Self Study Report
For B.S. in Computer Engineering
Appendix

July 1, 2008
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Appendix A – Course Syllabi

General Information:
- Alpha-numeric codification: INEL 3105
- Course Title: ELECTRICAL SYSTEMS ANALYSIS I
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Required in INEL and ICOM

Course Description:
English: Analysis of direct current and alternating current linear electric circuits; laws and concepts that characterize their behavior.
Spanish: Análisis de circuitos eléctricos lineales de corriente continua y de corriente alterna; las leyes y conceptos que caracterizan su comportamiento.

Pre/Co-requisites and other requirements:
MATE 3032 or MATE 3184. Co-requisites: (FISI 3172 or FISI 3162) and (MATE 3063 or MATE 3185).

Course Objectives:
The objective of this course is to introduce students to electric circuit analysis techniques, including the Kirchhoff’s Laws. Basic circuits elements such as, transformer, operational amplifiers, resistors, inductors, capacitors, dependent and independent sources are introduced. Simplification of electrical circuits is considered using various techniques, including Thevenin’s and Norton’s theorems. Single-phase circuits power analysis and first-order linear circuit analysis techniques are also presented.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- laboratory
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:
P-Spice, MATLAB, and demonstration of Practical Drive Systems in Laboratory

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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</thead>
<tbody>
<tr>
<td>Circuit variables and units.</td>
<td>2</td>
</tr>
<tr>
<td>Circuit elements, Kirchhoff’s laws.</td>
<td>5</td>
</tr>
<tr>
<td>Resistive circuits.</td>
<td>4</td>
</tr>
<tr>
<td>Techniques of circuit analysis and software simulation</td>
<td>10</td>
</tr>
<tr>
<td>The ideal operational amplifier and its inverting and non-inverting configurations.</td>
<td>3</td>
</tr>
<tr>
<td>Inductance (L), Capacitance (C) and Mutual Inductance (the transformer in the time domain).</td>
<td>4</td>
</tr>
<tr>
<td>The phasor and the frequency domain.</td>
<td>6</td>
</tr>
<tr>
<td>Power; instantaneous, average (P), reactive (Q), complex (S) and power factor (pf). Maximum power transfer.</td>
<td>3</td>
</tr>
<tr>
<td>RC, RL and RLC circuits.</td>
<td>5</td>
</tr>
<tr>
<td>Exams</td>
<td>3</td>
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</tbody>
</table>

Total hours: (equivalent to contact period) 45

Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Percent</th>
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<tbody>
<tr>
<td>Exams</td>
<td>3</td>
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</table>
Final Exam 1 20
Short Quizzes 5 10
Oral Reports
Monographies
Portfolio
Projects
Journals
Other, specify: Assignment 5 10
TOTAL: 100%

Bibliography:

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:
<table>
<thead>
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<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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Course Outcomes
1. Apply circuit analysis techniques to understand the physical operation of a electrical circuit system. (a)
2. Perform basic power calculations applying complex variable concepts. (a)
3. Perform transient and steady state calculations in RC, RL and RLC circuits. (a)
4. Interpretation of the results of simulation of electrical circuits (b)
5. Be able to interpret and draw electrical schematic diagrams. (g)
6. Be able to communicate graphically where appropriate. (g)
7. Simulate electrical circuits using commercially available software for circuit analysis. (k)

General Information:
Alpha-numeric codification: INEL 3115
Course Title: INTRODUCTION TO ELECTRICAL ENGINEERING
Number of credits: 2
   Contact Period: One two-hour laboratory per week.
   Elective in INEL.

Course Description:
   English: Basic concepts and applications on the specialization areas of electrical engineering and basic tools in preparation for the INEL courses. Experiments in the five specialization areas with experiences in design in control systems, communications, electronics, power, and applied electromagnetic. Other tools such as excel, power point and mat lab are also introduced.

   Spanish: Conceptos básicos y aplicaciones de las áreas de especialización en ingeniería eléctrica y herramientas básicas en preparación a los cursos de INEL. Experimentos en las cinco áreas de especialización con experiencia de diseño en aplicaciones de control, comunicaciones, electrónica, potencia y electromagnética aplicada. Otras herramientas como excell, power point y matlab son también introducidas.

Pre/Co-requisites and other requirements:
Pre-requisite: None.

Course Goals:
After Completing the course the student should have a clear idea of the curriculum and applications of the different specialization areas. Understanding of simple EE concepts and familiarization with measurement equipment is expected. It is expected that the students will learn the use of tools such as Matlab, Power Point, and Excel and be prepared to make an effective oral presentation.

Instructional Strategies:
 conference  discussion  computation  laboratory

 seminar with formal presentation  seminar without formal presentation  workshop

 art workshop  practice  trip  thesis  special problems  tutoring

 research  other, please specify:

Minimum or Required Resources Available:
Accepted in EE program, limited space.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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</thead>
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<td>Introduction to Electrical Engineering, Specialization areas, resources in EE, undergraduate research opportunities, societies.</td>
<td>2</td>
</tr>
<tr>
<td>Electrical Measurements Introduction, AC and DC, Voltage and Current, Ohms Law, Multimeter, Resistor’s V-I curve, Excel. Oscilloscope, signal generator, frequency, sinusoidal wave.</td>
<td>2</td>
</tr>
<tr>
<td>Introduction to Matlab - The student will learn the basics of Matlab. This software is widely used in several EE courses. The software will be used in the course in several experiments.</td>
<td>2</td>
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<tr>
<td>Electronic Option – Discussion of applications and course in the specialization area. Audio amplifier implementation.</td>
<td>2</td>
</tr>
<tr>
<td>Communication and Digital Signal Processing (DSP) Option – Discussion of applications and courses in the specialization area. The student will learn the modulation techniques used in the communication systems to transmit signals in AM and FM. Single transmitter is implemented. Time and frequency domain is introduced using an MP3 file with an oscilloscope and a spectrum analyzer. The signal is filtered to observe frequency and time domain response. Compression techniques are also introduced. The student will observe how a digital signal is processed using an audio signal as an example. Students will process their own photographs using Matlab. Use of Cool Edit.</td>
<td>2</td>
</tr>
<tr>
<td>Applied Electromagnetics Option – Basic concept in transmitter/receiver is introduced (antennas, amplifiers, filters) Legacy of Maxwell equations. Simple experiments in propagation of electromagnetic waves are presented. A simple radar system using a network analyzer is also demonstrated and used to detect targets.</td>
<td>2</td>
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measure range, and wave velocity. A time domain reflectometer using an oscilloscope is demonstrated and used to study the reflections in the transmission lines.

Control Systems Option - Discussion of applications and courses in the specialization area. Control experiments to be performed with Lego Robotics Kit. Different types of sensors are introduced. Robots are programmed to avoid obstacles and to follow reference trajectories.

Power Systems Option - Discussion of applications and courses in the specialization area. History of power generation in Puerto Rico. Basic house electric wiring diagram is presented. Source-line-load concepts. RMS, peak and average values. Power quality. A DC Motor-Generator system is presented to demonstrate the energy transformation and power generation. The generated DC current by the Motor-Generator system is transformed in AC current using a DC/AC inverter. Operation of a simple step-up and step-down transformer is also presented and used to power distribution. Experiment with low voltage lightbulb introducing different signals (frequency and shape) is presented.

Effective presentation using Power Point. Or Project

Grading System

Quantifiable (letters) ☑ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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Bibliography:
Introduction to Electrical Engineering laboratory manual, Class Notes.

According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

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</tr>
</tbody>
</table>

Course Outcomes

- The student already makes established experiments in the manual of the course, and designs a project to finalize the course with all the tools obtained during the course.
- The student analyze the behavior the collected data of different circuits, such as circuits series-parallel, different filters, etc., using computers tools.
- Outside the laboratory they work in group when making the report of the respective practice.
- The students during the laboratory will work in teams with attention to task distribution.
• During the course the student makes written and oral reports, to state his understanding and control of the subject covered in each laboratory.
• At the end of the course, each team will make one oral presentation of one of the course activities.
• The students use tools as computers software and learn to handle programs to analyze collected data and make reports.
• The students will learn to use electrical engineering laboratory equipment.

Person(s) who prepared this description and date of preparation: Academic Affairs Committee April 2007, Submitted by: Raúl E. Torres, Committee Coordinator, Rev. May 5, 08 Raúl E. Torres
**General Information:**

- Alpha-numeric codification: INEL 4048
- Course Title: ELECTRICAL ENGINEERING PRACTICE
- Number of credits: 3
- Contact Period: Depends on the assignment
- Elective in INEL

**Course Description:**

English: A course organized in cooperation with private industry or government to provide the student with practical experience in electrical engineering. The work performed by the student will be jointly supervised by the academic department and an appropriate official from the cooperating organization. An oral and written report will be required from the student upon completion of the project.

Spanish: Un curso organizado en cooperación con la industria privada o el gobierno para proveerle al estudiante experiencia practica en proyectos de ingeniería eléctrica. La labor del estudiante será supervisada conjuntamente por el departamento académico y por un funcionario apropiado de la entidad cooperadora. Se requerirá del estudiante un informe oral y escrito al finalizar el proyecto.

**Pre/Co-requisites and other requirements:**

Consent of the Director of the Department.

**Course Objectives:**

Students will compare and contrast the theoretical aspects of computer engineering with the real world practice. They will apply the fundamental concepts taught in the classroom and recognize their value in real practice. Students will experience and be exposed to the practical aspects of computer engineering design.

**Instructional Strategies:**

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

**Minimum or Required Resources Available:**

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
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**Total hours: (equivalent to contact period)**

**Grading System**

- ☑ Quantifiable (letters)
- ☐ Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Evaluation</th>
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<tr>
<td>Final Exam</td>
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<td></td>
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<tr>
<td>Short Quizzes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☑ Oral Reports</td>
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<td>10%</td>
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<td>Monographies</td>
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<td>Portfolio</td>
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<tr>
<td>Projects</td>
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Appendix

Journals

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<th>Other, specify:</th>
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<td>Supervisor Evaluation</td>
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</tr>
<tr>
<td>Final Report</td>
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</tr>
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</table>

TOTAL: 100%

Bibliography:

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Course Outcomes

Apply electrical engineering knowledge to conduct analysis and design of problems in a real engineering practice environment (a)
Design and conduct experiments as well as analyze and interpret data in a real engineering practice environment (b)
Design and analyze computer systems to meet an organizational need (c)
Ability to participate and collaborate with other professionals (d)
Ability to communicate effectively in an organizational environment (g)
Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k)
Prepare work progress reports and document project work. (g)

Map to Program Outcomes

General Information:
- Alpha-numeric codification: INEL 4075
- Course Title: FUNDAMENTALS OF ELECTRICAL ENGINEERING
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective course in INEL

Course Description:
- English: Laws and fundamental concepts that govern the behavior of electric and magnetic circuits; ideal models of resistors, voltage and current sources, capacitors and inductors; three-phase circuits and transformers.
- Spanish: Leyes y conceptos fundamentales que gobiernan el comportamiento de los circuitos eléctricos y magnéticos; modelos ideales de resistencias, fuentes de voltaje y corriente, condensadores e inductores; circuitos trifásicos y transformadores.

