE	4912	Electrical Engineering Seminar II
EE	4990/4991	Special Topics in Electrical Engineering

Other Department Courses
(Go to the Mathematics and Sciences Department Courses for the Description)

MATH 2360 Linear Algebra

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 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 graduate studies."

Program Educational Objectives

The 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/or graduate studies.

Student Outcomes

By the time of graduation, students of the Computer Engineering program at PUPR are expected to have attained the following:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

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 21st 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 for 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 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 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 for engineering courses, but two summer sessions for arts and sciences courses. Fall, winter and spring classes are scheduled from 8:00 a.m. to 10:30 p.m., Monday through Thursday, and from 8:00 a.m. to 5:00 p.m. on Fridays and Saturdays. Students are required to make-up class contact hours lost because of holidays.

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 and skills will be required to take some of these 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 computer 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
9	Credit-hours in Engineering Sciences
81	Credit-hours in Basic Computer Engineering Component
6	Credit-hours in Computer Engineering Program Electives
3	Credit-hours in Free 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 Communication	3
SOHU	2010	Socio-Humanistic Studies	3
SOHU	2040	Ethics, Global and Contemporary Issues	3
SOHU	XXXX	Socio-Humanistic Elective	3
SPAN	1010	Linguistic Analysis of Literary Genres	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

Computer Engineering Core Component
(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 Course I	3
COE	4022	Capstone Design Course II	3
COE	4320	Computer Architecture	4
COE	4321	Computer Architecture Laboratory	0
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 Laboratory	1
EE	2010	Computational Methods in Electrical & Computer Engineering	3
EE	2020	Circuit Analysis II	3
EE	2500	Electronics I	3
EE	3002	Signals & Systems	3
EE	4720	Digital Signal Processing	3

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
CECS	4911	Computer Engineering Seminar I	1
CECS	4912	Computer Engineering Seminar II	1
COE	4350	Embedded & Cyber-Physical Systems Design	3
COE	4351	Embedded & Cyber-Physical Systems Design Laboratory	1
COE	4902	Undergraduate Research in Computer Engineering	3
COE	4904	Undergraduate Research in Computer Engineering II	3
COE	4990	Special Topics in Computer 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	3
EE	3710	Random Processes	3
EE	4620	Robotic Engineering Design	4
EE	4621	Robotic Engineering Design Laboratory	0
EE	4640	Avionics Systems	3
EE	4722	Real Time Digital Signal Processing	3
MGMT	4660	Entrepreneurship	3

Notes: A student is required to select six 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, COE 4904 and COE 4990, as well as CS 4990, EE 4990, and EE 4991, 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)

Select 3 credit-hours of free electives in any area

COMPUTER ENGINEERING PROGRAM CURRICULUM SEQUENCE

(149 Credit-Hours)

First Year

1st Year - First Quarter

Course		Title	Credit-Hours
MATH	1350	Calculus I	4
SPAN	1010	Linguistic Analysis of Literary Genres	3
ENGL	1010	The Study of the Essay as a Literary Genre	3
EE	1130	Freshman Design for Electrical & Computer Engineers	3
		Total	13

1st Year - Second Quarter

Course		Title	Credit-Hours
MATH	1360	Calculus II	4
CECS	2004	Discrete Structures	3
SCIE	1210	Principles of Chemistry	4
SCIE	1211	Principles of Chemistry Laboratory	0
		Total	11

1st Year - Third Quarter

Course		Title	Credit-Hours
MATH	1370	Calculus III	4
SCIE	1430	Physics I	4
SCIE	1431	Physics I Laboratory	1
CECS	2200	Computer Programming Fundamentals	1
SOHU	2010	Socio-Humanistic Studies	3
		Total	13

Second Year

2nd 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
		Total	12

2nd Year- 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	Engineering Mechanics, Statics & Dynamics	3
		Total	13

2nd Year- Third Quarter

Course		Title	Credit-Hours
SOHU	2040	Ethics, Global and Contemporary Issues	3
EE	2020	Circuit Analysis II	3
EE	2001	Electrical Measurements Laboratory	1
CECS	3212	Data Structures	3
EE	2500	Electronics I	3
		Total	13

Third Year

3rd 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
		Total	13

3rd Year - 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 and Communication	3
		Total	13

3rd Year - Third Quarter

Course		Title	Credit-Hours
CECS	4204	Software Engineering	3
COE	4320	Computer Architecture	4
COE	4321	Computer Architecture Laboratory	0
ENGI	2260	Engineering Economics	3
EE	2010	Computational Methods in Electrical & Computer Engineering	3
		Total	13

Fourth Year

4th Year- First Quarter

Course		Title	Credit-Hours
CECS	4230	Operating Systems	3
COE	4340	Microcomputer Interfacing	4
COE	4341	Microcomputer Interfacing Laboratory	0
SOHU	XXXX	Socio-Humanistic Elective	3
EE	3002	Signals & Systems	3
		Total	13

4th Year- Second Quarter

Course		Title	Credit-Hours
COE	4002	Capstone Design Course 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
		Total	13

4th Year- Third Quarter

Course		Title	Credit-Hours
COE 4022		Capstone Design Course II	3
CECS/ COE	XXXX	Computer Engineering Technical Elective	3
XXXX	XXXX	Free Elective	3
		Total	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 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
CECS	4911	Computer Engineering Seminar I
CECS	4912	Computer Engineering Seminar 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 Course I
COE	4022	Capstone Design Course 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	4350	Embedded & Cyber-Physical Systems Design
COE	4351	Embedded & Cyber-Physical Systems Design Laboratory
COE	4902	Undergraduate Research in Computer Engineering
COE	4904	Undergraduate Research in Computer Engineering II
COE	4990	Special Topics in Computer Engineering

Electrical Engineering Courses

(Go to the ECECS Department Courses for the Description)

EE	1130	Freshman Design for Electrical and Computer Engineers
EE	2000	Circuit Analysis I
EE	2001	Electrical Measurements Laboratory
EE	2010	Computational Methods in Electrical & Computer Engineering
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 Engineering Design Laboratory
EE	4640	Avionics Systems
EE	4720	Digital Signal Processing
EE	4722	Real Time Digital Signal Processing

Other Department Courses

(Go to the Business Administration Department Courses for the Description)

MGMT	4660	Entrepreneurship

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, and develop business information systems for various industries, including finance and health care, support wide-area, local, and cellular networks, and design embedded computer-controlled products.

The computer science program is a flexible curriculum 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

Within a few years of graduation, graduates from the Computer Science Program will be able to:

1. Participate as key team members in the creation of robust and usable solutions to complex computing problems in any domain.
2. Participate as computer science professionals in leadership positions using appropriate communication skills, contextual awareness and ethical standards.

3. Perform as entrepreneurs, computer consultants, or providers of computing services and solutions.
4. Stay at the forefront of technological change and innovation by pursuing graduate studies, participating in professional organizations, and/or engaging in self-learning.

Student Outcomes

Graduates of the program will have an ability to:

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
6. Apply computer science theory and software development fundamentals to produce computing-based solutions.

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 Interfacing, Computer Architecture, Computer Networks, Real Time Digital Signal Processing, and Fundamentals of Digital Signal Processing.

Student Organizations

The students enrolled in the department may become members of the following professional and student organizations: ACM (Association for Computing Machinery) – is the world's first education 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

14	Credit-hours in Mathematics
14	Credit-hours in Basic Sciences
18	Credit-hours in Socio-Humanistic Studies and Languages
3	Credit-hours in Engineering Sciences
58	Credit-hours in Computer Science Core Component
6	Credit-hours in Computer Science Program Electives
6	Credit-hours in Free Electives
3	Credit-hours in Management
122	**Total Credit-hours**

COMPUTER SCIENCE CURRICULUM

(122 Credit-Hours)

Mathematics Component

(14 Credit-Hours)

Course		Title	Credit-Hours
MATH	1330	Precalculus I	3
MATH	1340	Precalculus II	3
MATH	1350	Calculus I	4
MATH	1360	Calculus II	4

Basic Sciences Component

(14 Credit-Hours)

Course		Title	Credit-Hours
SCIE	1110	General Biology	4
SCIE	1111	General Biology 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

(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	3
SOHU	2040	Ethics, Global and Contemporary Issues	3
SPAN	1010	Linguistic Analysis of Literary Genres	3
SPAN	2020	Business Spanish	3

Engineering Sciences Component

(3 Credit-Hours)

Course		Title	Credit-Hours
ENGI	2270	Engineering Probability & Statistics	3

Management Courses
(3 Credit-Hours)

Course		Title	Credit-Hours
MGMT	4660	Entrepreneurship	3

Computer Science Core Component
(58 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	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 Laboratory	1
CS	2302	Digital Logic for CS Majors	3
CS	3010	Numerical Analysis for CS Majors	3
CS	3300	Computer Architecture for CS Majors	3
CS	4002	Computer Science Project I	3
CS	4022	Computer Science Project II	3

Computer Science Technical Electives
(Must take 6 credits in technical electives to complete graduation requirements)

Course		Title	Credit-Hours
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	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
CECS	4911	Computer Engineering Seminar I	1
CECS	4912	Computer Engineering Seminar II	2
COOP	3010	Professional Practice	3
CS	4902	Undergraduate Research in Computer Science	3
CS	4904	Undergraduate Research in Computer Science II	3

CS	4990	Special Topics in Computer Science	3
MGMT	1010	Introduction to Management	3

Notes: A student is required to select six 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, CS 4904 and CS 4990, as well as COE 4990 for the Computer Science Program students will be determined by the Department Chairman, depending on the specific teaching or research topic.

Free Electives

(6 Credit-Hours)

Select 6 credit-hours of free electives in any area

COMPUTER SCIENCE PROGRAM CURRICULUM SEQUENCE

(122 Credit-Hours)

First Year

1st Year - First Quarter

Course		Title	Credit-Hours
MATH	1330	Precalculus I	3
SPAN	1010	Linguistic Analysis of Literary Genres	3
ENGL	1010	The Study of the Essay as a Literary Genre	3
SOHU	2010	Socio-Humanistic Studies	3
CECS	2200	Computer Programming Fundamentals	1
		Total	13

1st Year - Second Quarter

Course		Title	Credit-Hours
MATH	1340	Precalculus II	3
CECS	2202	Computer Programming I	4
CECS	2203	Computer Programming I Laboratory	0
SCIE	1110	General Biology	4
SCIE	1111	General Biology Laboratory	0
CECS	2004	Discrete Structures	3
		Total	14

1st Year - Third Quarter

Course		Title	Credit-Hours
MATH	1350	Calculus I	4
CECS	2222	Computer Programming II	4
CECS	2223	Computer Programming II Laboratory	0
CS	2302	Digital Logic for CS Majors	3
		Total	11

Summer – First Year

Course		Title	Credit-Hours
ENGL	2020	Business English and Communication	3
XXXX	XXXX	Free Elective	3
		Total	6

Second Year

2nd 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	Entrepreneurship	3
		Total	13

2nd Year - Second Quarter

Course		Title	Credit-Hours
SCIE	1430	Physics I	4
SCIE	1431	Physics I Laboratory	1
CECS	3210	Advanced Programming	3
CECS	4200	Programming Languages	3
		Total	11

2nd Year - 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 Laboratory	1
		Total	11

Summer – Second Year

Course		Title	Credit-Hours
SPAN	2020	Business Spanish	3
XXXX	XXXX	Free Elective	3
		Total	6

Third Year

3rd 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
		Total	12

3rd Year - Second Quarter

Course		Title	Credit-Hours
CS	3010	Numerical Analysis for CS Majors	3
CS	4002	Computer Science Project I	3
CECS	4230	Operating Systems	3
CECS	XXXX	CS Technical Elective	3
		Total	12

3rd Year - 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 Laboratory	1
CECS	XXXX	CS Technical Elective	3
		Total	13

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 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
CECS	4911	Computer Engineering Seminar I
CECS	4912	Computer Engineering Seminar 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	4904	Undergraduate Research in Computer Science II
CS	4990	Special Topics in Computer Science

Computer Engineering Courses

(Go to the ECECS Department Courses for the Description)

COE	4330	Computer Networks
COE	4331	Computer Networks Laboratory

Other Department Courses

(Go to the Business Administration Department Courses for the Description)

MGMT 4660 Entrepreneurship

COURSE DESCRIPTIONS – ECECS DEPARTMENT

Electrical Engineering Courses

EE 1130 – FRESHMAN DESIGN FOR ELECTRICAL & COMPUTER ENGINEERS
Three Credit-hours. Two two-hour lectures per week. Prerequisite: 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. Prerequisites: SCIE 1440, MATH 1360. For EE & CpE Students Only: CECS 2200. For ME Students Only: ME 2010. Corequisite: MATH 2350. For BME Students Only: BME 3010.

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, EE2000.

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. Corequisite: SCIE 1440.

Gaussian Elimination, Linear Equations, Orthogonal Projections, Least-Squares & Eigenvalue Problems, Applied Numerical Analysis. Approximations and Errors. Numerical Solution of Linear and Nonlinear Algebraic Equations, introduction to ODE (ordinary differential equations,) Numerical solution of energy storage 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.

This course exposes students to the fundamental laws of electro-static and magneto-static fields. The course also deals with the Maxwell's equations describing time-varying electric and magnetic fields with emphasis on Faraday's Law of Magnetic Induction.

EE 2400 – ELECTROMECHANICAL ENERGY CONVERSION I
Three credit-hours. Two two-hour lectures per week. Prerequisites: EE 2000, EE 2030. Corequisite: 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. Prerequisite: 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. Corequisite: 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. Prerequisite: 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. Prerequisite: EE 2400. Corequisite: 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. Prerequisite: COE 2300. Corequisite: 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. Prerequisite: COE 2301. Corequisite: 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.

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. Antennas for AM, FM and PM transceivers.

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. Prerequisite: 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 4010 – ELECTROMAGNETICS THEORY II
Three credit-hours. Two two-hour lectures per week. Prerequisite: EE 2030.

Review of Maxwell's Equations for non-time-varying electromagnetic fields. Study of time-varying electromagnetic fields. Study of Uniform Plane Wave Propagation in lossless, lossy, bounded, and unbounded material media. Study of Transmission Lines Theory.

EE 4022 – CAPSTONE DESIGN COURSE II
Three credit-hours. Two two-hour meetings per week. Prerequisite: 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 4030 – ELECTROMAGNETIC COMPATIBILITY (EMC/EMI)
Three credit-hours. Two two-hour meetings per week. Prerequisites: EE 2500, EE 3002, EE 4010.

Study of various aspects of Electromagnetic Compatibility including history, products requirements, as well as fundamental design principles, ramifications, and considerations. Understanding the role of Electromagnetic Compatibility in suppressing Electromagnetic Interference.

EE 4031 – ELECTROMAGNETIC COMPATIBILITY (EMC/EMI) LABORATORY
One credit-hour. One four-hour or two two-hour lectures per week. Prerequisites: EE 4030.

Experiments and demonstrations in Electromagnetic Compatibility.

EE 4400 – POWER SYSTEM ANALYSIS II
Three credit-hours. Two two-hour lectures per week. Prerequisite: 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. Prerequisite: EE 3420. Corequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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 4442 – LIGHTING FUNDAMENTALS DESIGN

Three credit-hours. Two two-hour lectures per week. Prerequisite: EE 2410. Corequisite: EE 3420.

Theory of light, sight and vision, language of lighting, light sources, luminaries data, illumination design: interior and exterior; roadway lighting.

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. Corequisite: 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. Corequisite: 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. Prerequisite: EE 4444.

Principles of Project Management applied to case studies of the Electrical Construction Industry, and conforming to NECA, MCAA, & SMAGNA techniques.