Pre/Co-requisites and other requirements:
- (MATE 3063 or MATE 3185) and (FISI 3172 or FISI 3162).

Course Objectives:
The objective of this course is to introduce students to electric circuit analysis techniques, including the Kirchhoff’s Laws. Basic circuits elements such as, transformer, operational amplifiers, resistors, inductors, capacitors, dependent and independent sources are introduced. Simplification of electrical circuits is considered using various techniques, including Thévenin’s and Norton’s theorems. Single-phase circuits power analysis and first-order linear circuit analysis techniques are also presented.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:
P-Spice, MATLAB, and demonstration of Practical Drive Systems in Laboratory

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
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<tbody>
<tr>
<td>Circuit variables and units.</td>
<td>2</td>
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<tr>
<td>Electric circuits, current, voltage, power, energy, active and passive circuits, resistors, Ohm's law, independent sources, connecting voltmeter and ammeter, dependent sources, transducer, switches.</td>
<td>5</td>
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<tr>
<td>KCL, KVL, series resistor, voltage divider, parallel resistor, current divider</td>
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<tr>
<td>Techniques of circuit analysis: resistance equivalence, node voltage analysis, mesh analysis, superposition, Thévenin's theorem, and Norton's equivalent circuit</td>
<td>12</td>
</tr>
<tr>
<td>The ideal operational amplifier and applications</td>
<td>3</td>
</tr>
<tr>
<td>Inductance (L), Capacitance (C) and first order systems</td>
<td>4</td>
</tr>
<tr>
<td>AC, sinusoidal sources, phasors, impedance and admittance</td>
<td>6</td>
</tr>
<tr>
<td>Power; instantaneous, average (P), reactive (Q), complex (S) and power factor (pf). Maximum power transfer.</td>
<td>3</td>
</tr>
<tr>
<td>Coupled inductors, ideal transformer.</td>
<td>2</td>
</tr>
<tr>
<td>Three phase voltages, sequence, Y-Y circuit, analysis of Y-Y balanced circuit</td>
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</tr>
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<td>Exams</td>
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Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
## Appendix 15

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<td>☐ Portfolio</td>
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<tr>
<td>☐ Projects</td>
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<td>☐ Journals</td>
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<td>☑ Other, specify: Assignments</td>
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<td>10</td>
</tr>
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</table>

**TOTAL:** 100%

### Bibliography:


### According to Law 51

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### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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</thead>
<tbody>
<tr>
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</tbody>
</table>

General Information:
Alpha-numeric codification: INEL4076
Course Title: Fundamentals of Electronics
Number of credits: 3
Contact Period: 3 hours of lecture per week

Course Description:
English: Fundamentals and Applications of Analog and Digital Electronics.
Spanish: Fundamentos y Aplicaciones de Electrónica Analógica y Digital.

Pre/Co-requisites and other requirements:
INEL4075

Course Objectives:
This course is designed to give non-electrical and computer engineering students the fundamental and application of analog and digital electronics. The course is complemented with INEL 4077, Basic Electronic Laboratory.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Conduction Mechanisms in Solids and electrical properties of semiconductors</td>
<td>2</td>
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<tr>
<td>The semiconductor Diode and models</td>
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<tr>
<td>Diode circuits and power supplies</td>
<td>2</td>
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<tr>
<td>The Zener diode voltage regulator</td>
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<tr>
<td>The bipolar junction transistor (BJT) construction</td>
<td>2</td>
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<tr>
<td>The BJT voltage and current components</td>
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<tr>
<td>BJT bias and circuits</td>
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<tr>
<td>Number systems and base conversion methods</td>
<td>2</td>
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<tr>
<td>Binary arithmetic</td>
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<td>Basic logic gates and definitions</td>
<td>3</td>
</tr>
<tr>
<td>Boolean algebra</td>
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<tr>
<td>Minimization of Boolean functions</td>
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<td>Design and minimization of combinational circuits</td>
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<tr>
<td>TTL and CMOS logic families</td>
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</tr>
<tr>
<td>Flip-Flops, registers and counters</td>
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<tr>
<td>Memories</td>
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<td>Microprocessors</td>
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<td>Operational Amplifiers</td>
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Grading System
- Quantifiable (letters) □ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<td>Monographies</td>
<td></td>
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Bibliography:

According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

General Information:
Alpha-numeric codification: INEL 4077
Course Title: Basic Electronics Laboratory
Number of credits: 3
Contact Period: 45

Course Description:
English: Description and use of basic equipment for electrical measurements in digital and analog circuits.
Spanish: Descripción y uso de equipo básico para medidas eléctricas en circuitos analógicos y digitales

Co-requisites and other requirements:
INEL 4076 Fundamental of electronics

Course Objectives:
To developed basic skill in electrical circuits measurements. To allow non electrical Engineer student to experiment with real electronics circuits.

Instructional Strategies:
☒ conference ☐ discussion ☐ computation ☒ laboratory
☒ seminar with formal presentation ☐ seminar without formal presentation ☒ workshop
☐ art workshop ☐ practice ☐ trip ☐ thesis ☐ special problems ☐ tutoring
☐ research ☐ other, please specify:

Minimum or Required Resources Available:
All students expected to bring knowledge in basic theory of circuits: Ohms law, Kirchhoff laws, Theorems and RLC circuits. The student have to use electrical simulation tools to complement the lab work.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety guidelines. Evaluation criteria. Laboratory rules. Format of laboratory report. Introduction to basic laboratory instruments. (lecture)</td>
<td>3</td>
</tr>
<tr>
<td>Series resistive circuits and their Thevenin and Norton equivalent circuits. (experiment)</td>
<td>3</td>
</tr>
<tr>
<td>Signal generator. Measurement of AC and DC signal characteristics using the VOM and the oscilloscope. (experiment)</td>
<td>3</td>
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<tr>
<td>Capacitive reactance. Series RC circuits. Study of time constant and waveforms. (experiment)</td>
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</tr>
<tr>
<td>Inductive reactance. Series RL circuits. Study of time constant and waveforms. (experiment)</td>
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<tr>
<td>RLC circuits. Study of damping ratio and waveforms. (experiment)</td>
<td>3</td>
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<tr>
<td>Series resonance. Passive filters. (experiment)</td>
<td>3</td>
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<tr>
<td>Diode characteristic curve. Zener diode. Circuits with diodes and resistors. (demonstration)</td>
<td>3</td>
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<tr>
<td>Half wave and full wave rectifiers. Voltage regulators. (experiment)</td>
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<tr>
<td>Bipolar Junction Transistor (BJT) characteristics. (demonstration)</td>
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<td>Basic amplifier circuits. (experiment)</td>
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<td>Logic circuit applications. (demonstration)</td>
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<td>Sequential logic circuit using flip-flops. (experiment)</td>
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<tr>
<td>Tests (Midterm and final exams).</td>
<td>6</td>
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Grading System
☒ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>☒ Short Quizzes</td>
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</table>
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---|---|---
Monographies |  | 
Portfolio |  | 
Projects | X | 
Journals |  | 
Other, specify: Homework |  | 
TOTAL: | 100% |

Bibliography:
Laboratory Manual for INE4075

According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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<tbody>
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General Information:
Alpha-numeric codification: INEL4085
Course Title: Fundamentals of Transformers and Electric Machinery
Number of credits: 3
Contact Period: 45
Elective course in INEL

Course Description:
English: Basics of electromechanical energy conversion. Theory, operation, construction, circuit modeling, analysis and applications of transformers, induction machines, synchronous machines and DC machines.

Spanish:

Pre/Co-requisites and other requirements:
Pre-requisites: INEL 4075

Course Objectives:
The objective of the course is to give mechanical engineering students an introduction to the operation and analysis of electromechanical energy converters and their applications. After completing the course, students should be prepared to apply basic energy conversion principles in the solution of electric machinery problems. Students will be able to evaluate the operation of transformers, motors and generators in modern industries.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
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<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
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<td>Introduction</td>
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<tr>
<td>Student learning profile.</td>
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</tr>
<tr>
<td>Review of power and electromagnetics fundamentals.</td>
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<tr>
<td>Basics of electromechanical energy conversion.</td>
<td>8</td>
</tr>
<tr>
<td>Theory, operation, construction, circuit modeling, analysis and applications of transformers.</td>
<td>8</td>
</tr>
<tr>
<td>Theory, operation, construction, circuit modeling, analysis and applications of induction machines.</td>
<td>8</td>
</tr>
<tr>
<td>Theory, operation, construction, circuit modeling, analysis and applications of synchronous machines.</td>
<td>8</td>
</tr>
<tr>
<td>Theory, operation, construction, circuit modeling, analysis and applications of DC machines.</td>
<td>8</td>
</tr>
<tr>
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Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
### Appendix 21

| Other, specify: Homework | 5 | 10 | TOTAL: | 100% |

### Bibliography:

P. Ryff, Electric Machinery, 2nd Ed., Prentice Hall, 1994 or more recent

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### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
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<th>Engineering Topic</th>
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</table>

### Course Outcomes

- Posses sufficient knowledge to understand the operation and analysis of electromechanical energy converters and their applications (a)
- Be able to apply algebra and mathematics to the solution of transformers and electric machinery problems (a)
- Be capable of defining transformer and electric machinery models as possible electrical engineering problem solutions (e)
- Be able to validate a solution (applying models above) within the physical context of a energy conversion apparatus and systems (e)

Person(s) who prepared this description and date of preparation: __________________________

Submitted by Efrain O’Neill, Nov 2006
1. **General Information:**
   - Alpha-numeric codification: INEL 4086
   - Course Title: TRANSFORMERS AND ELECTRIC MACHINERY LABORATORY
   - Number of credits: 3
   - Contact Period: 45
   - Required in INEL
   - For mechanical engineering students

2. **Course Description:**
   - English: Voltage, current electrical and mechanical power measurements and other parameters related to the operation of single phase, three phase, and direct current equipment.
   - Spanish: Voltage, current, electrical, and mechanical power measurements and other parameters related to the operation of single phase, three phase, and direct current equipment.

3. **Pre/Co-requisites and other requirements:**
   - Corequisite: INEL 4085

4. **Course Objectives:**
   - This course is designed to give students practical laboratory experience in the operation of three phase circuits, transformers and electric machines as well as the safe electrical measurements practices.

5. **Instructional Strategies:**
   - Conference
   - Discussion
   - Computation
   - Laboratory
   - Seminar with formal presentation
   - Seminar without formal presentation
   - Workshop
   - Art workshop
   - Practice
   - Trip
   - Thesis
   - Special problems
   - Tutoring
   - Research
   - Other, please specify: T

6. **Minimum or Required Resources Available:**
   - All students are expected to bring a solid background in circuit analysis and calculus. Students should also have basic knowledge of electromagnetic theory. Students must always bring to class the textbook and a scientific calculator (preferably one that handles complex numbers).

7. **Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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</thead>
<tbody>
<tr>
<td>Introduction</td>
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<td>Student learning profile</td>
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<td>Basic analysis of single phase AC and DC circuits</td>
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<td>Three phase circuits: analysis and power measurements</td>
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<td>Single phase transformers: tests, loading, efficiency and voltage regulation</td>
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<tr>
<td>Three phase transformers: voltage and current relationships and connections</td>
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<td>Three phase induction motor: no-load, speed, current and torque characteristics</td>
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<td>Single phase induction motors</td>
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<td>Synchronous motor: operation and control</td>
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<td>Three Phase Synchronous Generator</td>
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<td>DC Machines: Motors and Generators: Operation and Control</td>
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8. **Grading System**
   - Quantifiable (letters)
   - Not Quantifiable

9. **Evaluation Strategies (Suggested):** The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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</table>

10. Bibliography:
Textbook: UPRM, Electrical and Computer Engineering Department, Electric Machines Fundamentals Laboratory Manual, 7TH edition
References:

11. According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

12. Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

1. General Information:
   Alpha-numeric codification: INEL 4095
   Course Title: Signals and Systems
   Number of credits: 3
   Contact Period: 3 hours of lecture per week
   Require for the New Electrical Engineering Curriculum

Course Description:

Spanish: Introducción a la representación matemática de señales y sistemas análogos y discretos. Estudio de la serie de Fourier, la transformada de Fourier y la transformada Z aplicadas a señales análogas y discretas. Muestreo de señales análogas. Análisis de señales y respuesta de frecuencia de sistemas lineales. Caracterización de sistemas lineales invariantes en tiempo utilizando métodos de transformadas.

Pre/Co-requisites and other requirements:
INEL 4102 and MATE 4009

Course Objectives:
Electrical and Computer engineering students will learn discrete and continuous mathematical transforms and use them for the analysis of discrete and analog signals and linear time invariant systems. Students will also be able to develop mathematical representations of physical systems using the tools studied in class and understand how the same mathematical tools can be used to analyze signals and systems independent of the underlying physics. They will also be able to interpret the mathematical results based on the underlying physical process.

Instructional Strategies:
☑ conference ☐ discussion ☐ computation ☐ laboratory
☐ seminar with formal presentation ☐ seminar without formal presentation ☐ workshop
☐ art workshop ☐ practice ☐ trip ☐ thesis ☐ special problems ☐ tutoring
☐ research ☐ other, please specify:

Minimum or Required Resources Available:
Standard lecturing facilities, Signal Processing Laboratory for demonstrations and computer assisted homework, and MATLAB software.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Signals and Systems – mathematical representation</td>
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<tr>
<td>Systems – mathematical representation</td>
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<td>Introduction to Fourier Transforms</td>
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<td>1. Fourier Series</td>
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<td>2. Discrete Time Fourier Transform (DTFT)</td>
<td>3</td>
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<td>3. Fourier Transform</td>
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<td>4. Discrete Fourier Transform (DFT)</td>
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<tr>
<td>Using the FT with signals</td>
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<tr>
<td>Using the FT with systems</td>
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<td>Sampling Theorem</td>
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<td>Review of Laplace Transform</td>
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<tr>
<td>Characterizing LTI continuous systems with the Laplace Transform</td>
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<tr>
<td>Z-Transform</td>
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<td>Using the Z-Transform to solve difference equations</td>
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<td>Characterizing LTI discrete systems with the Z-Transform</td>
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Grading System
☑ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
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### General Information:
- Alpha-numeric codification: INEL 4102
- Course Title: ELECTRICAL SYSTEMS ANALYSIS II
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Required in INEL & ICOM

### Course Description:
- English: Network functions; circuit analysis by Laplace transforms and Fourier series; two-port networks; Butterworth and Chebyshev filters; computer-aided analysis of these systems.
- Spanish: Funciones de Redes; Análisis de Circuitos por medio de la Transformada de Laplace y Series de Fourier; Redes de dos puertas; filtros Butterworth y Chebyshev; análisis de estos sistemas mediante el uso de computadoras.

### Pre/Co-requisites and other requirements:
Prerequisites: INEL 3105, (FISI 3172 or FISI 3162) and INGE 3016. Co-requisite: MATE 4009.

### Course Objectives:
- One objective of the course is to develop in the student the ability to characterize and analyze linear systems using circuit parameters, impulse response, and transfer functions, as well as the characterization of signals. A second objective is to develop in the student the skill to use the Laplace transform and the Fourier series in the characterization and analysis processes. A third objective is to introduce the concept of the linear filter, its specification, and design.

### Instructional Strategies:
- ☒ conference
- ☐ discussion
- ☐ computation
- ☐ laboratory
- ☐ seminar with formal presentation
- ☐ seminar without formal presentation
- ☐ workshop
- ☐ art workshop
- ☐ practice
- ☐ trip
- ☐ thesis
- ☐ special problems
- ☐ tutoring
- ☐ research
- ☐ other, please specify:

### Minimum or Required Resources Available:

### Course time frame and thematic outline

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<thead>
<tr>
<th>Outline</th>
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<td>Phases and power calculations review</td>
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<tr>
<td>Coupled coils</td>
<td>4</td>
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<td>Introduction to Laplace transform:</td>
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<td>Signal representation using Laplace transform</td>
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<td>Analysis of the time domain response using Laplace</td>
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<td>Laplace transform in circuit analysis</td>
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<td>Circuit representation using the transfer function,</td>
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<td>Impulse response,</td>
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<td>Convolution</td>
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<td>Two-port networks:</td>
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<td>Bode diagrams:</td>
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<td>The transfer function and the steady state sinusoidal response</td>
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<tr>
<td>Bode plots and simulations</td>
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<td>Fourier Series: Ch. 16</td>
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<td>Series</td>
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<td>Spectra plots and simulations</td>
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<td>Average power, RMS value</td>
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<td>Steady state non sinusoidal circuit analysis</td>
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### Grading System
Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Projects</td>
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Bibliography:

According to Law 51
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Contribution of course to meeting the requirements of Criterion 5
- Engineering Science: 2.5 credits
- Engineering Design: 0.5 credits

Course Outcomes
- Apply Laplace Transform to solve or analyze electrical circuit system. (a)
- Apply Fourier Series to solve or analyze electrical circuit system. (a)
- Apply Bode diagram to analyze the transfer function and the steady state sinusoidal responses. (a)
- Be able to interpret and draw electrical circuits diagrams. (g)
- Use commercially available software for circuit analysis using Fourier Series, and Bode plots. (k)

Person(s) who prepared this description and date of preparation: Academic Affairs Committee, Feb 2007, Submitted by: Raúl E. Torres, Committee Coordinator
**General Information:**

Alpha-numeric codification: INEL 4103  
Course Title: Electrical Systems Analysis III  
Number of credits: 3  
Contact Period: 45  
Required in INEL

**Course Description:**

English: Analysis of magnetic circuits and polyphase balanced power systems. Topics include transformers and power transmission lines. Computer-aided analysis of these systems is introduced.  
Spanish: Análisis de circuitos magnéticos y sistemas de potencia monofásicos y trifásicos balanceados. Los temas incluyen transformadores, líneas de transmisión e introducción al análisis, por computadora, de dichos sistemas.

**Pre/Co-requisites and other requirements:**

INEL 4102, INEL 4151, MATE 4009

**Course Objectives:**

The course presents fundamental concepts of power transformers and transmission lines. This is a three credit-hours course, open to Junior Electrical Engineering students. After completing the course, students will have a sound background on the analysis of electric power systems. They will define and describe the basic components of a power system (source, feeders, transformers and loads). Students must identify three phase circuit configurations including transformer connections. They will apply three phase concepts to every day life situations and equipment. Students will be able to solve problems involving power transformers and transmission lines.

**Instructional Strategies:**

- conference  
- discussion  
- computation  
- laboratory  
- seminar with formal presentation  
- seminar without formal presentation  
- workshop  
- art workshop  
- practice  
- trip  
- thesis  
- special problems  
- tutoring  
- research  
- other, please specify: There will be laboratory demonstrations throughout the semester. Students must attend these demonstrations during the regular class period. Material from these demonstrations will be part of the class, and thus will be evaluated. Students may be asked to collect data from these demonstrations, analyze it and submit a report with the results of the analysis.

**Minimum or Required Resources Available:**

All students are expected to bring a solid background in circuit analysis and calculus. Students should also have basic knowledge of electromagnetic theory. Students must always bring to class the textbook and a scientific calculator (preferably one that handles complex numbers).

**Course time frame and thematic outline**

<table>
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<td>Student learning profile</td>
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<td>Review of power and electromagnetics fundamentals</td>
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<td>Single-phase systems</td>
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<td>Three-phase systems</td>
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**Grading System**

- [x] Quantifiable (letters)  
- [ ] Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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</table>

**Bibliography:**

Textbook:

References:

**According to Law 51**

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

**Contribution of Course to meeting the requirements of Criterion 5:**

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<th>General</th>
<th>Engineering Topic</th>
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<td></td>
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**Course Outcomes**

Possess sufficient knowledge of circuit analysis and electromagnetic principles to enable understanding of the physical operation of electric power devices and systems.

Be able to apply linear algebra and phasor analysis concepts to descriptions and solutions of steady state electric power engineering problems.

Be capable of extracting specifications and physical constraints from power engineering verbal problems.

Be capable of physical thinking, approximation and simplification within the context of fundamental frequency steady state, power system and device analysis.

Be capable of effectively describing single-phase and three-phase power systems in a way that can lead to the construction of a solution.

Be capable of defining single-line, transformer, transmission line models as possible power engineering problem solutions.

Be able to validate a solution (applying models above) within the physical context of a power system.

Person(s) who prepared this description and date of preparation: ____________________

Submitted by: Efrain O'Neill nov 2006
General Information:
Alpha-numeric codification: INEL 4115
Course Title: ELECTRICAL MEASUREMENTS LABORATORY
Number of credits: 3
Contact Period: One two-hour laboratory per week.
Required in INEL & ICOM

Course Description:
English: Experiments with electronic components and equipment; measurement techniques.
Spanish: Experimentos con componentes y equipo electrónico; técnicas de medición.

Pre/Co-requisites and other requirements:
Co-requisite: INEL 3105 and INEL 4201.

Course Objectives:
The primary objective is to familiarize students with the physical properties of electronic components, while providing practical experience with modern measurement instruments and techniques, stressing safety in the workplace. Secondary objectives are to expand the student’s ability to communicate technical information through technical reports and to continue developing team-working skills.