EE 4464 – GENERATION CONTROL SYSTEMS
Three credit-hours. Two two-hour lectures per week. Prerequisite: 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. Prerequisite: EE 3600. Corequisite: 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. Prerequisite: EE 3521. Corequisite: 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. Prerequisite: 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 basic components of a control system. Design of single process control systems. Study and design of cascade control systems. Study and design of ratio and feedforward control system. Study of piping and instrumentation diagram (P&ID) standards. Study of process characterization including thermal and mass transfer process. Study and analysis of fundamental PLC-based control system design. Study and analysis of final control elements.

EE 4603 – PROCESS CONTROL & INSTRUMENTATION LABORATORY
One credit-hour. One four-hour or two two-hour lectures per week. Prerequisite: 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 (PLC's).

EE 4612 – CONTROL SYSTEM DESIGN
Three credit-hours. Two two-hour lectures per week. Prerequisite: 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. Prerequisite: EE 3600. Corequisite: 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. Prerequisite: EE 3600. Corequisite: 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. Prerequisite: 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 4640 – AVIONICS SYSTEMS
Three credit-hours. Two two-hour lectures per week. Prerequisite: Department Permit.

This course explains the principles and underlying theory of the core avionic systems in civil and military aircraft, comprising the pilot displays, data entry and control systems, fly by wire flight control systems, inertial sensor and air data systems, navigation systems, autopilots and flight management systems. The implementation and integration of these systems with current (2010) technology is explained together with the methods adopted to meet the very high safety and integrity requirements.

EE 4706 – FIBER OPTICS SYSTEMS DESIGN
Three credit-hours. Two two-hour lectures per week. Prerequisites: EE 3700 or EE 4400.

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. Prerequisite: 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. Intersymbol interference and equalizing. 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. Spread spectrum systems. Overview of the Behavior of digital communication systems in presence of noise (AWGN).

EE 4718 – COMMUNICATION SYSTEMS, SIMULATION & DESIGN
Three credit-hours. Two two-hour lectures per week. Prerequisite: EE 4716.

Simulation and design of analog and digital communications systems. MATLAB, SIMULINK, the COMMUNICATION Toolbox and the Simulink DSP Block-Sets are used to verify and test the designed models. Topics include: Simulation of AM and FM links, Binary and M-ary Baseband and Passband Modulations, Time Division and Frequency Division Multiple Access. Inter Symbol Interference (ISI), Digital Equalization, Raised Cosine Shaping Filter, Spread Spectrum.

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. Corequisite: 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. Prerequisite: EE 4716. Corequisite: EE 3710.

1G-5G wireless standards. Cellular traffic capacity and trunking. Large scale and small-scale radio propagation channels. Review of Propagation Models, Fading. Performance of various modulation/demodulation schemes in fading channels. Fading Mitigation. Orthogonal Frequency Division Multiplexing (OFDM). Multiple-Input Multiple-Output Systems (MIMO). Modems for Wireless Communication. Multiple-Access Techniques in Wireless Communications. Antennas for cellular communications.

EE 4902 – UNDERGRADUATE RESEARCH IN ELECTRICAL ENGINEERING
Three credit-hours Prerequisites: 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 4904 – UNDERGRADUATE RESEARCH IN ELECTRICAL ENGINEERING II
Three credit-hours Prerequisites: Pre-requisites: EE 4902. Departmental Permit.

Extension of 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 4911 –ELECTRICAL ENGINEERING SEMINAR I
One credit-hour. Prerequisites: Departmental Permit.

Topics are limited to those which are not part of content of regular courses offered by the department. Credit-hours earned can fulfill the graduation requirements in Electrical Engineering. It will also serve to stimulate further advanced studies.

EE 4912 –ELECTRICAL ENGINEERING SEMINAR II
Two credit-hours. Prerequisites: Departmental Permit.

Topics are limited to those which are not part of content of regular courses offered by the department. Credit-hours earned can fulfill the graduation requirements in Electrical Engineering. It will also serve to stimulate further advanced studies.

EE 4990 & EE 4991 – 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. Prerequisite: CECS 2200. Corequisite: 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. Prerequisite: EE 2001. Corequisite: 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. Prerequisite: 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. Prerequisite: COE 2300. Corequisite: 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. Prerequisite: COE 2301. Corequisite: COE 3320.

The laboratory provides an introduction to microcontroller systems programming, including both hardware interfacing and software fundamentals.

COE 4002 – CAPSTONE DESIGN COURSE I
Three credit-hours. Two two-hour meetings per week. Prerequisite: 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. Prerequisite: 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. Prerequisite: COE 3320. Corequisite: 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. Prerequisite: COE 3320. Co-requisites: 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.

Using the public Internet as the model, a top-down approach to the data transport conventions from the Application to the Link layer are analyzed, relying on the protocols published by the IETF and IEEE. The course opens with a concise history of the Internet, followed by an introduction to the organizations involved in Internet governance. The socket concept is examined along with the most important Application, Transport, Network, Link layer open protocols. Routing algorithms, IP addressing, and NAT schemes are discussed. The course closes with the discussion of protocols for multimedia networking, network security, and network management. A team design project is required.

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. Prerequisite: COE 3320. Corequisite: COE 4341.

Practical architectural view of microprocessor and detailed description of its interfacing elements. Laboratory assignments place emphasis on embedded system microcontrollers, their machine language and high-level language, 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 lectures per week. Prerequisite: COE 3320. Co-requisites: 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 4350 – EMBEDDED & CYBER-PHYSICAL SYSTEMS DESIGN
Three credit-hours. Two two-hour lectures per week. Prerequisite: COE 3320. Corequisite: COE 4351.

This course introduces students to the design and analysis of embedded systems that interact with physical processes. A major theme of this course is on the interplay of practical design with models of systems, including both software components and physical dynamics. A major emphasis will be on building high confidence systems with real-time and concurrent behaviors.

COE 4351 – EMBEDDED & CYBER-PHYSICAL SYSTEMS DESIGN LABORATORY
One credit-hour. One four-hour or two two-hour lecture periods per week. Prerequisite: COE 3320. Corequisite: COE 4350.

This laboratory introduces students to the design and analysis of embedded systems that interact with physical processes. A major theme of this course is on the interplay of practical design with models of systems, including both software components and physical dynamics. A major emphasis will be on building high confidence systems with real-time and concurrent behaviors.

COE 4902 – UNDERGRADUATE RESEARCH IN COMPUTER ENGINEERING
Three credit-hours. Prerequisite: 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 4904 – UNDERGRADUATE RESEARCH IN COMPUTER ENGINEERING II
Three credit-hours. Prerequisite: COE 4902. Departmental Permit.

Extension of 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. Prerequisite: 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 prepositional 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. Prerequisite: 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. Prerequisite: CECS 2200. Corequisite: 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. Prerequisite: CECS 2200. Corequisite: 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. Prerequisite: CECS 2202. Corequisite: 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. Prerequisite: CECS 2202. Corequisite: 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. Pre-requisites: CECS 2202, 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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. Corequisite: CECS 4202.

The course presents the different phases for the development of software: project planning, object-oriented analysis, design, coding, and testing techniques using the Unified Modeling Language (UML). In addition, some tools to support the development to complete the activities necessary to develop software. Students are required to use what is presented to develop an application (the implementation is optional.)

CECS 4206 – DESIGN AND ANALYSIS OF ALGORITHMS
Three credit-hours. Two two-hour lectures per week. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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.

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.

CECS 4214 – NETWORK SECURITY
Three credit-hours. Two two-hour lectures per week. Prerequisite: 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. Prerequisite: 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. Prerequisite: CECS 2200.

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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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.

CECS 4228 – COMPUTATIONAL THEORY
Three credit-hours. Two two-hour lectures per week. Prerequisite: 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. Prerequisite: 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.

CECS 4911 –COMPUTER ENGINEERING SEMINAR I
One credit-hour. Prerequisites: Departmental Permit.

Topics are limited to those which are not part of content of regular courses offered by the department. Credit-hours earned can fulfill the graduation requirements in Computer Engineering and Computer Science. It will also serve to stimulate further advanced studies.

CECS 4912 –COMPUTER ENGINEERING SEMINAR II
Two credit-hours. Prerequisites: Departmental Permit.

Topics are limited to those which are not part of content of regular courses offered by the department. Credit-hours earned can fulfill the graduation requirements in Computer Engineering and Computer Science. It will also serve to stimulate further advanced studies.

Computer Science Courses

CS 2302 – DIGITAL LOGIC FOR COMPUTER SCIENCE MAJORS
Three credit-hours. Two two-hour lectures per week. Prerequisite: 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. Corequisite: 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. Prerequisite: CECS 3200.

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.

CS 4002 – COMPUTER SCIENCE PROJECT I
Three credit-hours. Two two-hour meetings per week. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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 4904 – UNDERGRADUATE RESEARCH IN COMPUTER SCIENCE II
Three credit-hours. Prerequisite: CS 4902. Departmental Permit.

Extension of 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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 dependent ideal energy sources. Introduction to basic techniques of electrical circuit analysis.

DEPARTMENTAL FACULTY

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INDUSTRIAL AND SYSTEMS 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 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 cycle. 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

The Industrial and Systems Engineering Department is committed to the success of every student. We demonstrate that commitment by providing an educational experience that cultivates excellence and innovation, as well as knowledge and practical experience. Our graduates will acquire fundamental skills, such as critical thinking, leadership, and entrepreneurship to face a competitive, changing and globalized world. And that will help them contribute to the solution of the complex problems of their community and motivated to continue learning throughout their career.

Program Educational Objectives

Within a few years of graduation, PUPR BSIE program graduates are expected to attain the following:

1. Make suitable, innovative and responsible decisions that contribute to the improvement of the systems' overall goals and objectives.
2. Become competent leaders of their profession and role models of their communities.
3. Acquire new knowledge and expertise to stay competitive in industrial and systems engineering and other fields of studies.

Student Outcomes

Our Industrial Engineering students will be demonstrating at graduation time the following student outcomes:

1. An ability to identify, formulate, and solve complex industrial engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively (written and oral) with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in industrial engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Career Opportunities

Manufacturing and service companies in both private and public sectors seek industrial engineering graduates for the 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. In many companies, industrial engineers are contracts as data analysts for their mastery of statistical tools. Practicing industrial engineer serve as transition and integration consultants as well as developers and system architects in the design for productivity and usability of products and services. Industrial engineers, in senior positions, are sought as strategic planners and integration 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 of institution. Often, industrial engineers ultimately become chief executive officers of organizations.

Degree Offered

The Industrial and Systems Engineering Department offers undergraduate instruction leading to the degree of Bachelor of Science in Industrial Engineering (BSIE). 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	**Total Credit-hours**

Industrial Engineering Laboratories

The Industrial and Systems 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.

L-201 – Job Design and Work Measurement: This classroom was re-designed to foster a collaborative and team-work atmosphere where students can sit around different tables as well as enjoy the projection on the current class directly in individual monitors setup for each table. The room is currently dedicated for the job design-related courses and laboratory experience where students are taught key competencies for workstation design, standard development and capacity analysis. It is also equipped with an intelligent podium allowing for video conference presentations, a sound system, and microphones systems. Courses can be recorded and posted in Blackboard platform. It can accommodate up to 25 students. This room is also equipped with a small recording room, where faculty and students alike can develop audiovisual materials to improve their course and assignment contents.

L-202 – Work Design and Human Factors: This engineering classroom has a capacity of 28 students. This laboratory was created 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 and human-workplace integration and process improvement. The laboratory also includes adjustable workstations, ergonomic equipment, sound level meters, light meters, goniometers, and push/pull gauges. A new addition to this laboratory is a layout design for the healthcare industry, particularly an emergency room setting simulating a station for vitals and a station for patient recovery. This simulated environment allows particular discussions for the quality and process improvement topics with specific real-life settings.

L-206 – Operations Management ISE Computer Laboratory: This classroom is designed for 30 students. The Operations Management Laboratory consists of Windows 10 (Office 365) network with thirty (30) Optiplex 8020 personal computers for the student's usage and particular computer-based courses within the ISE curricula. It is based on an open-access environment where students are given the opportunity to work on assignments and work on after-class jobs at their own pace with key industrial engineering software and tools. This laboratory offers the students the opportunity to access specialized software to tackle industrial engineering problems using state-of-the-art technologies.

L-210 - Operations Management ISE Computer Laboratory II: The Software Instruction Laboratory has a capacity for twenty-four (24) students. This lab consists of a Windows 10 network with twenty-four (24) Thin Client Computer (Wise 3040) for student usage. It is based on specific class needs and assignments, where student are requested to manage critical applications and on-class work. This laboratory has the equipment and software required to develop the system analysis, solutions development and decision-making skills of the students as mentioned above. The Laboratory also has a system of four (4) LCD 32 inches TV's, one projector and a simplified podium station.

L-211 – Smart Room ISE (classroom): This room has a capacity of thirty-two (36) seats. This classroom was planned as smart room to provide special presentations and courses. It is equipped with a video-conference system with comprehensive audiovisual capabilities. Courses can be recorded and posted in the online platform.

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 result 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 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

This department offers a student chapter affiliated to the Institute of Industrial and Systems Engineers (IISE), with the American Planning and Inventory Control Society (APICS), with the America Society for Quality (ASQ), with the Puerto Rico College of Engineers and Land Surveying (CIAPR) and with the Puerto Rico Manufacturing Association (PRMA). The chapter develops several academic, societal, social, and professional activities to promote the leadership skills and professional development of the members.

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 Language 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
SCIE 1430	Physics I (Mechanics)	4
SCIE 1431	Physics I Laboratory	1
SCIE 1440	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 Components		**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

INDUSTRIAL ENGINEERING 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 Literacy Genre	3
IE	1000	Introduction to Industrial Engineering	3
			13

1st Year - 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 Literacy Genre	3
SCIE	1211	Principles of Chemistry Lab.	0
			14

1st Year - 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

2nd Year - 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

2nd Year - 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

3rd Year - Second Quarter

Course		Title	Credit-Hours
IE	3410	Material Management and Inventory Control	3
ENGI	3510	Engineering Materials	3
ENGI	2310	Computer Programming and Algorithms	3
IE	3500	Services Engineering and Management	3
			12

3rd Year - 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 Dynamic	3
IE	3522	Operations Research Models II	3
IE	4212	Lean Six Sigma	3
			12

4th Year - 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

4th Year - Third Quarter

Course		Title	Credit-Hours
IE	4995	Capstone Design Course Extension	3
IE	4560	Project Management Techniques	3
ENGI	3520	Thermal System Engineering	1
			10

COURSE DESCRIPTIONS

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

ENGI 2260 – ENGINEERING ECONOMICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: Math 1350

Introduction to economic evaluation of investments for engineering projects. Life cycle costing. Replacement analysis. Evaluation of public projects. Depreciation and Income tax determination.

ENGI 2270 – ENGINEERING PROBABILITY AND STATISTICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: Math 1350

This course introduces the students to the basic concepts of probability and statistics and its application to the solution of engineering problems. Principles of probability theory, discrete and continuous random variables, probability distributions, hypothesis testing, correlation and simple linear regression concepts will be essential to identify, formulate and solve engineering problems.

IE 1000 – INTRODUCTION TO INDUSTRIAL ENGINEERING
Three 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 supporting 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 1
One credit-hours. Two two-hour lecture per week. Prerequisite: 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, Visio and Excel to be able to improve probability and statistics data analysis as well as process performance capabilities. This course focuses on the technological skills not on the deepening of statistical concepts. To drill down on statistical concepts, refer to the courses of Probability, Statistics, Statistical Quality Control and Lean Six Sigma. Other courses within the program might also require and reinforce the statistical and data analysis body of knowledge.