Instructional Strategies:
☐ conference ☒ discussion ☐ computation ☐ laboratory
☐ seminar with formal presentation ☐ seminar without formal presentation ☒ workshop
☐ art workshop ☐ practice ☐ trip ☐ thesis ☐ special problems ☐ tutoring
☐ research ☐ other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<td>Voltage and current measurement in a electric circuit, Ohm's Law, series resistive circuits</td>
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<tr>
<td>Kirchhoff's voltage law, Voltage dividers, Kirchhoff's current law, current dividers</td>
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<tr>
<td>Troubleshooting in series circuits, parallel resistive circuits, troubleshooting in parallel circuits, series-parallel combinations.</td>
<td>1</td>
</tr>
<tr>
<td>Superposition, Thevenin's and Norton's Theorems, Maximum power transfer</td>
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<tr>
<td>Oscilloscope familiarity I and II, Function Generator Familiarity I and II</td>
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<td>Series resonance, parallel resonance</td>
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Grading System
☒ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>☐ Final Exam</td>
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<td>☒ Short Quizzes</td>
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<td>☐ Oral Reports</td>
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<td>☐ Monographies</td>
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<tr>
<td>☐ Portfolio</td>
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<tr>
<td>Projects</td>
<td>Journals</td>
<td>Other, specify: Homework</td>
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TOTAL: 100%

**Bibliography:**
Laboratorio de Medidas Eléctricas, John Wiley.

**According to Law 51**
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**Contribution of course to meeting the requirements of Criterion 5**
- Engineering Science: 1 credits
- Engineering Design: 0 credits

**Course Outcomes**

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Map to Program Outcomes</th>
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<tbody>
<tr>
<td>Apply circuit analysis techniques to understand the physical operation of an electrical circuit system.</td>
<td>a</td>
</tr>
<tr>
<td>Be able to set up and safely perform basic electrical laboratory procedures.</td>
<td>b</td>
</tr>
<tr>
<td>Be able to graphically and verbally represent or describe experimental data sets.</td>
<td>b</td>
</tr>
<tr>
<td>Be able to analyze, interpret, and draw conclusions based on experimental data.</td>
<td>b</td>
</tr>
<tr>
<td>Be able to work in teams to complete laboratory work and assignment.</td>
<td>d</td>
</tr>
<tr>
<td>Be able to interpret and draw electrical schematic diagrams.</td>
<td>g</td>
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<tr>
<td>Simulate electrical circuits using commercially available software for circuit analysis.</td>
<td>k</td>
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General Information:
Alpha-numeric codification: INEL 4151
Course Title: Electromagnetics I
Number of credits: 3
Contact Period: 3 hours of lecture per week
Required in INEL

Course Description:
English: Static and time varying electric and magnetic fields; dielectric, magnetic and conducting materials; capacitance, inductance and conductivity; magnetic circuits; dielectric and magnetic hysteresis; Maxwell’s equations.
Spanish: Campos eléctricos y magnéticos estáticos y variables con el tiempo; materiales dieléctricos, magnéticos y conductores; capacitancia, inductancia y conductividad; circuitos magnéticos, histéresis dieléctrica y magnética; ecuaciones de Maxwell.

Pre/Co-requisites and other requirements:
Requisites: (FISI3172 O FISI3162) Y (MATE3063 O MATE3185)
Co-requisite: MATE4009

Course Objectives:
Describe the fundamental concepts of the interaction of electric and magnetic fields with matter. Introduce Maxwell’s equations and their physical significance.

Instructional Strategies:
☐ conference ☑ discussion ☐ computation ☐ laboratory
☐ seminar with formal presentation ☐ seminar without formal presentation ☐ workshop
☐ art workshop ☐ practice ☐ trip ☐ thesis ☐ special problems ☐ tutoring
☐ research ☐ other, please specify: oral presentation of a design project.

Minimum or Required Resources Available:
N/A

Course time frame and thematic outline

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<th>Outline</th>
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<td>Review of vector calculus concepts</td>
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<tr>
<td>Coulomb’s law and electric field intensity</td>
<td>3</td>
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<tr>
<td>Electric flux density, Gauss’ law and divergence</td>
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<tr>
<td>Conductors, divergence and capacitance</td>
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<tr>
<td>Laplace’s and Poisson’s equations</td>
<td>5</td>
</tr>
<tr>
<td>Magnetostatic fields</td>
<td>6</td>
</tr>
<tr>
<td>Magnetic forces, materials and inductance</td>
<td>7</td>
</tr>
<tr>
<td>Maxwell’s equations</td>
<td>3</td>
</tr>
<tr>
<td>Applications of Maxwell’s equations</td>
<td>2</td>
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Grading System
☑ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
Appendix

Bibliography:

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Contribution of Course to meeting the requirements of Criterion 5:

<table>
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<tr>
<th>Math</th>
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<th>Engineering Topic</th>
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</thead>
<tbody>
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</tbody>
</table>

Course Outcomes

| Solve electrostatic problems using Coulomb’s law, and Gauss’s law. | a |
| Describe the differences between dielectric and conducting materials. | a |
| Analyze capacitors and resistors using Gauss’s law, and the Laplace’s and Poisson’s equations. | a |
| Solve magnetostatic problems using Biot-Savart’s law and Ampere’s law. | a |
| Describe the differences between diamagnetic, paramagnetic and ferromagnetic materials. | a |
| Find the inductance and magnetic force on different structures | a |
| Design simple capacitors, resistors and inductors | c |
| Determine the energy density in the electric and magnetic fields for different configurations. | a |

Person who prepared this description and date of preparation: Electromagnetic Committee, March, 12, 2008. Submitted by: Dr. Rafael Rodríguez, Committee Coordinator, March, 12, 2008
Appendix 34

General Information:
Alpha-numeric codification: INEL 4152
Course Title: Electromagnetics II
Number of credits: 3
Contact Period: 3 hours of lecture per week
Required in INEL

Course Description:
Spanish: Ecuaciones de Maxwell y la ecuación de onda; ondas planas en medios dieléctricos y conductores; Fuljo de potencia y el vector de Poynting; polarización, reflexión y difracción de ondas; guías de onda, líneas de transmisión, carta de Smith, pareo de impedancias; antenas.

Pre/Co-requisites and other requirements:
Requisites: MATE4009, INEL4151

Course Objectives:
Introduce and describe wave propagation mechanisms in unbounded and bounded media and waveguides. Introduce radiation mechanisms and antenna parameters.

Instructional Strategies:
☒ conference ☐ discussion ☐ computation ☐ laboratory
☐ seminar with formal presentation ☐ seminar without formal presentation ☐ workshop
☐ art workshop ☐ practice ☐ trip ☐ thesis ☐ special problems ☐ tutoring
☐ research ☐ other, please specify: oral presentation of a design project.

Minimum or Required Resources Available:
N/A

Course time frame and thematic outline

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<thead>
<tr>
<th>Outline</th>
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<tbody>
<tr>
<td>Maxwell’s equations</td>
<td>3</td>
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<tr>
<td>Plane wave propagation</td>
<td>12</td>
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<tr>
<td>Transmission lines</td>
<td>12</td>
</tr>
<tr>
<td>Waveguides</td>
<td>9</td>
</tr>
<tr>
<td>Antennas</td>
<td>6</td>
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Grading System
☒ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>☐ Projects</td>
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<td>☐ Journals</td>
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<tr>
<td>☒ Other, specify: dependent on instructor</td>
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Bibliography:

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Contribution of Course to meeting the requirements of Criterion 5:

<table>
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<tr>
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<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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Course Outcomes

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Map to Program Outcomes</th>
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<tbody>
<tr>
<td>Formulate the equation for a plane wave traveling in a unbounded general medium</td>
<td>a</td>
</tr>
<tr>
<td>Calculate the reflection and transmission coefficients for normal and oblique incidence for a dielectric-dielectric interface and a dielectric-perfect electric conductor interface.</td>
<td>a,e</td>
</tr>
<tr>
<td>Calculate the reflection and transmission coefficients for normal incidence for a dielectric-conductor interface.</td>
<td>a,e</td>
</tr>
<tr>
<td>Describe the electromagnetic fields inside a transmission line</td>
<td>a</td>
</tr>
<tr>
<td>Calculate the reflection coefficient for a terminated transmission line</td>
<td>a,e</td>
</tr>
<tr>
<td>Design matching networks using quarter wave transformers and single stubs.</td>
<td>c,e</td>
</tr>
<tr>
<td>Use the Smith Chart to find reflection coefficients and impedances, and to design single stub matching networks.</td>
<td>k,e</td>
</tr>
<tr>
<td>Describe the electromagnetic fields inside a waveguide.</td>
<td>a</td>
</tr>
<tr>
<td>Determine the number of modes propagating in a waveguide</td>
<td>a,e</td>
</tr>
<tr>
<td>Design a waveguide given the desired operating frequency range</td>
<td>c,e</td>
</tr>
<tr>
<td>Describe the fundamental antenna parameters</td>
<td>a</td>
</tr>
<tr>
<td>Analyze and interpret data from laboratory demonstrations</td>
<td>b</td>
</tr>
</tbody>
</table>

Person who prepared this description and date of preparation: Electromagnetics Committee, March, 12, 2008. Submitted by: Dr. Rafael Rodriguez, Committee Coordinator, March, 12, 2008
Appendix

General Information:
Alpha-numeric codification: INEL 4201
Course Title: Electronics I
Number of credits: 3
Contact Period: # credit hours, 3 hours contact per week
Required in INEL and ICOM

Course Description:
Spanish: Características de dispositivos semiconductores, Diodos, Transistores FET y BJT, Modelos de amplificadores, Análisis de circuitos digitales básicos, Análisis y consideraciones de diseño de circuitos amplificadores utilizando transistores, Introducción a circuitos integrados

Pre/Co-requisites and other requirements:
INEL 3105 and FISI 3172

Course Objectives:

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<td>Introduction</td>
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<td>Amplifying Concept and Models</td>
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<td>Semiconductor Concepts</td>
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<td>Diodes:</td>
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<td>a: Structure</td>
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<td>b: Performance</td>
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</tr>
<tr>
<td>c: Analysis</td>
<td></td>
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<tr>
<td>d: Zener Diode and Applications</td>
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<td>Rectifiers</td>
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<td>Review for 1st test</td>
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<tr>
<td>MOSFET:</td>
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<tr>
<td>a: Structure and performance</td>
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<td>b: DC Analysis</td>
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<tr>
<td>c: Biasing</td>
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<td>BJT</td>
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<td>a: Structure and Operation</td>
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<td>b: Characteristic Curve</td>
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<tr>
<td>c: DC Analysis</td>
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<tr>
<td>d: Biasing</td>
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<tr>
<td>Signal Amplifiers with BJTs and MOSFETs</td>
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<tr>
<td>Review for 2nd Test</td>
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<td>Small signal model of BJT and MOSFETs</td>
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<tr>
<td>AC Analysis of amplifiers</td>
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<td>Different Amplifiers</td>
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<td>Comparison of Amplifiers</td>
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<td>Multiple Stage Amplifier</td>
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<tr>
<td>Review for 3rd Test</td>
<td>2</td>
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<tr>
<td>BJT Differential Amplifier</td>
<td>1.5</td>
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<td>Differential Amplifier Small signal Analysis</td>
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<tr>
<td>Differential Amplifier MOSFET and Current Mirrors</td>
<td>3</td>
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Total hours: (equivalent to contact period) 45

Grading System
- **Quantifiable (letters)**
- **Not Quantifiable**

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>☐ Projects</td>
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TOTAL: 100%

**Bibliography:**

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**Contribution of Course to meeting the requirements of Criterion 5:**

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<th>Engineering Topic</th>
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Course Outcomes
- Apply Acquired Knowledge to find Transfer function of circuits
- Design simple circuitry for specific transfer function
- Ability to use learned techniques to characterize and simplify analysis of a given circuit

Map to Program Outcomes
- (a)
- (c)
- (k)

Person(s) who prepared this description and date of preparation: Gladys O. Ducoudray. Submitted by Gladys O. Ducoudray Nov 2006
### General Information:
- Alpha-numeric codification: INEL 4202
- Course Title: Electronics II
- Number of credits: 3
- Contact Period: 3 credit hours, 3 hours of lecture per week
- Elective in INEL, Required in ICOM

### Course Description:
- English: Analysis and design of multi-stage amplifiers, wave generation and power circuits; operational amplifier characteristics and applications.
- Spanish: Diseño y análisis de amplificadores de multi etapas, generadores de onda y circuitos de potencia. Caracterización y aplicaciones de amplificadores operacionales

### Pre/Co-requisites and other requirements:
INEL4201 and INEL 4102

### Course Objectives:
This course seeks to develop in the student the ability to analyze and design multistage amplifiers with and without feedback, including frequency response characteristics, as well as circuits based on operational amplifiers and linear power amplifiers. Posses a combination of knowledge and analytical, computational, and experimental skills necessary to solve practical engineering problems.

- Thorough knowledge of basic electrical and computer engineering fundamentals and concepts
- Physical thinking, approximation, and simplification
- Have adequate communications skills both as an individual and as part of a team.
- Ability to interpret graphical, numerical, and textual data
- Ability to communicate effectively technical information to varied audiences in oral, written and graphical forms, both in English and Spanish
- Ability to organize information
- Value the importance of lifelong learning.
- Knowing how to ask questions and that there may be multiple answers.
- Commitment to constantly upgrading fundamental knowledge and skills

### Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

### Minimum or Required Resources Available:

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<td>Frequency response</td>
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<td>Feedback Amplifiers and stability</td>
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<tr>
<td>Differential amplifiers and integrated analog circuits</td>
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<td>Sinusoidal Oscillators and Power Circuits</td>
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<td>Waveform generators</td>
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<tr>
<td>Introduction to Active filters</td>
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- Quantifiable (letters)  
- Not Quantifiable

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Appendix 39

Short Quizzes
Oral Reports
Monographies
Portfolio
Projects
Journals
Other, specify:

TOTAL: 100%

Bibliography:

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Contribution of Course to meeting the requirements of Criterion 5:

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</table>

Course Outcomes

- Be able to determine the standard or criteria against which the outcome of the design process will be measured or compared.
- After completing this course, the student should be able to analyze and design transistor amplifiers with specific frequency response characteristics, to understand how feedback works and to apply it to the design of filters, to understand the basics of power circuits and operational amplifiers structures, with emphasis on u741. The student should also be able to design circuits using the operational amplifier as a block.
- Be able to follow logical and orderly design procedures, choosing the best solution for a given set of criteriarization of amplifiers and feedback.
- Analysis and characterization of logic families
- Analysis and characterization of logic families

Map to Program Outcomes

(a)
(b)
(c)
(e)

Appendix

General Information:
Alpha-numeric codification: INEL 4205
Course Title: Logic Circuits
Number of credits: Three credit hours
Contact Period: Three hours of lecture per week.
Required in INEL and ICOM

Course Description:
English: Boolean algebra, its theorems and postulates. Design of combinational circuits; minimization and reduction techniques, use of medium or large scale integration (MSI/LSI) in digital circuit design; analysis and design of sequential circuits; practical design considerations.
Spanish: Algebra Booleana, sus teoremas y postulados. Diseño de circuitos combinatoriales; técnicas de reducción o minimización. Conocimiento del uso de integración mediana o alta, (MSI/LSI) en el diseño de lógica digital; análisis y diseño de circuitos secuenciales y consideraciones prácticas de diseño.

Pre/Co-requisites and other requirements:
Prerequisite: INGE 3016. Co-requisite: INEL 4201.
Number systems, general computer concepts, basic circuit theory, semiconductor device characteristics.
Basic linear circuit analysis, high-level language programming knowledge

Course Objectives:
This course is designed to introduce students to the analysis and design of combinational and sequential digital systems. The course focuses on the different levels of abstraction present in digital system design and in proven design methodologies. System representation in the form of truth tables, Karnaugh maps, switch diagrams, logic gate diagrams, timing diagrams, transistor diagrams, state diagrams, and block diagrams will be presented. The course will extend beyond MSI and LSI technologies to include programmable devices such as Programmable Logic Arrays (PLAs), Programmable Logic Devices (PLDs), and Field Programmable Gate Arrays (FPGAs).

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:
Course time frame and thematic outline

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<td>Number systems and cCodes</td>
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<tr>
<td>Switching algebra, combinational circuit analysis and synthesis</td>
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<td>Decoders/encoders, three-state devices, muxes, comparators</td>
<td>5</td>
</tr>
<tr>
<td>Arithmetic circuits (adders, subtractors, multipliers)</td>
<td>5</td>
</tr>
<tr>
<td>Latches and flip-flops</td>
<td>2</td>
</tr>
<tr>
<td>Synchronous state machine analysis and design</td>
<td>3</td>
</tr>
<tr>
<td>Sequential circuit documentation standards and timing</td>
<td>2</td>
</tr>
<tr>
<td>Sequential programmable logic devices</td>
<td>1</td>
</tr>
<tr>
<td>Counters, shift registers, read only memories, static RAM</td>
<td>8</td>
</tr>
<tr>
<td>CPLDs and FPGAs</td>
<td>2</td>
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<td>Exams</td>
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<tr>
<td><strong>Total hours: (equivalent to contact period)</strong></td>
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</tr>
</tbody>
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Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Exams</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td>75</td>
</tr>
<tr>
<td>Appendix 41</td>
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<td></td>
</tr>
</tbody>
</table>

## Final Exam 1 25
- Short Quizzes
- Oral Reports
- Monographies
- Portfolio
- Projects
- Journals
- Other, specify:

**TOTAL:** 100%

### Bibliography:

### According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

### Course Outcomes
- Upon completion of this course the student will be able to describe, specify, analyze, simulate, synthesize, and implement combinational and sequential logic digital systems. (a)
- Posses a combination of knowledge and analytical, computational and experimental skills necessary to solve practical engineering problems (b)
  - Physical thinking, approximation, and simplification.
  - Thorough knowledge of basic electrical and computer engineering fundamental concepts.
- Have adequate communications skills both as an individual and as part of a team. (g)
  - Ability to interpret graphical, numerical, and textual data.
  - Ability to communicate effectively technical information to varied audiences in oral, written and graphical forms, both in English and Spanish.
  - Ability to organize information
- Value the importance of lifelong learning. (i)
  - Knowing how to ask questions and that there may be multiple answers.

Prepared by: Gladys Omayra Ducoudray (Electronics Committee Coordinator).
Submitted by: Gladys O. Ducoudray, Aug 2007
General Information:

- Alpha-numeric codification: INEL4206
- Course Title: Microprocessors
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Required in INEL and ICOM

Course Description:

English: Architecture, organization and operation of microprocessors and their supporting devices; design of microprocessor-based systems.

Spanish: Arquitectura, organización y operación de microprocesadores y sus dispositivos de apoyo; diseño de sistemas basados en microprocesadores.

Pre/Co-requisites and other requirements:

Prerequisite: INEL 4205 and INEL 4201

Prerequisite by topics:

- Number systems, knowledge of logic circuit design, knowledge of basic electronic circuits analysis and design, basic programming concepts.

Course Objectives:

The course is designed to introduce students to the architecture, operation, programming, and basic interfacing of microprocessors. The course, also, includes the study of the microprocessor instruction set and the use assembly language programming for the Intel family of microprocessors.

Instructional Strategies:

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify: Team work in software and computer hardware design

Minimum or Required Resources Available:

Computer labs, high level languages compilers, simulator for digital systems.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to microprocessor and computer</td>
<td>2</td>
</tr>
<tr>
<td>Microprocessor architecture</td>
<td>1</td>
</tr>
<tr>
<td>Addressing modes</td>
<td>2</td>
</tr>
<tr>
<td>Data movements instructions</td>
<td>3</td>
</tr>
<tr>
<td>Arithmetic and logic instructions</td>
<td>5</td>
</tr>
<tr>
<td>Program control instructions</td>
<td>2</td>
</tr>
<tr>
<td>Programming the microprocessor</td>
<td>7</td>
</tr>
<tr>
<td>8086/88 hardware specifications</td>
<td>2</td>
</tr>
<tr>
<td>Memory interface</td>
<td>5</td>
</tr>
<tr>
<td>Basic I/O interface</td>
<td>8</td>
</tr>
<tr>
<td>Interrupts</td>
<td>2</td>
</tr>
<tr>
<td>Direct memory access</td>
<td>3</td>
</tr>
<tr>
<td>Exams</td>
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<td>Total hours: (equivalent to contact period)</td>
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Grading System

- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies: (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
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<th>Evaluation Strategies</th>
<th>Quantity</th>
<th>Percent</th>
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<tr>
<td>Exams</td>
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<tr>
<td>Final Exam</td>
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<tr>
<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<td></td>
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<tr>
<td>Monographies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Portfolio | Projects | 3 | 35
--- | --- | --- | ---
Journals
Other, specify:

TOTAL: 100%

Bibliography:

**According to Law 51**

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design applications in assembly language</td>
<td>(a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design microprocessors based/related systems/components</td>
<td>(c)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop projects working in EE-CE teams</td>
<td>(d)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Write reports to present projects development process</td>
<td>(g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present projects in front of an audience</td>
<td>(g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use a digital circuits simulator to test hardware designs</td>
<td>(k)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Person(s) who prepared this description and date of preparation: José Navarro. Submitted by: Gladys O. Ducoudray, October 2007
General Information:
- Alpha-numeric codification: INEL 4207
- Course Title: Digital Electronics
- Number of credits: 3
- Contact Period: 3 credit hours, 3 hours of lecture per week
- Required in ICOM

Course Description:
English: Theory of Operation and Structure of Bipolar (BJT), metal Oxide semiconductor MOS logic gates; operation of semiconductor memories; Programmable Logic Arrays (PLA); operational amplifiers; analog to digital A/D and D/A digital to analog converters

Spanish: Teoría de operación y estructura de compuertas lógicas diseñadas con transistores BJT y MOSFETs; operación de memorias en semiconductores, Matrices de lógica programable (PLA); Amplificadores operacionales; Convertidores de señales análoga digital A/D y digital análoga D/A.