IE 2110 – FINANCIAL AND COST ACCOUNTING
Three 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 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 credit-hours. Two two-hour lecture periods per week. Prerequisites: 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 & HUMAN FACTORS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: IE 2210, ENGI2110

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 & HUMAN FACTORS LABORATORY
One credit-hour. One four-hour laboratory periods 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 credit-hours. Two two-hour lecture periods per week. Prerequisite: 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 credit-hours. Two two-hour lecture periods per week. Prerequisite: IE 2220

The purpose of the course is to prepare industrial engineering students in the areas of statistical process control, process capability analysis, measurement system analysis, basic acceptance sampling procedures, and DMAIC methodology. These concepts are fundamental to improve and eliminate waste in the process.

IE 3360 – JOB DESIGN & WORK MEASUREMENT
Three 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 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 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 1
Three credits-hours. Two two-hour lecture periods per week. Prerequisites: IE 2210, MATH 2360

Deterministic and probabilistic models in Operations Research. Includes the use of linear programming techniques for modelling and solving linear problems. Mathematical algorithms are Simplex, 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 – SERVICES ENGINEERING AND MANAGEMENT
Three credit-hours. Two two-hours lectures 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 credits-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 RESEACH MODELS II
Three credits-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 (Arena) 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 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 credits-hours. Two two-hour lecture periods per week. Prerequisites: 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 3720 – INTRODUCTION TO SYSTEMS ENGINEERING
Three credits-hours. Two two-hour lecture periods per week. Prerequisites: IE 2210, IE 2310

Systems Engineering is an integrative and highly dynamic field that deals with work-processes, optimization methods, and risk management tools in large and complex problems and particularly for the delivery aspect of those problems, using a highly structured problem-solving methodology, multiple stakeholders mapping and a robust project-delivery approach. Systems Engineering then requires integration from diverse technical disciplines, particularly with the specifics arising from product and process issues in the areas of reliability, logistics, team collaborative environments (design management) and evaluation measurements. Through this course using a case-study approach, Systems Engineering will also build-upon emerging areas of Design Thinking and Service Design to further develop engineering capabilities to deal with complex non-linear problems.

IE 4212 – LEAN SIX SIGMA
Three credit-hours. Two two-hour lecture period 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 phases and tools that enable, apply and target projects for variability and cost reduction while increasing customer satisfaction and experience. It will also built on your expert knowledge on Probability, Statistics and Statistical Process Control to further develop your problem solving, critical thinking and creativity skills.

IE 4560 – PROJECT MANAGEMENT TECHNIQUES
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: 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).

IE 4910 – FACILITIES PLANNING AND DESIGN
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: 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 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 credit-hours. By arrangement. Prerequisites: Department Head Approval

The student will participate in 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 on 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 credit-hours. By arrangement Prerequisites: IE 4212, IE 4910 and Department Head Approval. Corequisite: 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 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 credit-hours. Two two-hour lecture periods per week. Prerequisite: 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 MANAGMENT SYSTEM
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: IE 3500

This course provide student with the fundamental 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. How design a basic experiments and process validation can be used to improve process and quality. Students will learn by reading online documents, viewing videos, participating in group exercises, real life project and in-depth discussions.

IE 5990 – SPECIAL TOPICS
Three 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, service or research 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 and economical way, while considering the impacts on society.

Program Educational Objectives

Within a few years of graduation, the PUPR Mechanical Engineering Program graduates are expected to attain the following:

1. Develop a successful professional career in mechanical engineering, science or related fields, demonstrating high competence, and social and ethical responsibility.
2. Obtain a leadership position in the industry, academy or community, promoting communication, teamwork, and the inclusion of underrepresented groups.
3. Contribute to the advancement of science and engineering through innovation, creativity, and critical thinking.
4. Continue their professional development through independent learning or by pursuing graduate studies.

Student Outcomes

Every graduating mechanical engineer from our program shall demonstrate:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Career Opportunities
Mechanical engineers have many professional options due to the breath 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 a 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 Graduation 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 Graduation 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	Precalculus I	3
MATH 1340	Precalculus 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)
- American Institute of Aeronautics and Astronautics PUPR Branch (AIAA)
- Women Association of Mechanical Engineers (AEMIN) in Spanish
- Society of Automotive Engineers (SAE-Aero design)
- 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	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory.	1
SCIE 1430	Physics I	4
SCIE 1431	Physics 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 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

Total Minimum 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

MECHANICAL ENGINEERING 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
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1st Year – Second Quarter

Course	Title	Credit-Hours
MATH 1360	Calculus II	4
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1
ME 1211	Conventional Manufacturing Laboratory	1
SOHU 2010	Socio-Humanistic Studies	3
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1st Year – Third Quarter

Course	Title	Credit-Hours
MATH 1370	Calculus III	4
SCIE 1210	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory	0
SCIE 1440	Physics II	4
SCIE 1441	Physics II Laboratory	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
		12

Students with concentration in Aerospace Engineering add:

ME 2930	Introduction to Aerospace Engineering	3
		15

2nd Year – 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

2nd Year – 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 Laboratory	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 Laboratory	1
		13

3rd Year – 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 Laboratory	1
ME 3240	Design of Machine Elements I	3
		13

3rd Year – 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 Laboratory	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 Laboratory	1
		13

4th Year – Second Quarter

Course	Title	Credit-Hours
ME 4111	Thermal Engineering Laboratory	1
ME 4992	ME Capstone Design I	3
ME 4251	Modeling & Product Realization Laboratory	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 Laboratory	1
		10

4th Year – 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 Laboratory	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, pseudo coding, 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 introduction to the study of ideal gas mixtures.

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 teamwork 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 introduction to 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 teamwork 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 ad 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 teamwork, 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 teamwork, 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 fundamental concepts of aerodynamics and how they are applied to the design of aircraft. The concepts of lift, drag, propulsion, performance, stability and control are discussed through the reference of real-life examples.

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, calendering, 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 and wing theory as well as topics in gas dynamics that include shock and expansion waves applied to supersonic airfoils, inlet design, and the transonic flight regime.

ME 4931 – FLIGHT DYNAMICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 4930

This course is designed to provide aerospace engineering undergraduate students the fundamental concepts of modeling of aerodynamics in enough detail so they can study static and dynamic stability, and simulation of 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. Performance during steady and accelerated flights, from point performance to mission analysis of propeller-driven and jet-propelled aircraft is discussed, with emphasis on implications on conceptual design. Airplane aerodynamics, propulsion, weights, and vehicle synthesis and optimization methodologies are presented and applied to the conceptual design of an aircraft.

ME 4935 – AIRCRAFT PROPULSION
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ME 3120

This course covers the study of how concepts of thermodynamics, fluid mechanics, aerodynamics, and compressible flow theory are applied to the analysis and design of aircraft jet engines. The course includes the transition duct aerodynamics, the 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.

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, non-aerodynamic shapes, propellers, turbines, flight dynamics simulations, aerospace structures, vibrations, and instrumentation systems are performed. All results are compared to theoretical predictions. The laboratory emphasizes teamwork 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

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SCHOOL OF BUSINESS ADMINISTRATION, MANAGEMENT AND ENTREPRENEURSHIP

Program Description

The School of Business Administration, 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 Business Administration, Management and Entrepreneurship is dedicated to advancing business knowledge and the practical application of business principles in a global technological environment. The faculty has created a business curriculum which emphasizes the link between business management and technology. The 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.

Laboratories and Equipment

PUPR is in the final development phase for a Business Innovation Center, which will allow to put the acquired knowledge into practice, eventually helping students to become leaders and entrepreneurs. This project will be housed at the Polytechnic Innovation Center, providing a platform for integration of new technologies toward business development, growing ideas and registering patents. This will be made possible with the support of the faculty and specialized personnel throughout the different phases of business development and implementation.

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 a liaison between the technological resources of the industry and the human resources that make it work. The ability to do so it acquired through the various techniques of analysis and synthesis presented throughout the curriculum.

Mission

The School of Business Administration, Management and Entrepreneurship at Polytechnic University of Puerto Rico is dedicated to providing students with a well-rounded, technology-oriented business education that will empower them to become tomorrow's socially responsible business leader.

Educational Objectives of the Business Administration Programs

The main objectives of the academic programs offered at the School of Business Administration, 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, quantitative reasoning, knowledge of business fundamentals and their understanding of its application in a global business environment.
3. Improve the student's leadership abilities, teamwork, and communication skills. Contribute to achieving personal, professional and academic goals while being aware of ethical, and social responsibilities in the decision-making process.

Student Outcomes

The Business Administration program is designed to develop a broad knowledge of business disciplines, awareness, and skills in the use of technology for business decision-making, a sense of social responsibility, and effective communication and team-work skills.

Graduates from the Business Administration Program shall be able to:

1. Demonstrate the ability to gather and analyze information for research and creative problem-solving.
2. Employ effective communication skills in a variety of business situations and daily work environments.
3. Acquire the ability to utilize leadership skills, to influence and support others in the performance of their tasks.
4. Demonstrate the ability to work effectively as a team member and team leader.
5. Develop the ability to manage technological change and understand its role in the global business environment.
6. Demonstrate ability for self-evaluation, and behavior modification; and evidence comprehension of business ethics and social responsibility.
7. 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.
8. Acquire the ability to conceptualize, plan, develop and apply the necessary skills to engage in an entrepreneurial endeavor.

Degree Offered

The School of Business Administration, Management and Entrepreneurship offers a bachelor's degree in Business Administration (BBA) with majors in:

- Accounting
- Construction Management
- Entrepreneurship
- General Management
- Marketing

Majors in Business Administration (33 credit-hours)

Although students can select their courses from any of the five (5) majors, they should take 12-15 credit-hours in departmental electives from corresponding areas in business administration.

- Accounting: 18 credits-hours in Accounting, 12 credit-hours in directed department electives, 3 credit-hours in Accounting Project, Total: 33 credit-hours.
- Construction Management: 15 credit-hours in Construction Management, 15 credit-hours in directed department electives, 3 credit-hours in Construction Management Project, Total: 33 credit-hours.
- Entrepreneurship: 15 credit-hours in Entrepreneurship, 15 credit-hours in directed department electives, 3 credit-hours in Entrepreneurship Project, Total: 33 credit-hours.
- General Management: 15 credit-hours in General Management, 15 credit-hours in directed department electives, 3 credit-hours in General Management Project, Total: 33 credit-hours.
- Marketing: 15 credit-hours in Marketing, 15 credit-hours in directed department electives, 3 credit-hours in Marketing Project, Total: 33 credit-hours.

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 Majors
122	**Total Credit-Hours**

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 Business Administration Students Association (BASA), "Capítulo Universitario de la Cámara de Comercio" de Puerto Rico and the international organization ENACTUS at Universidad Politécnica. They can also participate in other student associations and fraternities organized and/or recognized by PUPR.

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 program. 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 Credits-Hours)

Course	Title	Credit-Hours
ATUL 0100	Adjustment to University Life	3
ENGL 0100	Preparatory English	3
MATH 0102	Preparatory Mathematics	3
MATH 0106	Elementary Algebra	3
MATH 0110	Intermediate Algebra	3
SPAN 0100	Preparatory Spanish	3
	Total	**18**

BUSINESS ADMINISTRATION CURRICULUM

General Education Component
(Maximum of 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 Studies I	3
SOHU 2020	Socio Humanistic Studies II	3
SPAN 0110	Spanish Grammar	3
SPAN 1010	Linguistic Analysis of Literary Genre	3
	Socio Humanistic Elective	3
	Socio Humanistic Elective	3
	Total	**36**

General Business Component
(Maximum of 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
ENGL 2020	Business English	3
ENTR 1010	Principles of Entrepreneurship	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 2010	Organizational Management Theory	3
MGMT 2020	Business Law	3
SPAN 2020	Business Spanish	3
STAT 2010	Probability & Statistics	3
STAT 2020	Statistics & Hypothesis Testing	3
	Total	**47**

Free Electives Component
(Maximum of 6 credit-hours)
Select two (2) courses from any area of interest

MAJORS IN BUSINESS ADMINISTRATION

Accounting Component*
(Maximum of 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
	Directed Departmental Electives	12
	Total	**33**

Construction Management Component*
(Maximum of 33 Credit-Hours)

Course	Title	Credit-Hours
MGMT 3210	Construction Management	3
MGMT 3220	Construction Contracts & Legal Documents	3
MGMT 3230	Construction Materials and Methods	3
MGMT 3240	Construction Estimates & Costs	3
MGMT 4210	Project Planning and Control (PERT)	3
MGMT 4270	Construction Management Project	3
	Directed Departmental Electives	15
	Total	**33**

Entrepreneurship Component*
(Maximum of 33 Credit-Hours)

Course	Title	Credit-Hours
ENTR 3010	Business Creativity & Innovation	3
ENTR 3020	Electronic Business	3
ENTR 4010	International Business	3
ENTR 4020	Entrepreneurial Finance	3
MGMT 4620	Strategic Management	3
ENTR 4070	Entrepreneurial Project	3
	Directed Departmental Electives	15
	Total	**33**

General Management Component*
(Maximum of 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	Strategy Management	3
MGMT 4630	Organizational Development	3
MGMT 4670	General Management Project	3
	Directed Departmental Electives	15
	Total	**33**

Marketing Component*
(Maximum of 33 Credit-Hours)

Course	Title	Credit-Hours
MARK 3410	Sales & Retail Management	3
MARK 3430	Product Management	3
MARK 3450	Advertising	3
MARK 3460	Public Relations	3
MARK 4410	Marketing Research	3
MARK 4470	Marketing Project	3
	Directed Departmental Electives	15
	Total	**33**

*Note: Not all classes are offered in all school terms. Students must plan their courses carefully to finish in the optimal time frame.

Directed Departmental Electives
Students should take 12-15 credits-hours from those corresponding business administration majors.

Course	Title	Credit-Hours
ACCO 3110	Managerial Accounting	3
ACCO 3320	Computer Application in Accounting	3

ACCO 3360	Federal Income Tax	3
ACCO 4320	Auditing	3
ACCO 4330	Accounting for Governmental & Not-for-Profit Organizations	3
COMP 3010	Database management	3
ENTR 4020	Entrepreneurial Finance	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
ISYS 3510	Management Information Systems	3
ISYS 3540	Computers & Information Technology	3
ISYS 3550	Data Communication and Networks I	3
ISYS 3560	Programming Language for Business Administration	3
ISYS 4510	System Analysis & Design	3
ISYS 4520	Computer Security & Audit	3
ISYS 4530	Local Area Network Systems	3
MARK 3420	Consumer Behavior	3
MARK 3430	Product Management	3
MARK 3440	Service Marketing	3
MGMT 3120	Operations and Production Management	3
MGMT 3130	Material & Purchasing Management	3
MGMT 3140	Inventory, Material & Capacity Requirement, Plan.	3
MGMT 3250	Construction Equipment	3
MGMT 3260	Construction Safety	3
MGMT 3670	Labor Relations	3
MGMT 4110	Statistical Quality Control	3
MGMT 4120	Advanced Operations and Production Management	3
MGMT 4220	Government Regulations	3
MGMT 4640	Collective Bargained	3
MGMT 4650	Adm. of Wages and Salaries	3
MGMT 4660	Entrepreneurship	3

BBA IN ACCOUNTING CURRICULUM SEQUENCE

(122 Credit-Hours)

First Year

First Quarter

Course	Title	Credit- Hours
ENGL 0110	English Grammar	3
SOHU 2010	Socio-Humanistic Studies I	3
SPAN 0110	Spanish Grammar	3
MGMT 1010	Introduction to Management	3
		12

1st Year - Second Quarter

Course	Title	Credit - Hours
ENGL 1010	The Study of the Essay as a Literary Genre	3
MATH 1310	Applied Mathematics for Business I	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SOHU 2020	Socio-Humanistic Studies II	3
		12

1st Year - Third Quarter

Course	Title	Credit- Hours
COMP 1010	Introduction to Computer & Basic Language	3
ENTR 1010	Principles of Entrepreneurship	3
MARK 1010	Marketing	3
MATH 1320	Applied Mathematics for Business II	3
		12

Second Year

First Quarter

Course	Title	Credit-Hours
ACCO 2010	Accounting Principles I	4
COMP 2010	Business Application Programs	3
MGMT 2010	Organizational Management Theory	3
ECON 3010	Micro-Economics	3
		13

2nd Year - Second Quarter

Course	Title	Credit- Hours
ACCO 2020	Accounting Principles II	4
ECON 3020	Macro-Economics	3
MGMT 2020	Business Law	3
STAT 2010	Probability and Statistics	3
		13

2nd Year - Third Quarter

Course	Title	Credit-Hours
ENGL 2020	Business English	3
FINA 2010	Finance	3
SPAN 2020	Business Spanish	3
STAT 2020	Statistics and Hypothesis Testing	3
		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
		14

3rd Year - Second Quarter

Course	Title	Credit-Hours
ACCO 3340	Intermediate Accounting II	4
DEPT ELECTIVE	Directed Dept. Elective	3
DEPT ELECTIVE	Directed Dept. Elective	3
FREE ELECTIVE	Free Elective	3
		13

3rd Year - Third Quarter

Course	Title	Credit-Hours
ACCO 4310	Advanced Accounting	3

ACCO 4370	Accounting Project	3
DEPT ELECTIVE	Directed Dept. Elective	3
DEPT ELECTIVE	Directed Dept. Elective	3
		12

Fourth Year

First Quarter

Course	Title	Credit-Hours
FREE ELECTIVE	Free Elective	3
SOHU ELECTIVE	Socio-Humanistic Elective	3
SOHU ELECTIVE	Socio-Humanistic Elective	3
		9

BBA IN CONSTRUCTION MANAGEMENT CURRICULUM SEQUENCE

(122 Credit-Hours)

First Year

First Quarter

Course	Title	Credit -Hours
ENGL 0110	English Grammar	3
SOHU 2010	Socio-Humanistic Studies I	3
SPAN 0110	Spanish Grammar	3
MGMT 1010	Introduction to Management	3
		12

1st Year - Second Quarter

Course	Title	Credit-Hours
ENGL 1010	The Study of the Essay as a Literary Genre	3
MATH 1310	Applied Mathematics for Business I	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SOHU 2020	Socio-Humanistic Studies II	3
		12

1st Year - Third Quarter

Course	Title	Credit-Hours
COMP 1010	Introduction to Computer & Basic Language	3
ENTR 1010	Principles of Entrepreneurship	3
MARK 1010	Marketing	3
MATH 1320	Applied Mathematics for Business II	3
		12

Second Year

First Quarter

Course	Title	Credit-Hours
ACCO 2010	Accounting Principles I	4
COMP 2010	Business Application Programs	3
MGMT 2010	Organizational Management Theory	3
ECON 3010	Micro-Economics	3
		13

2nd Year - Second Quarter

Course	Title	Credit-Hours
ACCO 2020	Accounting Principles II	4
ECON 3020	Macro-Economics	3
MGMT 2020	Business Law	3
STAT 2010	Probability and Statistics	3
		13

2nd Year - Third Quarter

Course	Title	Credit-Hours
ENGL 2020	Business English	3
FINA 2010	Finance	3
SPAN 2020	Business Spanish	3
STAT 2020	Statistics and Hypothesis Testing	3
		12

Third Year

First Quarter

Course	Title	Credit-Hours
MGMT 3210	Construction Management	3
MGMT 3220	Construction Contracts and Legal Documents	3
PHIL 3000	Business Ethics	3
DEPT. ELECTIVE	Directed Department Elective	3
		12

3rd Year - Second Quarter

Course	Title	Credit-Hours
MGMT 3230	Construction Materials and Methods	3
MGMT 4210	Project Planning and Control (PERT)	3
DEPT ELECTIVE	Directed Department Electives	3
SOHU ELECTIVE	Socio-Humanistic Elective	3
		12

3rd Year - Third Quarter

Course	Title	Credit-Hours
MGMT 3240	Construction Estimates and Costs	3
MGMT 4270	Construction Management Project	3
DEPT ELECTIVE	Directed Department Elective	3
DEPT. ELECTIVE	Directed Department Elective	3
		12

Fourth Year

First Quarter

Course	Title	Credit-Hours
DEPT. ELECTIVE	Directed Department Elective	3
FREE ELECTIVE	Free Elective	3
FREE ELECTIVE	Free Elective	3
SOHU ELECTIVE	Socio-Humanistic Elective	3
		12

BBA IN ENTREPRENEURSHIP CURRICULUM SEQUENCE
(122 Credit-Hours)

First Year

First Quarter

Course	Title	Credit-Hours
ENGL 0110	English Grammar	3
SOHU 2010	Socio-Humanistic Studies I	3
SPAN 0110	Spanish Grammar	3
MGMT 1010	Introduction to Management	3
		12

1st Year - Second Quarter

Course	Title	Credit-Hours
ENGL 1010	The Study of the Essay as a Literary Genre	3
MATH 1310	Applied Mathematics for Business I	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SOHU 2020	Socio-Humanistic Studies II	3
		12

1st Year - Third Quarter

Course	Title	Credit-Hours
COMP 1010	Introduction to Computer & Basic Language	3
ENTR 1010	Principles of Entrepreneurship	3
MARK 1010	Marketing	3
MATH 1320	Applied Mathematics for Business II	3
		12

Second Year

First Quarter

Course	Title	Credit-Hours
ACCO 2010	Accounting Principles I	4
COMP 2010	Business Application Programs	3
MGMT 2010	Organizational Management Theory	3
ECON 3010	Micro-Economics	3
		13

2nd Year - Second Quarter

Course	Title	Credit-Hours
ACCO 2020	Accounting Principles II	4
ECON 3020	Macro-Economics	3
MGMT 2020	Business Law	3
STAT 2010	Probability and Statistics	3
		13

2nd Year - Third Quarter

Course	Title	Credit-Hours
ENGL 2020	Business English	3
FINA 2010	Finance	3
SPAN 2020	Business Spanish	3
STAT 2020	Statistics and Hypothesis Testing	3
		12

Third Year

First Quarter

Course	Title	Credit-Hours
ENTR 3010	Business Creative and Innovation	3
ENTR 3020	Electronic Business	3
PHIL 3000	Business Ethics	3
DEPT. ELECTIVE	Directed Department Elective	3
		12

3rd Year - Second Quarter

Course	Title	Credit-Hours
ENTR 4010	International Business	3
MGMT 4620	Strategic Management	3
DEPT. ELECTIVE	Directed Department Elective	3
SOHU ELECTIVE	Socio-Humanistic Elective	3
		12

3rd Year - Third Quarter

Course	Title	Credit-Hours
ENTR 4020	Entrepreneurial Finance	3
ENTR 4070	Entrepreneurial Project	3
DEPT. ELECTIVE	Directed Department Elective	3
DEPT. ELECTIVE	Directed Department Elective	3
		12

Fourth Year

First Quarter

Course	Title	Credit-Hours
DEPT. ELECTIVE	Directed Department Elective	3
FREE ELECTIVE	Free Elective	3
FREE ELECTIVE	Free Elective	3
SOHU ELECTIVE	Socio-Humanistic Elective	3
		12

BBA IN GENERAL MANAGEMENT CURRICULUM SEQUENCE

(122 Credit-Hours)

First Year

First Quarter

Course	Title	Credit-Hours
ENGL 0110	English Grammar	3
SOHU 2010	Socio-Humanistic Studies I	3
SPAN 0110	Spanish Grammar	3
MGMT 1010	Introduction to Management	3
		12

1st Year - Second Quarter

Course	Title	Credit-Hours
ENGL 1010	The Study of the Essay as a Literary Genre	3
MATH 1310	Applied Mathematics for Business I	3
SPAN 1010	Linguistic Analysis of Literary Genres	3

SOHU 2020	Socio-Humanistic Studies II	3
		12

1st Year - Third Quarter

Course	Title	Credit-Hours
COMP 1010	Introduction to Computer & Basic Language	3
ENTR 1010	Principles of Entrepreneurship	3
MARK 1010	Marketing	3
MATH 1320	Applied Mathematics for Business II	3
		12

Second Year

First Quarter

Course	Title	Credit-Hours
ACCO 2010	Accounting Principles I	4
COMP 2010	Business Application Programs	3
MGMT 2010	Organizational Management Theory	3
ECON 3010	Micro-Economics	3
		13

2nd Year - Second Quarter

Course	Title	Credit-Hours
ACCO 2020	Accounting Principles II	4
ECON 3020	Macro-Economics	3
MGMT 2020	Business Law	3
STAT 2010	Probability and Statistics	3
		13

2nd Year - Third Quarter

Course	Title	Credit-Hours
ENGL 2020	Business English	3
FINA 2010	Finance	3
SPAN 2020	Business Spanish	3
STAT 2020	Statistics and Hypothesis Testing	3
		12

Third Year

First Quarter

Course	Title	Credit-Hours
MGMT 3610	Human Resources Management	3
MGMT 3620	Organizational Behavior	3
MGMT 4610	Total Quality Management	3
PHIL 3000	Business Ethics	3
		12

3rd Year - Second Quarter

Course	Title	Credit-Hours
MGMT 4620	Strategic Management	3
DEPT. ELECTIVE	Directed Department Elective	3
DEPT. ELECTIVE	Directed Department Elective	3
SOHU ELECTIVE	Socio-humanistic Elective	3
		12

3rd Year - Third Quarter

Course	Title	Credit-Hours
MGMT 4630	Organizational Development	3
MGMT 4670	General Management Project	3
DEPT. ELECTIVE	Directed Department Elective	3
DEPT. ELECTIVE	Directed Department Elective	3
		12

Fourth Year

First Quarter

Course	Title	Credit-Hours
DEPT. ELECTIVE	Directed Department Elective	3
FREE ELECTIVE	Free Elective	3
FREE ELECTIVE	Free Elective	3
SOHU ELECTIVE	Socio-Humanistic Elective	3
		12

BBA IN MARKETING CURRICULUM SEQUENCE

(122 Credit-Hours)

First Year

First Quarter

Course	Title	Credit-Hours
ENGL 0110	English Grammar	3
SOHU 2010	Socio-humanistic Studies I	3
SPAN 0110	Spanish Grammar	3
MGMT 1010	Introduction to Management	3
		12

1st Year - Second Quarter

Course	Title	Credit-Hours
ENGL 1010	The Study of the Essay as a Literary Genre	3
MATH 1310	Applied Mathematics for Business I	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
SOHU 2020	Socio-Humanistic Studies II	3
		12

1st Year - Third Quarter

Course	Title	Credit-Hours
COMP 1010	Introduction to Computer & Basic Language	3
ENTR 1010	Principles of Entrepreneurship	3
MARK 1010	Marketing	3
MATH 1320	Applied Mathematics for Business II	3
		12

Second Year

First Quarter

Course	Title	Credit-Hours
ACCO 2010	Accounting Principles I	4
COMP 2010	Business Application Programs	3
MGMT 2010	Organizational Management Theory	3

ECON 3010	Micro-Economics	3
		13

2nd Year - Second Quarter

Course	Title	Credit-Hours
ACCO 2020	Accounting Principles II	4
ECON 3020	Macro-Economics	3
MGMT 2020	Business Law	3
STAT 2010	Probability and Statistics	3
		13

2nd Year - Third Quarter

Course	Title	Credit-Hours
ENGL 2020	Business English	3
FINA 2010	Finance	3
SPAN 2020	Business Spanish	3
STAT 2020	Statistics and Hypothesis Testing	3
		12

Third Year

First Quarter

Course	Title	Credit-Hours
MARK 3410	Sales and Retail Management	3
MARK 3430	Product Management	3
PHIL 3000	Business Ethics	3
DEPT. ELECTIVE	Directed Department Elective	3
		12

3rd Year - Second Quarter

Course	Title	Credit-Hours
MARK 3450	Advertising	3
MARK 3460	Public Relations	3
DEPT. ELECTIVE	Directed Department Elective	3
SOHU ELECTIVE	Socio-Humanistic Elective	3
		12

3rd Year - Third Quarter

Course	Title	Credit-Hours
MARK 4410	Marketing Research	3
MARK 4470	Marketing Project	3
DEPT. ELECTIVE	Directed Department Elective	3
DEPT. ELECTIVE	Directed Department Elective	3
		12

Fourth Year

First Quarter

Course	Title	Credit-Hours
DEPT. ELECTIVE	Directed Department Elective	3
FREE ELECTIVE	Free Elective	3
FREE ELECTIVE	Free Elective	3
SOHU ELECTIVE	Socio-Humanistic Elective	3
		12

COURSE DESCRIPTIONS

Accounting Courses

ACCO 2010 – ACCOUNTING PRINCIPLES I
Four credit-hours and a half hour lecture periods twice per week. Prerequisites: MATH 0110, and COMP 1010

Study the basic accounting principles and concepts. Complete accounting cycle using different procedures for preparation, adjustments, and 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 partnership 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. Prerequisite: 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 productions 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 a review of the complete cycle plus the analysis of its components and related topics. Use of time value of money techniques (Present Value of $1 of an Ordinary Annuity or 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 website on 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 problem 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 adjustment.

ACCO 4320 – AUDITING
Three credit-hours. Two-hour lecture periods, twice per week. Prerequisite: 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 websites on the Internet.

ACCO 4330 – ACCOUNTING FOR GOVERNMENT 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 citizen (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 structure using OBASIC language.

COMP 2010 – BUSINESS APPLICATIONS PROGRAMS
Three credit-hours. Two-hour lecture periods, twice per week. Prerequisite: COMP 1010

Learn the used of the currently most popular business software packages at present they are Microsoft Office 2010, Publisher 2010, 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 database systems. Survey of the techniques and methodologies used in database management, Software design analysis and programming in the database environment. Introduce internet environment. Interface business application program with the Internet.

Entrepreneurship Courses

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 interest in establishing and managing a business.

ENTR 3010 – BUSINESS CREATIVITY AND INNOVATION
Three credit-hours. Two-hour lecture periods, twice per week. Prerequisite: ENTR 1010 OR MGMT 4660

Study of the principles of database systems. Survey of the techniques and methodologies used in database management, Software design analysis, and programing in the database environment. Introduce students to the Internet environment. Interface business application programs with the 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 business needs to adapt and innovate in a constantly changing technology. Students develop administrative and operational plans aimed at 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 business 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 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~~s~~ 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 any 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: Department Head Authorization

The project course is oriented to integrate the knowledge and skills that student obtains through 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 in 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

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 credit-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 progress of optimal financial variables.

FINA 3720 – FINANCIAL MATHEMATICS
Three credits-hours. Two-hours 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 systems 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 analyzes. Emphasis is placed on the importance of the financial and monetary sector of the economy. The Central Bank System of the United States of America, the Federal Reserve, and its monetary 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 functions 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 to understand investment and financial processes. After the 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 – RISKS 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 investment and their markets. Debt values are analyzed, along with profit sharing and hybrids. Then nature of the market of share options reading and interpretation of the financial press and the negotiation with a registered broker are studies.