Pre/Co-requisites and other requirements:
INEL4201 and INEL 4205

Course Objectives:
The objective of the course is to provide each student an understanding of the internal structure, operation and interfacing requirements of digital logic families, semiconductor memories and A/D and D/A converters

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
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<tr>
<td>BJT fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>Basic Bipolar gates</td>
<td>6</td>
</tr>
<tr>
<td>MOS fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>Fabrication and layout of MOS circuits</td>
<td>3</td>
</tr>
<tr>
<td>NMOS, CMOS and BiCMOS gates</td>
<td>6</td>
</tr>
<tr>
<td>Interface logic</td>
<td>3</td>
</tr>
<tr>
<td>Regenerative Circuits</td>
<td>4</td>
</tr>
<tr>
<td>Operational Amplifiers</td>
<td>3</td>
</tr>
<tr>
<td>Sampling and quantization of analog signals</td>
<td>3</td>
</tr>
<tr>
<td>A/D and D/A converters</td>
<td>4</td>
</tr>
<tr>
<td>Semiconductormemories</td>
<td>4</td>
</tr>
<tr>
<td>Exams</td>
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<tr>
<td><strong>Total hours: (equivalent to contact period)</strong></td>
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Grading System
- Quantifiable (letters) □ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
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<th>Quantity</th>
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<td>Final Exam</td>
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<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<tr>
<td>Monographies</td>
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<tr>
<td>Portfolio</td>
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<tr>
<td>Projects</td>
<td>1</td>
</tr>
<tr>
<td>Journals</td>
<td></td>
</tr>
</tbody>
</table>
Bibliography:

According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

Course Outcomes

- Be able to determine the standard or criteria against which the outcome of the design process will be measured or compared. (a)
- Be able to follow logical and orderly design procedures, choosing the best solution for a given set of criteriarization of logic families (b)
- Analysis and characterization of logic families (c)
- Analysis and characterization of logic families (e)

Person(s) who prepared this description and date of preparation: Gladys O. Ducoudray. Submitted by Gladys O. Ducoudray
Nov 2006
General Information:

- Alpha-numeric codification: INEL 4211
- Course Title: ELECTRONICS LABORATORY 1
- Number of credits: 3
- Contact Period: One credit hour. One three-hour laboratory per week
- Required in INEL and ICOM

Course Description:

- English: Experiments with basic amplifiers and digital circuits. Design and testing of simple electronic circuits.
- Spanish: Experimentos con amplificadores y circuitos digitales básicos. Diseño y prueba de circuitos electrónicos simples.

Pre/Co-requisites and other requirements:

- Prerequisites: INEL 4115 and INEL 4205. Co-requisite: INEL 4201

Course Objectives:

- This course is designed to provide students with hands-on experience in the design, assembly, and test of electronic circuits. As part of the course activities, the written and graphical technical communications skills will be further developed.

Instructional Strategies:

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:

<table>
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<th>Outline</th>
<th>Contact Hours</th>
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<tr>
<td>Zener diodes and voltage regulator</td>
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<tr>
<td>Bipolar Transistors</td>
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</tr>
<tr>
<td>Basic amplifier circuits</td>
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<tr>
<td>Logic Families and circuits</td>
<td>2</td>
</tr>
<tr>
<td>Seven Segment LED’s</td>
<td>1</td>
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<tr>
<td>Multiplexers, decoders and memories</td>
<td>1</td>
</tr>
<tr>
<td>Adder binary circuit</td>
<td>1</td>
</tr>
<tr>
<td>Combinational digital circuits</td>
<td>1</td>
</tr>
<tr>
<td>Flip-Flops</td>
<td>1</td>
</tr>
<tr>
<td>Digital Clocks</td>
<td>1</td>
</tr>
<tr>
<td>Project</td>
<td>2</td>
</tr>
<tr>
<td>Test</td>
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</tr>
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Grading System

- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th></th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Exams</td>
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<tr>
<td>Final Exam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Quizzes</td>
<td></td>
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<td>Oral Reports</td>
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<td>Monographies</td>
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<td>Portfolio</td>
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<tr>
<td>Journals</td>
<td></td>
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<tr>
<td>Other, specify: Homework</td>
<td></td>
<td></td>
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</tbody>
</table>

**TOTAL:** 100%

Bibliography:
Appendix 47

Electronics Laboratory Manual, RUM.

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

Course Outcomes

- Apply circuit analysis techniques to understand the physical operation of an electrical circuit system.
- Be able to set up and safely perform basic electrical laboratory procedures.
- Be able to graphically and verbally represent or describe experimental data sets.
- Be able to analyze, interpret, and draw conclusions based on experimental data.
- Be able to work in teams to complete laboratory work and assignment.
- Be able to interpret and draw electrical schematic diagrams.
- Simulate electrical circuits using commercially available software for circuit analysis.

Map to Program Outcomes

- a
- b
- b
- d
- g
- k

Person(s) who prepared this description and date of preparation: Gladys O. Ducoudray.
**General Information:**
- Alpha-numeric codification: INEL 4212
- Course Title: ELECTRONICS LABORATORY II
- Number of credits: 3
  - Contact Period: One three-hour laboratory per week.
- Electives in INEL

**Course Description:**
- English: Experiments and projects with electronic circuits emphasizing their design.
- Spanish: Experimentos y proyectos con circuitos electrónicos poniendo énfasis en su diseño.

**Pre/Co-requisites and other requirements:**
- Prerequisites: INEL 4211 Co-requisite INEL 4202

**Course Objectives:**
- To provide the students practical experience in the design, assembly and testing of electronic analog-circuits.

**Instructional Strategies:**
- [ ] conference  [ ] discussion  [ ] computation  [ ] laboratory
- [ ] seminar with formal presentation  [ ] seminar without formal presentation  [ ] workshop
- [ ] art workshop  [ ] practice  [ ] trip  [ ] thesis  [ ] special problems  [ ] tutoring
- [ ] research  [ ] other, please specify:

**Minimum or Required Resources Available:**

**Course time frame and thematic outline**

<table>
<thead>
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<th>Contact Hours</th>
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<tr>
<td>Regulators and power supplies</td>
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<tr>
<td>Feedback amplifiers</td>
<td>1</td>
</tr>
<tr>
<td>Frequency response of amplifiers</td>
<td>1</td>
</tr>
<tr>
<td>Operational amplifier circuits</td>
<td>1</td>
</tr>
<tr>
<td>Norton amplifiers</td>
<td>1</td>
</tr>
<tr>
<td>Active filters</td>
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</tr>
<tr>
<td>Sinusoidal oscillators</td>
<td>1</td>
</tr>
<tr>
<td>Multivibrators</td>
<td>1</td>
</tr>
<tr>
<td>Analog gates</td>
<td>1</td>
</tr>
<tr>
<td>A/D, D/A converters</td>
<td>1</td>
</tr>
<tr>
<td>Design project</td>
<td>4</td>
</tr>
<tr>
<td>Test</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total hours: (equivalent to contact period)</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

**Grading System**
- [x] Quantifiable (letters)  [ ] Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Map to Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply circuit analysis techniques to understand the physical operation of an electrical circuit system.</td>
<td>a</td>
</tr>
<tr>
<td>Be able to set up and safely perform basic electrical laboratory procedures.</td>
<td>b</td>
</tr>
<tr>
<td>Be able to graphically and verbally represent or describe experimental data sets.</td>
<td>b</td>
</tr>
<tr>
<td>Be able to analyze, interpret, and draw conclusions based on experimental data.</td>
<td>b</td>
</tr>
<tr>
<td>Be able to work in teams to complete laboratory work and assignment.</td>
<td>d</td>
</tr>
<tr>
<td>Be able to interpret and draw electrical schematic diagrams.</td>
<td>g</td>
</tr>
<tr>
<td>Simulate electrical circuits using commercially available software for circuit analysis.</td>
<td>k</td>
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</tbody>
</table>

Person(s) who prepared this description and date of preparation: Dr. Raúl E. Torres, Feb 2007. Revised by: Academic Affairs Committee, May 15, 08.
General Information:
Alpha-numeric codification: INEL 4218
Course Title: Introduction to VLSI Design
Number of credits: 3
Contact Period: 3 credit hours, 3 hours of lecture per week
Elective in INEL and ICOM

Course Description:
English: Study of transistor properties and design methodologies for digital and analog circuits
Spanish: Estudio de las propiedades y diseño de los transistores para circuitos digitales y análogos.

Pre/Co-requisites and other requirements:
INEL4201

Course Objectives:
This course seeks to develop basic tools and understanding of VLSI design at transistor level. It includes process for designing layout and simulations of components for a system using Cadence Tools.

Instructional Strategies:
☑ conference ☐ discussion ☐ computation ☐ laboratory
☐ seminar with formal presentation ☐ seminar without formal presentation ☐ workshop
☐ art workshop ☐ practice ☐ trip ☐ thesis ☐ special problems ☐ tutoring
☐ research ☑ other, please specify: Problem with design components. Open ended solution

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Introduction to CMOS Circuits.</td>
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</tr>
<tr>
<td>MOS Transistor Theory.</td>
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<tr>
<td>Introduction.</td>
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<tr>
<td>MOS Device Design Equation.</td>
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<td>The Complementary CMOS Inverter-DC Characteristics.</td>
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<td>The Differential Stage.</td>
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<td>The Transmission Gate.</td>
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<td>Determination of Conductor Size.</td>
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<td>Basic Physical Design of Simple Logic Gates.</td>
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<td>Clocking Strategies.</td>
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<td>Physical and Electrical Design of Logic Gates.</td>
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<td>10 Structures.</td>
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### Structured Design Strategies.
- Introduction.
- Design Economics.
- Design Strategies.
- Design Methods.
- CMOS Chip Design Options.
- Design Capture Tools.
- Design Verification Tools.

<table>
<thead>
<tr>
<th>CMOS Test Methodsologies.</th>
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<tr>
<td>Introduction.</td>
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<td>Automatic Test Pattern Generation.</td>
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<td>Design for Manufacturability.</td>
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**Total hours: (equivalent to contact period)** 48

### Grading System
- ☒ Quantifiable (letters)
- ☐ Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>☐ Monographies</td>
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**TOTAL:** 100%

### Bibliography:

### According to Law 51
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### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
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<th>Math</th>
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<th>Engineering Topic</th>
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### Course Outcomes
- Be able to determine the standard or criteria against which the outcome of the design process will be measured or compared.
- Be able to follow logical and orderly design procedures, choosing the best solution for a given set of criteria
- Analysis and characterization of simple logic families
- Analysis and characterization of single stage amplifiers using cadence tools
- Communicate effectively their project

**Map to Program Outcomes**
- (a)
- (b)
- (c)
- (e, k)
- (g)

Person(s) who prepared this description and date of preparation: (Electronics Committee). Submitted by: Gladys O. Ducoudray, May 2007
General Information:
Alpha-numeric codification: INEL 4225
Course Title: DIGITAL ELECTRONICS LABORATORY
Number of credits: 3
Contact Period: One three-hour laboratory per week.
Required in ICOM

Course Description:
English: Experiments with digital electronic circuits and analog gates.
Spanish: Experimentos con circuitos electrónicos digitales y compuertas analógicas.