FINA 4720 – INTERNATIONAL FINANCE
Three credit-hours. Two-hour lecture periods, twice per week. Prerequisites: FINA 02010, 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-hours lecture periods, twice per week. 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 are changes in financial institutions will be studied.

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 design. (Service and manufacturing environment will be of special interest). Analyze the organization regarding 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 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 technologies in the areas of computer architecture, operating systems, software translators, compilers and telecommunications and Networks serve as facilitator course allowing systems to communicate effectively and efficiently 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 FOR BUSINESS ADMINISTRATION
Three credit-hours. Two-hour lecture periods, twice per week. Prerequisite: COMP 1010

The course concentrates on fundamentals of new 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 3590 – ELECTRONIC COMMERCE
Three credit-hours. Two-hour lecture periods, twice per week. Prerequisite: COMP 3010

The course emphasizes techniques to plan and design a platform-independent commerce website. 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 to 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 an audit of deficiency, effectiveness, control, and security. Other topics include audit techniques and their effect on information system development. Cover and 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.

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 of the establishment of innovative 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 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 Rico 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.

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-hour. 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 among other topics are discussed.

MGMT 3130 – 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 functions in manufacturing, service and public organizations. Topics include source selection, make-buy analysis, and inventory control, warehousing. The course emphasizes innovative models of intervention theories and method, business transformation, corporate evolution and organizational culture change, geared to develop a new philosophy of business.

MGMT 3140 – INVENTORY AND MATERIAL REQUIREMENT PLANNING/CAPACITY REQUIREMENT PLANNING
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 characteristics curves and various criteria are also included; Statistical and mathematical concepts are explored.

MGMT 4120 – ADVANCED OPERATIONS & PRODUCTION MANAGEMENT
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 and computer programs for the solution of Operation Management problems. Computer models as Linear Programming, Waiting Lines, and Transportation Models will be studies.

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 enterprise contractor's organization structure 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 CONTRACT AND LEGAL DOCUMENTS
Three credit-hours. Two-hour lecture periods, twice per week. Prerequisite: 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 or 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 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 if financial decision making on construction selection; application of engineering fundamentals and economic of performance characteristics and production equipment specification.

MGMT 3260 – SAFETY AND OCCUPATIONAL HEALTH IN THE CONSTRUCTION INDUSTRY – CONSTRUCTION SAFETY
Three credit-hours. Two-hour lecture periods, twice per week. Prerequisites: MGMT 3210, MGMT 3250

The course exposes the regulations and laws that govern the construction industry in Puerto Rico following the principles and requirements of PR-OSHO/OSHA. The regulation and control of the working environment of employees in the construction industry, the use of safety equipment, and the application of a safety system and occupational health procedures is covered.

MGMT 4210 – PROJECT PLANNING AND CONTROL (PERT)
Three credit-hour lecture periods, twice per week. Prerequisite: MGMT 3210
Study the Network planning techniques for project management and resource allocation. Emphasis on PERT, CPN, 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 regulation 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 construction projects from the development and planning to estimating cost, construction, project control and final stage. Students must apply real world construction project 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 labor relations, the government 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 studied.

MGMT 4610 – TOTAL QUALITY MANAGEMENT
Three credit-hours. Two-hour lecture, 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 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 four 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 innovative models of intervention theories and methods, business transformation, corporate evolution and organizational culture change, geared to develop a fundamentally 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

The 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 the business establishment. Also, the student will analyze the conflicts and problems faced by an entrepreneur in his/her way to success.

MGMT 4670 – MANAGEMENT PROJECT
Three credit-hour. By Arrangement. Prerequisite: Department Head Authorization

The General Management Project consists of a field research project in which the students 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, and 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 prs21ograms to stimulate the sales activity. Also study of the retail functions in an organization, consideration of managerial problems in the operation of a large and small retailing organization, control of retail operations, the 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 the selection of goods and services. Analyze the prevailing theories of 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 the 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 form the service industry. Strategic development plans for the service industry.

MARK 3450 – ADVERTISING
Three credit-hours. Two-hour lecture periods, twice per week. Prerequisite: 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 reach decisions and functions 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 quantitative marketing 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 student obtain in the 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 presentations of data. Topics like frequency distributions, graphical methods for data presentation, central tendency and dispersion measurements, probability, discrete and continuous probability distributions. Fundamentals 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

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COMBINED BACHELOR'S AND 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. Students enrolled in 5-year bachelor's degrees may request admission to this program after completing 105 undergraduate credit-hours (excluding developmental courses.) Those enrolled in 4-year bachelor's degrees may request admission to this program after completing 72 undergraduate credit-hours (excluding developmental courses.)

Admission

Conditions for admission to the combined program will be the following:

1. GPA of 3.00 or higher. When the student has a GPA of 2.50 to 2.99 his/her application may be evaluated and conditionally admitted to the combined program
2. Comply 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 director/coordinator.

Procedure

1. The student must complete and submit the application form.
2. The department chairperson and graduate program director/coordinator recommend the candidate for admission.
3. The application is evaluated to verify that the student indeed qualifies for the program
4. The dean verifies the recommendations and gives its approval/denial of the student's application.
5. The final decision is notified to the student.

General Comments

Whenever any of the courses are passed with a grade of "C" or lower, the student is disqualified to continue in the combined program. In the event that the application is denied, the student may appeal the decision in writing to a committee composed of the undergraduate department head, graduate program director/coordinator, dean of the Graduate School and the vice-president for Academic Affairs. The decision of the committee is final.

ASSOCIATE DEGREE PROGRAMS

THE SCHOOL OF ARCHITECTURE

Associate Degree in Product Design

The School of Architecture developed an Associate Degree in Product Design to promote short-term employment and entrepreneurship. This associate degree is a two-year program with several courses shared with the Bachelor of Architecture program as well as the school's resources (Materials and Digital Fabrication Laboratory and Computer Laboratory.) Students of the Associate Degree in Product Design will become professionals, with strong multidisciplinary education, involved in the development of products, and their inclusion in the Interior Design and Architectural environment.

Program Mission

The associate degree focuses on the integration of product design with the architectural environment. Product design graduates will be able to advance as entrepreneurs within the work environment through collaboration and partnership with local and international manufacturers of mass production and distribution.

Program Educational Objectives

The Associate Degree in Product Design was developed to prepare graduates to achieve adequate expertise by complying with the following objectives:

1. Demonstrate an effective integration of knowledge and skills to identify and improve design solutions in product development.
2. Apply the principles of the product design discipline to draw justifiable, educated, reasonable, and creative solutions for the needs of society.
3. Design a product by effectively applying technology and tools to gather, process, and analyze the information required to solve complex design problems.
4. Become leaders with organizational skills to create, develop, and foster new business opportunities supporting private companies and their own as entrepreneurs.

Student Outcomes

The academic program of the Associate Degree in Product Design will provide students with the necessary tools to demonstrate the following student outcomes upon graduation:

1. An ability to apply scientific principles, understand cause and effect relationships, define, analyze, and solve problems through the product development methodology, from an idea into a final product on the market.
2. An ability to integrate the fundaments of ergonomics, function, and form in the design of product components.
3. An ability to represent a design concept by applying a variety of visualization models and digital fabrication techniques.
4. An ability to communicate professionally and effectively (orally and in writing) in a multidisciplinary group to maximize the optimal solution of design, taking into consideration the ethical and social and environmental responsibilities of a product designer.
5. An ability to effectively utilize project management strategy to timely design solutions related to product innovation, and to understand the manufacturing technologies that enable the production process.

Career Opportunities

Following the mission of Polytechnic of Puerto Rico (PUPR) and its School of Architecture, the Associate Degree in Product Design program will provide opportunities for individuals from diverse backgrounds to develop their potential to become socially responsible professionals. The incorporation of local industrial producers as partners of the program will offer real work experience opportunities for students during lessons and allow them to develop the necessary skills to become entrepreneurs. The integration of creativity and multidisciplinary education of the programs of the School of Architecture will expose students to an environment of professional collaboration conducive to the creation of functional products, from the process of ideation and their viability (addressing lifecycle stages) according to a sustainable logic, to marketing, project management, and distribution.

Degree Offered
The Architecture Department offers technical education leading to an Associate Degree in Product Design. In order to earn the degree, the student must complete the following requirements:

Minimum Graduation Requirements

6 Credit-Hour in Developmental Studies
12 Credit-hours in General Studies
31 Credit-hours in Core Courses
12 Credit-hours in Product Design Courses
6 Credit-hours in Departmental Electives
67 Total Credit-hours

School of Architecture Laboratories
The academic program of the Associate Degree in Product Design benefits from the appropriate technological infrastructure for the search, management, and investigation of information.

- **Digital Fabrication Laboratory -** Serves as rapid prototyping and model fabrication shop with specialized hardware and digital tools such as Laser Cutter, 3D Printer. It also has traditional tools as Band Saw, Milling Machine, Drill Press, Chop Saw, and Table Saw.
- **Material Laboratory -** Inventory material samples available for the development and manufacturing of product models and real-scale prototypes.
- **Computer Laboratory -** Support the course lesson by applying technical software for tridimensional product modeling, analysis, and visualization. The computer laboratory has twenty-four (24) computers, software, and seating capacity. It serves as a classroom and computer room with specialized software.
- **Architectural Conservation Laboratory**
- **Ceramic Laboratory**

Developmental Studies
All students that request admission and are admitted to the Associate Degree in Product Design must show that they have acquired the academic abilities and skills necessary to progress through the 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 placement tests, previous university experience, other tests, or criteria) will be required to take developmental courses. These courses are designed to help students overcome deficiencies in languages, mathematics, and or science. The developmental courses are in addition to the 67 credit-hours of the Associate Degree in Product Design program. The courses are awarded their corresponding credits according to the contact hours. These courses are the following:

Developmental Studies Component
(Maximum of 6 credit-hours)

Course	Title	Credit-Hours
ENGL 0100	Preparatory English	3
MATH 0102	Preparatory Mathematics	3

ASSOCIATE DEGREE IN PRODUCT DESIGN CURRICULUM
(67 Credit-Hours)

General Studies
(Maximum of 18 credit-hours)

Course	Title	Credit-Hours
ATUL 0100	Adjustment to University Life	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3
MATH 0106	Elementary Algebra	3

ENGL 3010	Conversational English	3
SOHU 2010	Socio Humanistic Studies I	3

Product Design Core Courses
(12 Credit-Hours)

Course	Title	Credit-Hours
ARPD 1020	Product Design I	4
ARPD 1030	Product Design II	4
ARPD 2010	Product Design III	4

ARCC-Architectural Representation
(15 Credit-Hours)

Course	Title	Credit-Hours
ARCC 0170	Perspective	3
ARCC 0240	Introduction to Industrial Design	3
ARCC 2010	Architectural Representation II	3
ARCC 0410	Parametric Modeling and Digital Fabrication	3
ARCC 0191	Visual Communication in Architecture	3

ARTE-Technology
(6 Credit-Hours)

Course	Title	Credit-Hours
ARTE 2010	Materials & Methods	3
ARTE 0440	Architecture & Light	3

ARPP-Practice
(3 Credit-Hours)

Course	Title	Credit-Hours
ARPP 3010	Practice / Experience	3

ARCH-Architecture Design
(4 Credit-Hours)

Course	Title	Credit-Hours
ARCH 0203	Design Seminar	4

ARIN-Interior Design
(3 Credit-Hours)

Course	Title	Credit-Hours
ARIN 2310	Color Theory and Psychology	3

Departmental Electives
(6 Credit-Hours)

Course	Title	Credit-Hours
ARCC 0315	Ceramics	3
ARPP 0310	The Architect as Entrepreneur	3
ARIN 2320	History of Furniture I	3

ASSOCIATE DEGREE IN PRODUCT DESIGN CURRICULUM SEQUENCE
(67 Credit-Hours)

First Year

First Quarter

Course	Title	Credit-Hours
ARCC 0170	Perspective	3
ENGL 3010	Conversational English	3
ARCC 0240	Introduction to Industrial Design	3
SPAN 0100	Preparatory Spanish	3
ATUL 0100	Adjustment to University Life	3
		Total 15

1st Year - Second Quarter

Course	Title	Credit-Hours
ARPD 1020	Product Design I	4
SOHU 2010	Socio Humanistic Studies I	3
ARCC 2010	Architectural Representation II	3
MATH 0106	Elementary Algebra	3
		Total 13

1st Year - Third Quarter

Course	Title	Credit-Hours
ARPD 1030	Product Design II	4
ARCC 0410	Parametric Modeling and Digital Fabrication	3
SPAN 0110	Spanish Grammar	3
ARTE 2010	Materials & Methods	3
		Total 13

Second Year

First Quarter

Course	Title	Credit-Hours
ARPD 2010	Product Design III	4
ARCC 0191	Visual Communication in Architecture	3
ARTE 0440	Architecture & Light	3
ARPP 3010	Practice / Experience	3
		Total 13

2nd Year -Second Quarter

Course	Title	Credit-Hours
ARCH 0203	Design Seminar	4
ARIN 2310	Color Theory and Psychology	3
Elective	Departmental Elective	3
Elective	Departmental Elective	3
		Total 13

COURSE DESCRIPTIONS

ARCC 0170 – PERSPECTIVE
Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisites: None

This course introduces students to techniques for graphic construction of three-dimensional space, both as representational and design tool. It also explores free-hand sketching and one- and two-point constructions.

ARCC 0191 – VISUAL COMMUNICATION IN ARCHITECTURE
Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisites: None

In this introductory course, the student learns the basics of graphic communication and how it can be integrated to architecture. The course teaches how design and communication inform, guide, stimulate and inspire when it's well combined with developed surroundings, thus resulting in a dynamic relationship between space and people. The course also promotes participation, analysis and exchange of ideas, and the development of a creative and multidisciplinary student.

ARCC 0240 – INTRODUCTION TO INDUSTRIAL DESIGN
Three credit-hours. Two two-hour lecture/studio periods per week. Prerequisites: 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 0410 –DIGITAL FABRICATION
Three credit-hours. Two two-hour lecture/laboratory periods per week. Laboratory Fee. Prerequisite: ARCC 2010 or ARPD 1020

This course introduces students to tools, techniques, concepts and design solutions through the non-Euclidean Geometry, digital modeling. The course emphasizes on architectural precedents as a framework for drawing possibilities for the comprehension of non-Euclidian tectonic models. Students engage in digital three-dimensional modeling analyzing case studies visualizations, architectural components, assembly, structure and virtual simulation.

ARCC 2010 – ARCHITECTURAL REPRESENTATION II
Three credit-hours. Two two-hour lecture/studio periods per week. Laboratory Fee. Prerequisites: ARCC 1010, ARCH 1020 or ARCC 0240

Introduction to the basic concepts, software and drawing techniques for digital drafting. The course focus **is** on bi-dimensional drawings and its representation, and basic 3D modeling using the digital tools currently available.

ARCH 0203 – DESIGN SEMINAR
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: ARCH 1030 or ARPD 2010

Principles of design are addressed in short exercises in which the students use previous projects to develop different skills related to proportions, composition, structural logic, sequence, and materiality.

ARIN 2310 – COLOR (THEORY AND PSYCHOLOGY)
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARHH 1010/1011, SOHU 2010 or ARPD 1020

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.

ARPD 1020 – PRODUCT DESIGN I
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: ARCC 0240

This course will apply concepts, methods and product ideation on the design processes involving form, function, user interaction and tridimensional model development. The student will also identify the principles of the functional components of the object, what means to redesign an existing one, and how to explore a variety of product design solutions.

ARPD 1030 – PRODUCT DESIGN II
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: ARPD 1020

This studio course will expand the previously acquired ideation skills into a product development solution for a consumer or specific social need. The course will focus on manufacturing technologies, materials research applied to product design that can be integrated to the architectural environment.