Pre/Co-requisites and other requirements:
Prerequisites: INEL 4211 and INEL 4207

Course Objectives:
The objective of the course is to provide the students with practical experience in the design, assembly and testing of prototypes for digital and analog electronic circuits.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

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<th>Outline</th>
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<td>Multivibrators</td>
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<td>Logic Families</td>
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<td>Operational amplifier circuits</td>
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<td>A/D, D/A converters</td>
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<td>LED’s applications</td>
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<td>Frequency counter</td>
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<tr>
<td>Project</td>
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<tr>
<td>Exams</td>
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Grading System
- Quantifiable (letters)
- Not Quantifiable

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<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<td>Monographies</td>
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<td>Portfolio</td>
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<td>Projects</td>
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<td>Journals</td>
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Bibliography:
Digital Electronics Lab. Manual; RUM.

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(exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

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<th>Engineering Topic</th>
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</table>

Course Outcomes

- Apply circuit analysis techniques to understand the physical operation of an electrical circuit system.
- Be able to set up and safely perform basic electrical laboratory procedures.
- Be able to graphically and verbally represent or describe experimental data sets.
- Be able to analyze, interpret, and draw conclusions based on experimental data.
- Be able to work in teams to complete laboratory work and assignment.
- Be able to interpret and draw electrical schematic diagrams.
- Simulate electrical circuits using commercially available software for circuit analysis.

Map to Program Outcomes

a
b
b
b
d
g
k

**General Information:**

- Alpha-numeric codification: INEL4301
- Course Title: Communications Theory 1
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Required in ICOM

**Course Description:**

English: Components of Communications Systems; Fourier Transform Analysis of Filtered Signals; Nyquist Theorem; Analog to Digital and Digital to Analog Conversion Processes; Bandwidth; Modulation and Noise. Computer-aided Analysis.

Español: Componentes de Sistemas de Comunicación; Uso de la Transformada de Fourier en el Análisis de Señales Filtradas; Teorema de Nyquist; Procesos de Conversión de Analógico A Digital y de Digital a Analógico; Ancho de Banda; Modulación y Ruido. Análisis Utilizando Computadoras.

**Pre/Co-requisites and other requirements:**

Prerequisite INEL4102 and ININ 4010

**Course Objectives:**

Provide students with a classical treatment of analog and digital communications theory.

**Instructional Strategies:**

- lectures
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

**Minimum or Required Resources Available:**

Materials, equipment, and physical facilities needed to fulfill the course objectives.

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Introduction to telecommunications</td>
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<tr>
<td>Representation of signals and systems</td>
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<tr>
<td>Introduction to noise</td>
<td>4</td>
</tr>
<tr>
<td>Continuous-wave modulation AM, SSB, FM</td>
<td>12</td>
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<tr>
<td>Sampling</td>
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</tr>
<tr>
<td>Pulse Modulation</td>
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**Grading System**

- Quantifiable (letters) □ Not Quantifiable

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<table>
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**Bibliography:**


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<th>Engineering Topic</th>
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<td>Course Outcomes</td>
<td>Map to ABET Outcomes</td>
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<tr>
<td>--------------------------------------------------------------------</td>
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<td></td>
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<tr>
<td>Explain the components of a modern communication system</td>
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<tr>
<td>Develop analytical and computational skills to analyze signals and systems using Fourier transforms.</td>
<td>a, k</td>
<td></td>
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</tr>
<tr>
<td>Understand the process of converting analog to discrete signals and vice versa.</td>
<td>a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understand linear (DSB, AM,SSB), angular (PM, FM) and digital (PCM) modulation techniques</td>
<td>a</td>
<td></td>
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<tr>
<td>Assess the impact of noise in analog and digital modulation systems</td>
<td>a</td>
<td></td>
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<tr>
<td>Recognition of importance of lifelong learning</td>
<td>i</td>
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Person(s) who prepared this description and date of preparation: Mario Ierkic. Submitted by: Miguel Vélez, Feb 2007
**General Information:**

- Alpha-numeric codification: INEL 4307
- Course Title: Communication between Computers
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Electives in INEL and ICOM

**Course Description:**

- Spanish: Características de los canales de voz que se utilizan para la comunicación digital. Sincronización y múltiplex. Claves de información, normas de interconexión y protocolos de comunicación. Técnicas para encriptar datos. Computación distribuida y redes locales

**Pre/Co-requisites and other requirements:**

- Prerequisite INEL 4301, INEL 4206 and (ININ 4010 or ININ 4011).

**Course Objectives:**

To introduce the techniques and standards used in computer communications including: the OSI layered model, modulation and demodulation techniques, physical, link, network, and transport-layer protocols, including the TCP architecture.

**Instructional Strategies:**

- Lecture
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

**Minimum or Required Resources Available:**

Materials, equipment, and physical facilities needed to fulfill the course objectives.

**Course time frame and thematic outline**

<table>
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<th>Outline</th>
<th>Contact Hours</th>
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<td>Introduction to computer communications</td>
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<tr>
<td>Protocols and protocol architecture</td>
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<tr>
<td>Data communications: properties, models, techniques</td>
<td>15</td>
</tr>
<tr>
<td>Wide Area Networks: architectures and techniques</td>
<td>12</td>
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<tr>
<td>TCP/IP</td>
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**Grading System**

- Quantifiable (letters)
- Not Quantifiable

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Appendix

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</tbody>
</table>

Course Outcomes

- Understand and explain the architecture of computer communications using the OSI Reference Model, the specifications of protocols, and technical literature in the field. In addition, the student should be capable of making simple design decisions on network topology, and participate in the design and implementation of computer communication protocols.
- Identify the theoretical limitations of communication systems using Nyquist and Shannon-Hartley theorems.
- Understand and make informed decisions about selecting the appropriate transmission medium and coding technique for data communications.
- Understand and explain the principles of framing a protocol data unit, flow and error control across a digital data link.
- Evaluate the performance of data link protocols in terms of utilization, net throughput, and latency.
- Describe and classify computer communication networks according to geographical extension (WAN vs LAN), topology and switching technique: circuit switching, packet switching using virtual circuits, datagrams, or cells.
- Understand how routing functions are implemented in Wide Area Networks including the use of least cost algorithms (Bellman-Ford and Dijkstra) and flooding.
- Understand and apply the fundamental principles of the IP and TCP layers in WAN.
- Understand the organization and nomenclature of the local area network based on the IEEE802 standards family and their scope.
- Understand and explain how network stations exercise media access control under IEEE802.3 and IEEE802.11 sections of the standard.

Person(s) who prepared this description and date of preparation: Jorge Cruz Emeric. Submitted by: Miguel Vélez, July, 07.
**General Information:**

- Alpha-numeric codification: INEL 4405
- Course Title: Electrical Machines
- Number of credits: 3
- Contact Period: 45
- Required in INEL

**Course Description:**

- English: Electromechanical energy conversion; induction, synchronous and direct current machines are studied
- Spanish: Conversión electromecánica de energía; máquinas de inducción, sincrónicas y de corriente directa son estudiadas

**Pre/Co-requisites and other requirements:**

- INEL 4103

**Course Objectives:**

To introduce students to the fundamental concepts of electromechanical energy conversion and electric machines. After completing the course, the students will have a solid background on the construction, operation characteristics and the analysis of each of the electrical machines discussed

**Instructional Strategies:**

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify: There will be laboratory demonstrations throughout the semester. Students must attend these demonstrations during the regular class period. Material from these demonstrations will be part of the class, and thus will be evaluated. Students may be asked to collect data from these demonstrations, analyze it and submit a report with the results of the analysis.

**Minimum or Required Resources Available:**

All students are expected to bring a solid background in circuit analysis and calculus. Students should also have basic knowledge of electromagnetic theory. Students must bring to class the textbook and a scientific calculator (preferably one that handles complex numbers).

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Introduction</td>
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<tr>
<td>Student learning profile</td>
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<td>Review of three phase power systems connections and analysis, phasor diagrams representation</td>
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<td>Three phase power measurements (Two Wattmeter Method)</td>
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<td>Reluctance torque in rotating machines</td>
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<td>3</td>
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<tr>
<td>Three phase induction machines</td>
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<td>Single phase induction motors</td>
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<td>Synchronous machines</td>
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**Grading System**

- Quantifiable (letters) ☑ Not Quantifiable

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Projects
Journals
☑ Other, specify: Homework 5
TOTAL: 100%

Bibliography:
Textbook:

References:

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Course Outcomes
- Possess sufficient knowledge of circuit analysis and electromagnetic principles to enable understanding of the physical operation of electric machines
- Be able to apply linear algebra and phasor analysis concepts to descriptions and solutions of steady state electric machines engineering problems.
- Be capable of extracting specifications and physical constraints from electrical machines engineering verbal problems.
- Be capable of physical thinking, approximation and simplification of electric machines behavior as to perform laboratory test to compare actual results with theoretical ones.
- Be capable of effectively describing electrical machines steady state working conditions in a way that can lead to the construction of a solution.
- Be capable to use the existing data acquisition module and computer programs to obtain and analyze the electric machines operation characteristics

Map to Program Outcomes
(a) (a) (a) (b) (e) (k)

Person(s) who prepared this description and date of preparation: ____________________
Submitted by: Efrain O’Neill nov 2006
Appendix

General Information:
- Alpha-numeric codification: INEL 4406
- Course Title: Electrical Machines Laboratory
- Number of credits: 3
- Contact Period: 45
- Required in INEL

Course Description:
- English: Magnetic circuits; single phase transformers; three phase systems: passive loads and transformers; single phase and three phase induction motors; synchronous machines; direct current machines.
- Spanish: Circuitos magnéticos; transformadores monofásicos; sistemas trifásicos: cargas pasivas y transformadores; motores de inducción trifásicos y monofásicos; máquina sincrónica; máquina de corriente directa

Pre/Co-requisites and other requirements:
- INEL 4115, INEL 4103 / INEL 4405

Course Objectives:
This course is designed to give students practical laboratory experience in the operation of three phase circuits, transformers and electric machines as well as the safe electrical measurements practices.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify: T

Minimum or Required Resources Available:
All students are expected to bring a solid background in circuit analysis and calculus. Students should also have basic knowledge of electromagnetic theory. Students must always bring to class the textbook and a scientific calculator (preferably one that handles complex numbers).