ARPD 2010 – PRODUCT DESIGN III
Four credit-hours. Two three-and-a-half lecture/studio periods per week. Design Fee. Prerequisites: ARPD 1030

This course will practice methodologies for developing concepts and marketing strategies in the design of innovative products for architectural components. The course integrates multidisciplinary design activities with digital technology, business and engineering. It emphasizes the development of experimental design methods that enable the student to foresee innovation opportunities for the built industry.

ARPP 0310 – THE ARCHITECT AS ENTREPRENEUR
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: None

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 3010 – PRACTICE / EXPERIENCE
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARCH 2020 or ARPD 1030

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.

ARTE 0440 – ARCHITECTURE & LIGHT
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARCH 3030, ARTE 2010 or ARPD 1020

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 using different lighting typologies. Students design a lighting device and build A prototype.

ARTE 2010 – MATERIALS AND METHODS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ARCC 1010, ARCH 1030, ARTE 1010 or ARPD 1020

Materials, their history, and their application to construction technology are studied, including characteristics, behavior, manufacturing, conventions, standards, and restrictions. Issues of assembly are addressed to understand the logic of building envelope system.

DEPARTMENTAL FACULTY

ALBALADEJO RIVERA, LUIS R. – M Architecture; University of Puerto Rico, Río Piedras Campus, 2013; B Environmental Design; University of Puerto Rico, Río Piedras Campus, 2009.

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THE SCHOOL OF ENGINEERING, SURVEYING AND GEOSPATIAL SCIENCE

The School of Engineering, Surveying and Geospatial Science consists of six academic departments, as follows:

- Biomedical Engineering Department
- Chemical Engineering Department
- Civil & Environmental Engineering and Land Surveying Department
- Electrical & Computer Engineering and Computer Science Department
- Industrial and Systems Engineering Department
- Mechanical Engineering Department

Four of these departments developed associate degrees directed to promote short term employment and potential bachelor's degrees continuation programs:

- Electrical & Computer Engineering and Computer Science Department: Associate Degree of Engineering in Software Development
- Civil & Environmental Engineering and Land Surveying Department: Associate Degree in Land Surveying
- Industrial and Systems Engineering Department: Associate Degree of Engineering in Supply Chain and Logistics
- Mechanical Engineering Department: Associate Degree in Mechanical Engineering

These associate degrees were designed for a two-year program of study. Students enter these programs in their first year by taking some engineering science courses. The second year serves to teach/train students in engineering or technology field applications.

ELECTRICAL & COMPUTER ENGINEERING AND COMPUTER SCIENCE DEPARTMENT

Associate Degree of Engineering in Software Development

Computer Software Development is a rapidly changing field that spans a wide range of topics concerned with design, implementation, and programming of computers and digital systems. Software developers apply creative solutions to problems in government, telecommunication, entertainment and other businesses. These solutions are key enablers to global economic development and social welfare. These professionals are dedicated to automating processes that can leverage human performance in many disciplines.

The Associate Degree of Engineering in Software Development provides breadth in the software discipline by incorporating basic sciences, mathematics, engineering and technical subjects, and fundamental computer science topics. It also includes a set of carefully selected specialized courses in areas of strong demand that prepares students on being valuable contributors of hardware and software development positions and to continue their studies towards completing the bachelor's degree in computer engineering, and/or computer science.

Topics covered include algorithms and programming languages, digital system design, computer organization and architecture, operating systems, microprocessor-based systems, database systems, and software engineering.

Program Mission

To educate graduates with a strong background in practical hardware and software development skills, capable of successfully performing as computer software development specialist.

Program Educational Objectives

Within a few years of graduation, PUPR's Associate Degree of Engineering in Software Development graduates, are expected to attain the following:

1. Establish themselves as practicing professional associates 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 and/or entrepreneurs in the Software Development area.
3. Contribute to the creation of comprehensive solutions to Software Development problems that leverage technology advancements.
4. Engage in professional development through a lifetime of continuing education, research, and completion of their BS in Computer Engineering or Computer Science.

Student Outcomes

Upon graduation, students from the Computer Development Program must have acquired:

1. An ability to identify, formulate, and solve technical problems by applying principles of technology, science and mathematics.
2. An ability to apply technical principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in technical situations and make informed judgments, which must consider the impact of the solutions in a global, economic, environmental, and societal contexts.
5. An ability to function affectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and the use of professional judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Career Opportunities

The demand for Computer Software Development continues to expand in parallel to the computer and information revolution that has characterized the twenty first century. Computers are expected to continue to impact human development in all disciplines and industries, including business, and entertainment. Job opportunities exist within all types of businesses, given their need and reliance on computational programming.

Academic Load

The average full-time load per trimester is twelve credit-hours. Credits will not be awarded for courses that students are not properly registered.

Duration

The Associate Degree of Engineering in Software Development program may be completed in two (2) years by enrolling in about 11 to 13 credits per trimester.

Developmental Studies

All students that request admission and are admitted to the Associate Degree of Engineering in Software Development Program must show evidence that they have acquired the academic ability and skills necessary to progress through this degree. 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 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 73 credit-hours of the Software Development Program. The courses are awarded their corresponding credits per 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
ENG L0100	Preparatory English	3
ENG L0110	English Grammar	3
SPAN 0100	Preparatory Spanish	3
SPAN 0110	Spanish Grammar	3

Laboratories

The ECECS Department provides undergraduate laboratories in the following topics for this program: Fundamental Electricity, Computer Programming, Logic Circuit, Microprocessors, and Computer Architecture.

Student Organization

The students enrolled in the department may become members of the following organization: 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 Electronic Engineers, Inc., the world's largest professional engineering society.

Degree Offered

PUPR offers an Associate Degree of Engineering in Software Development. In order to earn the degree, the student must complete the following requirements:

Minimum Graduation Requirements

13	Credit-hours in Mathematics
04	Credit-hours in Basic Science
13	Socio-Humanistic Studies and Languages
40	Credit-hours in Basic Computer Engineering
03	Credit-hours in Management
73	**Total Credit-hours**

ADE SOFTWARE DEVELOPMENT CURRICULUM
(73 Credit-Hours)

Mathematics Component
(10 Credits-Hours)

Course	Title	Credit-Hours
MATH 1330	Precalculus I	3
MATH 1340	Precalculus II	3
MATH 1352	Calculus I-A	3
MATH 1354	Calculus I-B	3

Basic Science Component
(4 Credit-Hours)

Course	Title	Credit-Hours
SCIE 1210	Principles of Chemistry	4
SCIE 1211	Principles of Chemistry Laboratory	0

Socio-Humanistic and Languages Components
(10 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
ENGL 1101	Conversational English Lab 1	0
ENGL 1102	Conversational English Lab 2	0
ENGL 1103	Presentation Skills Lab	1
SOHU 2010	Socio-Humanistic Studies	3
SPAN 1010	Linguistic Analysis of Literary Genres	3

Basic Management Component
(3 Credits-Hours)

Course	Title	Credit-Hours
MGMT 4660	Entrepreneurship	3

Computer Engineering and Technical Core Courses
(43 Credit-Hours)

ASSOCIATE DEGREE OF ENGINEERING IN SOFTWARE DEVELOPMENT CURRICULUM SEQUENCE
(73 Credit-Hours)

Course	Title	Credit-Hours
CECS 2004	Discrete Structures	3
CECS 2200	Computer Programing Fund.	1
CECS 2202	Computer Programing I	4
CECS 2203	Computer Programing I Laboratory	0
CECS 2222	Computer Programing II	4
CECS 2223	Computer Programing II Laboratory	0
CECS 3212	Data Structures	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 3320	Microprocessors	3

COE	3321	Microprocessors Laboratory	1
COE	3302	Digital Systems Design with VHDL	3
COE	4320	Computer Architecture	4
COE	4321	Computer Architecture Laboratory	0
EE	1130	Freshman Design for Electrical & Computer Engineering	0
ETEC	1001	Fundamentals of Electricity Lab.	1

First Year

First Quarter

Course		Title	Credit-Hours
MATH	1330	Precalculus I	3
ENGL	1010	The Study of the Essay as a Lit. Genre	3
CECS	2200	Computer Programming Fund.	1
EE	1130	Freshman Design for EE & COE	3
ETEC	1001	Fundamental Electricity Lab.	1
			Total 11

1st Year - Second Quarter

Course		Title	Credit-Hours
MATH	1340	Precalculus II	3
CECS	2202	Computer Programming I	4
CECS	2203	Computer Programming I Lab	0
CECS	2004	Discrete Structures	3
SPAN	1010	Linguistic Analysis of Literacy Gen.	3
			Total 13

1st Year - Third Quarter

Course		Title	Credit-Hours
MATH	1352	Calculus I-A	2
CECS	2222	Computer Programming II	4
CECS	2223	Computer Programming II Lab	0
COE	2300	Logic Circuits	3
COE	2301	Logic Circuits Lab	1
ENGL	2020	Business English and Communication	3
			Total 13

Second Year

First Quarter

Course		Title	Credit-Hours
CECS	4202	Database Systems	3
COE	3320	Microprocessors	3
COE	3321	Micro Processors Lab	1
COE	3302	Digital System Design with VDHL	3
MATH	1354	Calculus I-B	2
ENGL	1101	Conversational English Lab	0
			Total 12

2nd Year - Second Quarter

Course		Title	Credit-Hours
SOHU	2010	Socio-Humanistic Studies	3
CECS	3320	Data Structure	3
MGMT	4660	Entrepreneurship	3

SCIE	1210	Principles of Chemistry	4
SCIE	1211	Principle of chemistry Lab	0
ENGL	1102	Conversational English Lab	0
			Total 13

2nd Year - Third Quarter

Course		Title	Credit-Hours
CECS	4202	Software Engineering	3
CECS	4230	Operating Systems	3
COE	4320	Computer Architecture	4
COE	4321	Computer Architecture Lab	0
ENGL	1103	Presentation Skills Lab	1
			Total 11

COURSE DESCRIPTIONS

Electrical Engineering Courses

EE 1130 – FRESHMAN DESIGN FOR ELECTRICAL & COMPUTER ENGINEERS
Three credit-hours. Two two-hour lectures per week. Prerequisite: 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.

Technology courses

ETEC 1001 – FUNDAMENTAL OF ELECTRICITY LABORATORY
One credit-hour. One four-hour or two two-hour lectures per week. Prerequisite: MATH 0110 or Equivalent.

This laboratory provides the necessary technical skills to understand how electrical circuits work. An initial exposure to the SI units and fundamental resistive circuit laws are given (KVL, KCL, and Ohm's Law & Energy Conservation Law) with the required experimentation. Laboratory equipment, such as voltage and current meters as well as oscilloscopes, is introduced. Circuit building skills are developed. Other skills developed involve modern electronics measurement methods, instrument calibration and use. Experimental study of capacitive and inductive circuits. Use computer programs to analyze circuits. Safety considerations are considered in the laboratory.

Computer Engineering Courses

COE 2300 – LOGIC CIRCUITS
Three-credit hours. Two two-hour lectures per week. Prerequisite: CECS 2200. Corequisite: 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 design practices, introduction to combinational logic design with PLDs, sequential logic design principles and practices. A general exposure to the combinational design of an Arithmetical-Logic Unit (ALU) and the sequential design with PDLs. 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. Prerequisite: ETEC 1001. Corequisite: COE 2300.

The laboratory provides an experimental study using TTL digital logic circuits. Two levels of integrations are used: small-scale integrations (SSI) and medium scale integrations (MSI). These logic circuits are then used in applications such as: combination logic and design, decoding, arithmetic and comparison operation, memory device, counting, and sequential logics and design. Computer simulation will also be required.

COE 3302 – DIGITAL SYSTEMS DESIGN WITH VHDL
Three credit-hours. Two two-hour lectures per week. Prerequisite: COE 2300.

Study of 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. Prerequisite: COE 2300. Corequisite: 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 – MICROPROCESSOR LABORATORY
One credit-hour. One four-hour or two two-hour lectures per week. Prerequisite: COE 2301. Corequisite: COE 3320.

The laboratory provides an introduction to microcontroller systems programming, including both hardware interfacing and software fundamentals.

COE 4320 – COMPUTER ARCHITECTURE
Four credit hours. Two two-hour lectures per week. Prerequisite: COE 3320. Corequisite: 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 or two two-hour lectures per week. Prerequisite: COE 3320. Corequisite: COE 4320.

A practical experience on design, organization, performance measurement, benchmark, and implementation of a computer system.

Computer Engineering and Computer Science Courses

CECS 2004 – DISCRETE STRUCTURES
Three credit-hours. Two two-hour lectures per week. Prerequisite: MATH 1330 or Equivalent. Corequisite: MATH 1340.

Fundamental mathematical concepts related to computer science, including finite and finite sets, relations, functions, and prepositional logic. Introduction to other proofing techniques. Modeling and solving problems in computer science. 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. Prerequisite: 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 pseudo code. 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 developmental environment and a high-level language such as C++.

CECS 2202 – COMPUTER PROGRAMMING I
Four credit-hours. Two two-hour lectures per week. Prerequisite: CECS 2200. Corequisite: CECS 2203.

The course is a follow-up to the CECS 2200 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 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. Prerequisite: CECS 2200. Corequisite: CECS 2202.

This course is the laboratory companion of the Computer Programming I course (CECS 2202). It uses two different pedagogic strategies to assure that students carry out 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. Prerequisite: CECS 2202. Corequisite: CECS 2223.

This course continues the development of the students' skills in algorithm programming using the object-oriented paradigm. It emphasizes dramatically 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. Prerequisite: CECS 2202. Corequisite: CECS 2222.

This course is the laboratory companion to the Computer Programming II course (CECS 2222). The student completes 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 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 this implies 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 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, relation database concepts, hierarchies, relation algebra and SQL, storage structures, and the role of database and computers in application environment. Various programming assignments in SQL and a design project are required.

CECS 4204– SOFTWARE ENGINEERING
Three credit-hours. Two two-hour lectures per week. Corequisite: CECS 4202.

The course presents the different phases for the development of software: project planning, object-oriented analysis, design, coding, and testing techniques using the Unified Modeling Language (UML). In addition, some tools to support the development to complete the activities necessary to develop software. Students are required to use what is presented to develop an application (the implementation is optional).

CECS 4230 – OPERATING SYSTEMS
Three credit-hours. Two two-hour lectures per week. Corequisite: COE 4320.

Operating systems are programs that manage the computer hardware resources, and augment or enhance their basic functionality on behalf of application programs that use the computer. The course discusses various aspects of the computer operating systems including processes, Process Scheduling, memory management, concurrent programming, deadlocks, and others.

DEPARTMENTAL FACULTY

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CIVIL & ENVIRONMENTAL ENGINEERING AND LAND SURVEYING DEPARTMENT

Associate Degree in Land Surveying

Land Surveying is the science of determining the positions 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 measurements of angles and distances, the establishment of vertical and horizontal control points, plan confection, cadastral measurements, highway tracing and building locations, submarine topography and ocean depths, plus the location of legal boundaries.

Program Mission

Provide the technical knowledge through an educational experience that enriches the lives of program students in order to prepare them to support the surveying profession in its mission of protecting the public health and welfare.

Program Educational Objectives

Within a few years of graduation, associate degree program graduates are expected to attain the following:

1. Contribute to society as skillful technicians that execute their work following the principles of moral conducts and ethics.
2. Gain the necessary knowledge and techniques to pursue a bachelor’s degree.
3. Have the capability to be employed and successfully support professional surveyors in the practice.

Student Outcomes

Upon graduation associate degree program graduates, will be able to demonstrate the following program outcomes:

1. An ability to identify, formulate, and solve technical problems by applying principles of technology, science and mathematics.
2. An ability to apply technical principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in technical situations and make informed judgments, which must consider the impact of the solutions in a global, economic, environmental, and societal context.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and the use of professional judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Career Opportunities

Surveying related careers have undergone important technological changes in recent years. Therefore, the job market requires to Surveying Technicians a broad and contemporary knowledge of the current equipment and practices to support surveying projects. This associate degree offers a complete education design to comply with job market demands, providing great job opportunities to its alumni in Puerto Rico as well as in the United States. The combination of diverse technologies covered in the associate 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.

Degree Offered

The Civil & Environmental Engineering and Land Surveying Department offers the Associate Degree in Land Surveying. In order to get this degree, the student must complete the following minimum requirements:

Minimum Graduation Requirements

6	Credit-hours in Mathematics
3	Credit-hours in Basic Science
13	Credit-hours in Socio-Humanistic Studies and Languages
24	Credit-hours in Surveying
15	Credit-hours in Geomatic Science
3	Credit-hours in Management
3	Credit-hours in Elective Component
67	**Total Credit-hours**

Laboratories

The associate degree will be benefitting of the Land Surveying Laboratory. Since the surveying profession is practiced mainly in the field, practical experience using PUPR's equipment is acquired in the field.

Student Organizations

The students enrolled in the program can become members of the student chapter of the Institute of Land Surveyors of the College of Engineers and Land Surveyors of Puerto Rico.

Developmental Studies

All students who apply for admission and those selected who are admitted to the Associate Degree in Land Surveying must show evidence that they have acquired the necessary skills and abilities to progress through this track. Those failing to do so (as reflected by the results of their College Entrance Examination Board tests, results in PUPR placement tests, previous university experience, other tests, or criteria) will be required to take developmental courses. These courses are designed to help students overcome deficiencies in languages, mathematics, and/or science. These developmental courses are in addition to the 67 credits of the pre-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 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

ASSOCIATE DEGREE IN LAND SURVEYING CURRICULUM

Mathematics Components

(6 Credits-Hours)

Course	Title	Credit-Hours
MATH 1330	Precalculus I	3

MATH 1340	Precalculus II	3

Basic Science Component
(3 Credit-Hours)

Course	Title	Credit-Hours
SCIE 2410	General Physics I	3

Socio-Humanistic and Languages Components
(13 Credit-Hours)

Course	Title	Credit-Hours
SOHU 2010	Socio-Humanistic Studies	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
ENGL 2020	Business English and Communication	3
ENGL 1101	Conversational English Lab I	0
ENGL 1102	Conversational English Lab II	0
ENGL 1103	Presentation Skills Lab	1
SPAN 1010	Linguistic Analysis of Literary Genres	3

Surveying Component
(24 Credits-Hours)

Course	Title	Credit-Hours
SURV 2091	Surveying Instruments Lab	1
SURV 2202	Surveying Analysis	3
SURV 2300	Legal Aspects of Surveying I	3
SURV 2302	Fundamentals of Surveying	4
SURV 2303	Fundamentals of Surveying Lab	0
SURV 2310	Surveying Data Management	3
SURV 2802	Visualization of Spatial Information	3
SURV 3310	Industry Practice	4
SURV 3804	Computer Applications for Land Surveyors	3

Geomatics Science Component
(15 Credits-Hours)

Course	Title	Credit-Hours
GEOM 2102	Introduction to Geomatics	3
GEOM 2800	Information Systems for Land Surveyors	3
GEOM 3606	Digital Cartography	3
GEOM 4104	Dendrology	3
GEOM 4504	Surveying Space Techniques	3

Management Component
(3 Credits-Hours)

Course	Title	Credit-Hours
MGMT 4660	Entrepreneurship	3

Elective Component
(3 Credits-Hours)

Course	Title	Credit-Hours
SURV 2304	Legal Aspects in Surveying II	3
GEOM 3502	Fundamentals of Geodesy	3
GEOM 5600	Geospatial Information Science Fundamentals	4

ASSOCIATE DEGREE IN LAND SURVEYING CURRICULUM SEQUENCE

First Year

First Quarter

Course	Title	Credit-Hours
MATH 1330	Precalculus I	3
ENGL 1010	The Study of the Essay as Literary Genre	3
SPAN 1010	Linguistic Analysis of Literary Genres	3
GEOM 2102	Introduction to Geomatics	3
		Total 12

1st Year - Second Quarter

Course	Title	Credit-Hours
MATH 1340	Precalculus II	3
MGTM 4660	Entrepreneurship	3
GEOM 2800	Information Systems for Land Surveyors	3
SOHU 2010	Socio-Humanistic Studies I	3
		Total 12

1st Year - Third Quarter

Course	Title	Credit-Hours
SURV 2202	Surveying Analysis	3
SURV 2802	Visualization of Spatial Information	3
GEOM 3606	Digital Cartography	3
ENGL 2020	Business English and Communications	3
		Total 12

Second Year

First Quarter

Course	Title	Credit-Hours
SURV 2302	Fundamentals of Surveying	4
SURV 2303	Fundamentals of Surveying Lab	0
SURV 2300	Legal Aspect of Surveying I	3
SCIE 2410	General Physics I	3
ENGL 1101	Conversational English Lab I	0
		Total 10

2nd Year - Second Quarter

Course	Title	Credit-Hours
GEOM 4504	Surveying Space Techniques	3
SURV 2091	Surveying Instruments Lab	1
SURV 3804	Computer Applications for Land Surveyors	3
SURV 2310	Surveying Data Management	3
ENGL 1102	Conversational English Lab II	0
		Total 10

2nd Year - Third Quarter

Course	Title	Credit-Hours
SURV 3310	Industry Practice	4
SURV or GEOM	Department Elective	3

GEOM	4104	Dendrology	3
ENGL	1103	Presentation Skills Lab	1
		Total	**11**

COURSE DESCRIPTIONS

SURV 2091 – SURVEYING INSTRUMENTS LAB
One credit-hour. Three hours per week and field laboratory. Prerequisites: SURV 2302 and SURV 2303

Through conference and field practices, the student will learn the basic surveying concepts applicable for the design and construction of route.

SURV 2202 – SURVEYING ANALYSIS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1340.

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 OF SURVEYING I
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: GEOM 2102

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 2302 – FUNDAMENTALS OF SURVEYING
Four credit-hours. Two two-hour lecture periods per week. Prerequisite: SURV 2202. Corequisite: SURV 2203

The theory and practice of land surveying. Measurements of difference in elevations using leveling network. Measurement of distances using tapes and other methods; also, measurements of angles. Application to boundary identification.

SURV 2303 – FUNDAMENTAL3S OF SURVEYING LAB
Zero credit-hours. One four-hour laboratory per week. Prerequisites: SURV 2202. Corequisite: SURV 2302

Laboratory practice of Land Surveying related to course SURV 2302. The practices will concentrate in the uses of Land Surveying Instruments. Measurements of difference in elevations using differential and trigonometric leveling. Measurements of distances using tapes and other methods; also, measurements of angles. Application to Traverse and polygonal closure.

SURV 2310 – SURVEYING DATA MANAGEMENT
Three credit-hours. Two two-hour lectures periods per week. Prerequisite: SURV 2302

Surveying although is one of the oldest professions, this day relies on the efficiency without losing precision, thanks to the new techniques and technology. The different modern surveying data tapes will be introduced. How through the electronics hardware, the collection of data is done and measures the point with data collector, download and upload points, will be discussed and practiced.

SURV 2802 – VISUALIZATION OF SPATIAL INFORMATION
Three credit-hours. Two two-hour lectures periods per week. Prerequisites: GEOM 2800 and MATH 1340

Basic knowledge of spatial information management and visualization using computer software (CAD).

SURV 3310 – INDUSTRY PRACTICE
Four credit-hours. Two two-hour lectures periods per week. Prerequisite: SURV 2310

Discussion and development of land surveying project. The course will require fieldwork, boundary and topography survey, design of evidence gathering, resurvey, retracement and analysis techniques for complex Land Surveying System, riparian, mineral, land grant and fraudulent surveys; case studies.

SURV 3804 – COMPUTER APPLICATIONS FOR LAND SURVEYORS
Three credit-hours. Two two-hour lectures periods per week. Prerequisites: SURV 2302, SURV 2303 and SURV 2802

Computer applications used on the land surveying professional practice. Computer Drafting.

GEOM 2102 – INTRODUCTION TO GEOMATICS
Three credit-hours. Two two-hour lectures 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 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 sand land use management. It is thus fundamental to all the geosciences disciplines which use spatial 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 lectures periods per week. Prerequisite: 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. The course will place special attention to the design, development and management of databases either for office management or Geographic Information Systems.

GEOM 3606 – DIGITAL CARTOGRAPHY
Three credit-hours. Two two-hour lectures periods per week. Prerequisite: GEOM 2602

Introduction to digital cartography concepts. The course covers techniques, error handling and software used for the creation of vector and raster data.

GEOM 4104 – DENDROLOGY
Three credit-hours. Two two-hour lectures periods per week. Prerequisites: SURV 2302 and SURV 2303
Introduction to trees, their identifying characteristics, habitats, distribution, and systematic classification.

GEOM 4504 – SURVEYING SPACE TECHNIQUES
Three credit-hours. Two two-hour lectures periods per week. Prerequisite: SURV 2302 and SURV 2303

The very basic principles of satellite geodesy and concept of satellite positioning techniques will be introduced. Satellite Laser Ranging, altimetry and Very Long Base Lines, Interferometry will be discussed briefly.

DEPARTMENTAL FACULTY

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INDUSTRIAL AND SYSTEMS ENGINEERING DEPARTMENT

Associate Degree of Engineering in Supply Chain and Logistics

The curriculum is designed to develop Logistics Technicians capable of planning, implementing, and managing integrated supply chain delivery systems to assure performance, reliability, maintainability, schedule adherence and cost control of logistics operations. The integration of systems will be applied to the functions of transportation, procurement, planning, warehousing, distribution and customer service operation.

The Logistic Technician adopts as its goals: profitability, effectiveness, efficiency, adaptability, responsiveness, quality, and the continuous improvements of supply chain channels to reduce delivery time and cost. 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 a robust supply chain and logistics professional for the community.

Program Mission

To provide our graduates with the knowledge and skills in Supply Chain and Logistics necessary to hold professional positions in industry, government, warehouse, transportation, and distribution center and to contribute with the development of the community and the society.

Program Educational Objectives

The associate program of the Industrial and Systems Engineering Department at Polytechnic University of Puerto Rico has the following educational objectives:

1. Graduates will demonstrate an effective integration of knowledge and skills to identify and improve opportunities in any organization.
   The ADESL graduate's role can and does vary widely across modern Supply Chain and Logistics organizations. Graduates will be able to analyze and improve transportation, warehousing, customer relations, procurement and planning of inventory throughout the supply chain channels of material supply, product distribution and reject disposal. They will be able to support private companies or their own.
2. Graduates will demonstrate the leadership skills to contribute ethically and responsibly to the social and economic development of their communities.
   The ADESL graduate should be able to understand the organizational culture to effectively apply soft skills in the leadership of operational work teams. This graduate has the knowledge to develop a professional conduct based on an ethical, social and economic perspective to improve its community development.
3. Graduates will be prepared to pursue advanced studies and continuing education to develop their career skills.
   The ADESL graduate must be able to take responsibility for their own learning in order to respond to their needs including tasks or responsibilities associated with their jobs and personal interests. This graduate must be able to continue his education and pursue a bachelor's degree in industrial engineering as a result of 44 directly transferred credits.
4. Graduates will be able to communicate professionally and effectively in a team-based environment performing as proactive change agents.
   The ADESL graduate has received a strong English and Spanish preparation through the use of idioms laboratories and courses directed to improve idiom fluency, technical writing and presentation skills.

Student Outcomes

The following are specific program outcomes that graduates from the Associate Degree of Engineering in Supply Chain and Logistics shall demonstrate upon program completion:

1. An ability to identify, formulate, and solve technical problems by applying principles of technology, science and mathematics.
2. An ability to apply technical principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in technical situations and make informed judgments, which must consider the impact of the solutions in a global, economic, environmental, and societal contexts.
5. An ability to function affectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and the use of professional judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Career Opportunities

The graduate of this program will be able to perform technical analysis and develop alternatives to improve the process of transportation, planning, warehousing, procurement, distribution, and customer service for any of the supply chain channels. Logistic Technicians will support the operation that improve the inventory control and cost of any kind of company within a private or government sector.

Degree Offered

The Industrial and Systems Engineering Department offers technical education leading to the Associate Degree of Engineering in Supply Chain and Logistics (ADESL). In order to earn the degree, the student must complete the following requirements:

Minimum Graduation Requirements

10	Credit-hours in Mathematics
09	Credit-hours in Basic Science
19	Socio-Humanistic Studies and Languages
22	Credit-hours in Industrial Engineering/Technology
03	Credit-hours in Management
72	**Total Credits-hours**

Industrial Engineering Laboratories

The Industrial and Systems Engineering Department offers students hands-on experiences in both academic laboratories as well as in supply chain environments where students practice concepts and techniques learned in the classroom. Laboratory facilities have been designed to cover major areas of the logistics management programming, and simulation practices.

A. Operation Management

The Operation Management Laboratory consist of a Window 7 Enterprise network with twenty-eight (28) Intel Xeon personal computers for student based on an open-access environment where students are given 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 include AutoCAD, Minitab, Witness, Arena for Simulation, Mathcad, Microsoft Office 365, Microsoft Project, Microsoft Visio, Microsoft Visual Studio, Microsoft SQL Server, and PSpice Student Version.

B. 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 specifics class needs and assignments, where student are requested for critical application and 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 systems analysis, solution development and decision-making skills in our students. The different applications in the network include AutoCAD, Minitab, Witness, Arena and Simio for Simulation, Mathcad, Microsoft Office 365, 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 that they have acquired the academic abilities and skills necessary to progress through the 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 placement tests, previous university experience, other tests, or criteria) will be required to take developmental courses. These courses are designed to help students overcome deficiencies in languages, mathematics, and or 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 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 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. ADESL 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 experiences with the students.

ASSOCIATE DEGREE OF ENGINEERING IN SUPPLY CHAIN AND LOGISTICS CURRICULUM

Mathematics Components

(10 Credits-Hours)

Course		Title	Credit-Hours
MATH	1330	Precalculus I	3
MATH	1340	Precalculus II	3
MATH	1352	Calculus IA	2
MATH	1354	Calculus IB	2

Socio-Humanistic and Languages Components

(19 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
ENGL	1101	Conversational English Lab I	0
ENGL	1102	Conversational English Lab II	0
ENGL	1103	Presentation Skills	1

Basic Science Component

(9 Credit-Hours)

Course		Title	Credit-Hours
SCIE	1210	Principles of Chemistry	4
SCIE	1211	Principles of Chemistry Laboratory	0
SCIE	1430	Physics I (Mechanics)	4
SCIE	1431	Physics I Laboratory	0

Industrial Engineering Component

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
ITEC	1000	Procurement Management	3
ITEC	1010	Costumer Service Management	3
ITEC	1020	Transportation Management	3
ITEC	1030	Planning and Inventory Control	3

ITEC	1040	Warehouse and Distribution Management	3
IE	4915	Facilities Planning and Design Project	1
IE	4990	Capstone Design Course	3
IE	4995	Capstone Design Course Extension	3

Management Component
(3 Credits-Hours)

Course		Title	Credit-Hours
MGMT	4660	Entrepreneurship	3

Minimum Total Program Credits **72**

ASSOCIATE DEGREE OF ENGINEERING IN SUPPLY CHAIN AND LOGISTICS CURRICULUM SEQUENCE

First Year

First Quarter

Course		Title	Credit-Hours
MATH	1330	Precalculus I	3
SPAN	1010	Linguistic Analysis of Literature Genres	3
ENGL	1010	The Study of the Essay as a Literature Genre	3
ENGI	1110	Engineering Graphics	3
		Total	**12**

1st Year - Second Quarter

Course		Title	Credit-Hours
MATH	1340	Precalculus II	3
IE	1000	Introduction to Industrial Engineering	3
ITEC	1000	Procurement Management	3
SOHU	2010	Socio-Humanistic Studies	3
		Total	**12**

1st Year - Third Quarter

Course		Title	Credit-Hours
MATH	1352	Calculus IA	3
ENGL	2020	Business English and Communication	3
IE	1611	Computer Tools for IE's Lab I	1
SCIE	1211	Principles of Chemistry	4
SCIE	1211	Principles of Chemistry Laboratory	0
SOHU	2040	Ethics, Global, and Contemporary Issues	3
		Total	**12**

Second Year

First Quarter

Course		Title	Credit-Hours
SPAN	2020	Business Spanish	3
IE	2110	Financial and Cost Accounting	3
MATH	1354	Calculus IB	2
ITEC	1010	Costumer Service Management	3
ENGL	1101	Conversational English Lab	0
		Total	**11**

2nd Year - Second Quarter

Course		Title	Credit-Hours
ITEC	1030	Planning and Inventory Control	3
ENGI	2270	Probability and Statistics for Engineering	3
ENGL	1102	Conversational English II Lab	0
SCIE	1430	Physics I	4
SCIE	1431	Physics I Lab	1
		Total	**11**

2nd Year - Third Quarter

Course		Title	Credit-Hours
ENGI	2260	Engineering Economics	3
ITEC	1020	Transportation Management	3
ITEC	1040	Warehouse and Distribution Mgmt.	3
MGMT	4660	Entrepreneurship	3
ENGL	1103	Presentation Skills	1
		Total	**13**

COURSE DESCRIPTIONS

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 computer-aided design (CAD) system to create engineering drawings.

ENGI 2260 – ENGINEERING ECONOMICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 1360

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

This course introduces students to the basic concepts of probability and statistics and its applications 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 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 credit-hour. Two two-hour lecture periods per week. Prerequisite: 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.

IE 2110 – FINANCIAL AND COST ACCOUNTING
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: 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, cost of resources, objectives and purposes. Use of cost-volume-profit (CVP) analysis as a planning and decision-making aid.

ITEC 1000 – PROCUREMENT MANAGEMENT
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: MATH 0110

This course is designed to develop the student's knowledge in the areas of procurement procedures, policies, laws, and strategies for the acquisition of materials, equipment, and other resources. The student will recognize the legal responsibility under contract, receiving or purchase order documentation within domestic and international markets.

ITEC 1010 – CUSTOMER SERVICE MANAGEMENT
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ITEC 1000

This course is designed to prepare the student to maximize the sale opportunities within a contract agreement. It will also provide the negotiating strategies to manage claims and returns for services and finished products.

ITEC 1020 – TRANSPORTATION MANAGEMENT
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ITEC 1000

This course will provide the student with the knowledge of transportation processes for materials and/or finished products. The student will learn transportation laws, contract strategies, cost control, and other areas for domestic and international markets.

ITEC 1030 – PLANNING AND INVENTORY CONTROL
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ITEC 1000

This course will prepare the student to forecast demand, develop the material requirement planning, and keep the inventory in control to reduce holding and purchasing cost.

ITEC 1040 – WAREHOUSE AND DISTRIBUTION MANAGEMENT
Three credit-hours. Two two-hour lecture periods per week. Prerequisite: ITEC 1030

This course will provide the understanding of the operational function in a warehouse or distribution center. Functions including receiving, put away, storing, picking, shopping, inventories controls, and warehouse regulations control will be covered.

DEPARTMENTAL FACULTY

AYALA, JORGE – Professor, PhD, Management Engineering, Operations Research, Rensselaer Polytechnic Institute, Troy, New York, 1993; MBA Production Management, Quantitative Methods, University of Puerto Rico, Río Piedras Campus, 1990; MS Operation Research Statistics, Rensselaer Polytechnic Institute, Troy, New York, 1991; BSM, Mathematics, University of Puerto Rico, Río Piedras Campus 1983. Email address: jayala@pupr.edu

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PONS FONTANA, CARLOS A. – Associate Professor; Professor, Assistant to the Department Head in Student Affairs, PhD Psych., Carlos Albizu University, San Juan, 2004; MEM, Polytechnic University of Puerto Rico, 1994; BSIE, Polytechnic University of Puerto Rico, 1986; MS Psych, Centro Caribeño de Estudios Post Graduados, 1975; BA Psych, University of Puerto Rico, 1972. Email: pons@pupr.edu

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MECHANICAL ENGINEERING DEPARTMENT

Associate Degree in Mechanical Engineering

Mechanical engineer technicians use the fundamental principles of energy and mechanics in supporting the design development, testing and manufacturing of mechanical or electromechanical devices and systems. In particular, they are well educated in the preparation of accurate mechanical drawings, layouts, data analysis, cost estimates, and reports. The program is suited for students with the ability to develop proper engineering documentation to support projects and to continue their career to become a professional mechanical engineer. The program was 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 Associate Degree in Mechanical Engineering (A.D.M.E.) covers the fundamental aspects of the field, focuses on basic principles and educates students to support Mechanical Engineers in the design of equipment and mechanical device performance problems. The curriculum integrates advanced computer skills, laboratory work, and technical projects in a teamwork setting throughout the program. The program was designed to be completed in two years. Mechanical Engineer Associate student graduates with a conceptual base for mechanical drawing and aerospace engineering. The student will be able to develop mechanical drawings based on laboratory and practical work to enhance the experience of learning by doing. Courses were designed to develop an engineering perspective to improve manufacturing equipment performance by implementing solutions.

Program Mission

The Associate Degree in 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 the development of the ability and competency of our students in utilizing scientific and technical methods to improve manufacturing equipment designs and support engineering projects in a competitive industrial environment and economically satisfy the community while considering the impacts on society.

Program Educational Objectives

Within a few years of graduation, PUPR'S Associate Degree of Mechanical Engineering graduates are expected to attain the following:

1. Prepare mechanical engineering technicians to provide support to engineers in the preparation of mechanical drawings, mechanical system design and work in support of mechanical and aerospace engineers.
2. Develop technically educated individuals for employment as mechanical engineering technicians, engineering assistants, mechanical supervisors or equipment specialists for a manufacturing environment.
3. Develop graduates with a well-developed social and economic conscience.
4. Develop of competitive graduates for advanced study in the areas of Mechanical Engineering.
5. Develop graduates with adequate communication skills for the local and national market.

Student Outcomes

Graduates from the Associate Degree in Mechanical Engineering program shall demonstrate:

1. An ability to identify, formulate, and solve technical problems by applying principles of technology, science and mathematics.
2. An ability to apply technical principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in technical situations and make informed judgments, which must consider the impact of the solutions in a global, economic, environmental, and societal context.
5. An ability to function affectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and the use of professional judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Career Opportunities

Mechanical Engineering Technicians have many professional options due to the breadth of their preparation in many varieties of industries. They are prepared to evaluate, develop sketches and improve mechanical designs of a variety of electromechanical systems. They can also work in an aerospace industry environment. Our graduates can pursue their careers with local, state and federal agencies, as well as with private enterprises, or even organize their own business. 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 Technician 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 Department offers undergraduate instruction leading to the Associate Degree in Mechanical Engineering (ADME). To obtain this degree, the student must complete the following minimum requirements:

Minimum Graduation Requirements

11	Credit-hours in Mathematics
09	Credit-hours in Basic Science
19	Credit-hours in Socio-Humanistic Studies and Languages
06	Credit-hours in Engineering Science
14	Credit-hours in Mechanical Engineering
09	Credit-hours in Mechanical Technology
03	Credit-hours in Management
71	**Total Credit-hours**

Developmental Studies

Students admitted to the Mechanical Engineering Associate Degree 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 the 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 students overcome deficiencies in languages, mathematics, and or science. These courses are required in addition to the 71 credit-hours required by the Associate Degree Program.

Developmental Studies Component

(Maximum of 30 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	Precalculus I	3
SCIE 0110	Introduction Physics	3

Laboratories

The facilities and laboratories of the Mechanical Engineering Department of PUPR provide associate degree students with hands-on experience on several important areas such as Measurements, Engineering Materials, Mechatronics, Manufacturing, and Computer Aided Design and Computer Aided Manufacturing. The mechanical department experimental facilities are housed in the first and fourth floors of the laboratory building. In addition to this, chemistry, physics, electronics and computer 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 organizations:

- Student Chapter of the Institute of Mechanical Engineers of the College of Engineers and Land Surveyors of Puerto Rico (CIAPR)
- Society Automotive Engineers (SAE)
- American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- American Society of Mechanical Engineers (ASME)

These organizations provide students with the opportunity to get acquainted with their careers and participate in conferences, seminars, and field trips to broaden their professional and social activities, and nurture their leadership and communications skills.

ASSOCIATE DEGREE IN MECHANICAL ENGINEERING CURRICULUM

Mathematics Components

(11 Credits-Hours)

Course	Title	Credit-Hours
MATH 1340	Precalculus II	3
MATH 1350	Calculus I	4
MATH 1360	Calculus II	4

Science Component

(9 Credit-Hours)

Course	Title	Credit-Hours
SCIE 1210	General Chemistry I	4
SCIE 1211	General Chemistry I Laboratory	0
SCIE 1430	Physics I	4
SCIE 1431	Physics I Laboratory	1

Socio-Humanistic and Languages Components

(19 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
ENGL 1101	Conversational English Lab I	0
ENGL 1102	Conversational English Lab II	0
ENGL 1103	Presentation Skills	1

Engineering Sciences Component
(6 Credit-Hours)

Course	Title	Credit-Hours
ENGI 2270	Engineering Probability and Statistics	3
ENGI 2110	Engineering Mechanics, Statics	3

Mechanical Engineering Component
(14 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 2210	Engineering Materials	3
ME 2211	Engineering Materials Laboratory	1
ME 2930	Introduction to Aerospace Engineering	3

Mechanical Technology Components
(9 Credit-Hours)

Course	Title	Credit-Hours
MTEC 1000	Geometric Dimensioning and Tolerance	3
MTEC 2010	Computer Aided Manufacturing	3
MTEC 2020	Manufacturing Engineering Technology	3

Business Component
(3 Credits-Hours)

Course	Title	Credit-Hours
MGMT 4660	Entrepreneurship	3

Minimum Total Program Credits **71**

ASSOCIATE DEGREE IN MECHANICAL ENGINEERING CURRICULUM SEQUENCE

First Year

First Quarter

Course	Title	Credit-Hours
MATH 1340	Precalculus II	3
ME 1210	Computer Aided Drafting and Design	3
ENGL 1010	The Study of the Essay as a Literary Genre	3
SOHU 2010	Socio-Humanistic Studies	3
	Total	**12**

1st Year - Second Quarter

Course	Title	Credit-Hours
MATH 1350	Calculus I	4
SPAN 1010	Linguistic Analysis of Literary Genres	3
MTEC 1000	Geometric Dimensioning and Tolerance	3
ENGL 2020	Business English and Communication	3
	Total	**13**

1st Year - Third Quarter

Course		Title	Credit-Hours
MATH	1360	Calculus II	4
SCIE	1210	General Chemistry I	4
SCIE	1211	General Chemistry I Lab	0
SPAN	2020	Business Spanish	3
		Total	**11**

Second Year

First Quarter

Course		Title	Credit-Hours
ENGI	2270	Engineering Probability & Statistics	3
SCIE	1430	Physics I	4
SCIE	1431	Physics I Lab	1
ME	1211	Conventional Manufacturing Lab	1
MGTM	4660	Entrepreneurship	3
ENGL	1101	Conversational English Lab I	0
		Total	**12**

2nd Year - Second Quarter

Course		Title	Credit-Hours
ENGI	2110	Engineering Mechanical, Statistics	3
SOHU	2040	Ethics, Global & Contemporary Issues	3
ME	2210	Engineering Materials	3
ENGL	1102	Conversational English Lab II	0
ME	2010	Computer Programming for ME	3
		Total	**12**

2nd Year - Third Quarter

Course		Title	Credit-Hours
MTEC	2010	Computer Aided Manufacturing	3
MTEC	2020	Manufacturing Engineering Technology	3
ENGL	1103	Presentation Skills Lab	1
ME	2211	Engineering Materials Lab	1
ME	2930	Introduction of Aerospace Engineering	3
		Total	**11**

COURSE DESCRIPTIONS

ENGI 2110 – ENGINEERING MECHANICS, STATICS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: MATH &SCIE 1430/1431

Analysis of force systems. Vectors. Laws equilibrium of particles and rigid bodies. Structural analysis trusses, frames, and machines. Centers of gravity and moments of inertia. Internal forces, Friction.

ENGI 2270 – PROBABILITY AND STATISTICS FOR ENGINEERS
Three 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.

ME 1210 – COMPUTER AIDED DRAFTING AND DESIGN
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: 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 student will work on a team-based design prototype to be fabricated in ME 1211.

ME 1211 – CONVENTIONAL MANUFACTURING LABORATORY
One credit-hour. One four-hour lecture periods per week. Prerequisites: 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. Prerequisites: MATH 1350

This course will introduce 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, pseudo coding, editing and debugging. Students will apply the learned techniques to the solution of engineering problems.

ME 2210 – ENGINEERING MATERIALS
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: SCIE 1210, SCIE 1211. Corequisite: 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 binding, 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 lecture periods per week. Prerequisites: 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 teamwork and communication skills through the submissions of oral and written reports.

ME 2930 – INTRODUCTION TO AEROSPACE ENGINEERING
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: None

Introduction to the basic concepts of aerodynamics and how they are applied to the flight of aircraft: lift, drag, propulsion, performance, stability and design team setting will be used to work with the concepts discussed.

MTEC 1000 – GEOMETRIC DIMENSIONING AND TOLERANCE
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 1210

This course presents a complete introduction to the ASME Y14.5 2009 standard. The course covers the concepts of GD&T such as Standards symbols, datum reference frames, and material condition modifiers. General applications in mechanical engineering are included.

MTEC 2010 – COMPUTER AIDED MANUFACTURING
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 2010, ME 1211

Computer implementations of finite element methods for the analysis of structural and heat transfer problems. Computer programming in MATLAB or any other programming language and mastering in the use of commercial software for finite element analysis will be required.

MTEC 2020 – COMPUTER AIDED MANUFACTURING
Three credit-hours. Two two-hour lecture periods per week. Prerequisites: ME 2010, ME 1211

This course covers a comprehensive collection of manufacturing and materials processing techniques. Students learn historical perspectives and basic science of manufacturing and its related materials, specific manufacturing methods as they are applied to specific materials, and the theory of the automation of today's manufacturing environment, productivity, and quality improvement systems.

DEPARTMENTAL FACULTY

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DECLARATIONS AND CERTIFICATIONS

NON-DISCRIMINATION CLAUSE

Polytechnic University of Puerto Rico does not discriminate against any individual 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.

FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA)

STUDENT'S RIGHTS TO KNOW UNDER THE FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA)

Annual Notice to Students

Each year, Polytechnic University of Puerto Rico informs 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 student's academic records, to establish the student's 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 for 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 to 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 2016 - 2020.

Ernesto Vázquez Barquet
President
Polytechnic University of Puerto Rico