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Introduction</td>
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<td>Student learning profile</td>
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<tr>
<td>Safety Rules</td>
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<tr>
<td>Passive loads and instrumentation connection for experiment</td>
<td>3</td>
</tr>
<tr>
<td>Basic analysis of single phase AC and DC circuits</td>
<td>3</td>
</tr>
<tr>
<td>Three phase circuits: analysis and power measurements</td>
<td>3</td>
</tr>
<tr>
<td>Single phase transformers: tests, loading, efficiency and voltage regulation</td>
<td>3</td>
</tr>
<tr>
<td>Three phase transformers: voltage and current relationships and connections</td>
<td>3</td>
</tr>
<tr>
<td>Three phase induction motor: no-load, speed, current and torque characteristics</td>
<td>6</td>
</tr>
<tr>
<td>Single phase induction motors</td>
<td>3</td>
</tr>
<tr>
<td>Synchronous motor: operation and control</td>
<td>3</td>
</tr>
<tr>
<td>Three Phase Synchronous Generator</td>
<td>3</td>
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<td>DC Machines: Motors and Generators: Operation and Control</td>
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Grading System

- Quantifiable (letters) [x]
- Not Quantifiable [ ]

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<th>Quantity</th>
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<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<td>Monographies</td>
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<td>Portfolio</td>
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</table>

 please specify: T
Projects | 1 | 10
Journals | | |
Other, specify: Laboratory Reports | | 25
TOTAL: | | 100%

Bibliography:
Textbook:
UPRM, Electrical and Computer Engineering Department, Electric Machines Fundamentals Laboratory Manual, 7TH edition

References:

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

Course Outcomes

- Possess sufficient knowledge of circuit analysis and electromagnetic principles to enable understanding of the physical operation of electric machines (a)
- Be able to apply linear algebra and phasor analysis concepts to descriptions and solutions of steady state electric machines engineering problems. (a)
- Be capable of extracting specifications and physical constraints from electrical machines engineering verbal problems. (a)
- Be capable of physical thinking, approximation and simplification of electric machines behavior as to perform laboratory test to compare actual results with theoretical ones (b)
- Be capable of effectively describing electrical machines steady state working conditions in a way that can lead to the construction of a solution. (e)
- Be capable to use the existing data acquisition module and computer programs to obtain and analyze the electric machines operation characteristics (k)

Person(s) who prepared this description and date of preparation;
Submitted by: Efrain O’Neill Nov 2006
1. General Information:

   Alpha-numeric codification: INEL 4407  
   Course Title: Electrical System Design I  
   Number of credits: 3  
   Contact Period: 45  
   Elective in INEL

Course Description:

English: Design of electrical systems for buildings; wiring systems, illumination, protection and grounding.

Spanish: Diseño de sistemas eléctricos de edificios; alambrado, iluminación, protección y sistema de puesta a tierra.

Pre/Co-requisites and other requirements:

INEL 4103 (pre-requisite)

Course Objectives:

This is a course for majors in electrical engineering. After completing the course, the student should be able to design electrical systems for buildings and select appropriate systems components including wiring, illumination, protection devices, grounding system and buildings' electrical power supply.

Instructional Strategies:

☒ conference  ☐ discussion  ☐ computation  ☐ laboratory  
☒ seminar with formal presentation  ☐ seminar without formal presentation  ☒ workshop  
☐ art workshop  ☐ practice  ☐ trip  ☐ thesis  ☐ special problems  ☐ tutoring  
☐ research  ☐ other, please specify:

Minimum or Required Resources Available:

All students are expected to bring a solid background in electric power systems fundamentals. Students must always bring to class the current edition of the National Electrical Code (NFPA 70), and a scientific calculator (preferably one that handles complex numbers).

Course time frame and thematic outline

<table>
<thead>
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<td>Introduction to the NEC</td>
<td>6</td>
</tr>
<tr>
<td>Single family dwellings</td>
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<td>Grounding and Bonding, NEC Article 250</td>
<td>3</td>
</tr>
<tr>
<td>Local requirements and other NEC articles</td>
<td>6</td>
</tr>
<tr>
<td>Multifamily dwellings and Transformer loading</td>
<td>3</td>
</tr>
<tr>
<td>Comercial buildings and Transformer specifications</td>
<td>9</td>
</tr>
<tr>
<td>Voltage drop computation and compliance</td>
<td>3</td>
</tr>
<tr>
<td>Short circuit analysis and device specifications</td>
<td>3</td>
</tr>
<tr>
<td>Motor circuits, Article 430</td>
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</tr>
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<td><strong>Total hours: (equivalent to contact period)</strong></td>
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Grading System

☒ Quantifiable (letters)  ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
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<td>☒ Short Quizzes</td>
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</tr>
<tr>
<td>☐ Oral Reports</td>
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</tr>
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<td>☐ Monographies</td>
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<td>☒ Projects</td>
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<td>☐ Journals</td>
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<td>☒ Other, specify: Homework</td>
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Bibliography:
Instructor assigned material will be announced.

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of course to meeting the requirements of Criterion 5

| Engineering Science: | 1 credits |
| Engineering Design:  | 2 credits |

Course Outcomes

- Possess sufficient knowledge of power system analysis that will enable them to understand the physical operation of the wiring system and the power sub-stations. (a)
- Be able to apply complex variable concepts to the solution of wiring system problems. (a)
- Be able to follow logical and orderly design procedures to choose the best solution for the relaying of the power system. (c)
- Be able to determine criteria to compare the designed outcome and to estimate the cost of the electrical installation. (c)
- Be able to identify ethical issues faced on the solution to the buildings power distribution design. (f)
- Be able to write effectively and be understood by technical audience (other engineering and electrical contractors) (g)
- Be able to communicate graphically using construction drawings and symbols. (g)
- Be aware of modern devices used in wiring and grounding systems. (k)
- Apply computer software as a tool for design computations (k)

Person(s) who prepared this description and date of preparation: Lionel Orama.
**General Information:**

- Alpha-numeric codification: INEL 4408
- Course Title: Electrical Systems Design II
- Number of credits: 3
- Contact Period: 45
- Required in INEL

**Course Description:**

- English: Design of electrical systems for buildings: power supply, exterior illumination, signal systems, and emergency/standby power equipment.

- Spanish: Diseño de sistemas eléctricos de edificios: el sistema de potencia, iluminación exterior, sistemas de señales, y sistemas de generación para emergencias.

**Pre/Co-requisites and other requirements:**

- INEL 4103

**Course Objectives:**

This course is designed to give students in electric power engineering the hands on design practice of illumination, signal systems design, and emergency/standby power equipment requirements for different types of buildings.

**Instructional Strategies:**

- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

**Minimum or Required Resources Available:**

All students are expected to bring a solid background in electric power systems fundamentals. Students must always bring to class the current edition of the National Electrical Code (NFPA 70), and a scientific calculator (preferably one that handles complex numbers).

**Course time frame and thematic outline**

<table>
<thead>
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<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Signal systems design: residential building design; commercial building design; institutional building design; grounding requirements; protection requirements; voltage drop considerations; substation design; short circuit calculations, lighting calculations.</td>
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<td>Emergency/standby power equipment</td>
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<td>Exams</td>
<td>3</td>
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- Total hours: (equivalent to contact period) 45

**Grading System**

- Quantifiable (letters)
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
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<td>Journals</td>
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<td>Other, specify: Homework</td>
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</table>

TOTAL: 100%

**Bibliography:**
Instructor notes available on Web.


Instructor assigned material will be announced.

**According to Law 51**
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

**Contribution of Course to meeting the requirements of Criterion 5:**

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

- Possess sufficient knowledge of power system analysis that will enable them to understand the physical operation of the wiring. (a)
- Be able to apply complex variable concepts to the solution of wiring system problems. (a)
- Be able to follow logical and orderly design procedures to choose the best solution for the relaying of the power system. (c)
- Be able to determine criteria to compare the designed outcome and to estimate the cost of the electrical installation. (c)
- Be able to identify ethical issues faced on the solution to the buildings power distribution design. (f)
- Be able to write effectively and be understood by technical audience (other engineering and electrical contractors). (g)
- Be able to communicate graphically using construction drawings and symbols. (g)
- Be aware of modern devices used in wiring and grounding systems. (k)
- Use computer software as a tool for design computations and drawing (k)

Person(s) who prepared this description and date of preparation: Lionel Orama. Submitted by: Lionel Orama, Committee Coordinator June, 2008.
**General Information:**
- Alpha-numeric codification: INEL 4409
- Course Title: ILLUMINATION ENGINEERING
- Number of credits: 3
- Contact Period: 45
- Elective in INEL

**Course Description:**
- Spanish: Diseño de iluminación. Desarrollo y aplicación de métodos en técnicas de luminancia. Iluminación interior y exterior.

**Pre/Co-requisites and other requirements:**
- Prerequisite: INEL 4103

**Course Objectives:**
- The purpose of this course is to prepare students to be proficient in designing interior and exterior illumination systems.

**Instructional Strategies:**
- conference  
- discussion  
- computation  
- laboratory
- seminar with formal presentation  
- seminar without formal presentation  
- workshop
- art workshop  
- practice  
- trip  
- thesis  
- special problems  
- tutoring
- research  
- other, please specify:

**Minimum or Required Resources Available:**
- All students are expected to bring a solid background in electric systems analysis. Students must work on projects by applying the techniques discussed in class.

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
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<tr>
<td>Light, eye, and vision</td>
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<td>Color</td>
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**Grading System**

- Quantifiable (letters)  
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Portfolio</td>
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Bibliography:

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
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<th>Math</th>
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<th>Engineering Topic</th>
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<tbody>
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</tr>
</tbody>
</table>

12. Course Outcomes

The student is able to apply mathematics and science fundamentals to solve or to analyze an engineering problem or principle within the course material.

The students are able to follow logical and orderly design procedures, and complete a design to meet the given set of specification. The students clearly document his alternatives and decisions along the design process, and include considerations of codes, protocols, and engineering standards related to the design area.

Team members demonstrate an ability to organize the team assigning responsibilities, balancing the work load, and participating in regular meetings.

The objective of the design or assignment is completed. Students are able to compare different alternatives to present a suitable solution.

Students are able to compare different alternatives to present a suitable solution. Their solution shows their ability of physical thinking, approximation and simplification.

Students are able to apply ethical analysis in the evaluation of the proposed design. The work complies with safety standards, and their final design solution avoids ethical compromises.

Students are able to write a project report or paper.

Students prove their ability to find information related to their discipline by including a reference list of articles related to their course work.

Students discuss different alternatives to solve their problem with emerging technologies and their associated cost, and comment on their importance and how they cope with the needs of their design.

Students are able to make an appropriate choice and use of specialized tools, and software to complete a design.

Person(s) who prepared this description and date of preparation: Lionel R. Orama. Submitted by: Lionel R. Orama, June, 19, 2008, Committee Coordinator.
Appendix 68

General Information:
- Alpha-numeric codification: INEL 4415
- Course Title: Power System Analysis
- Number of credits: 3
- Contact Period: 45
- Elective course in INEL

Course Description:
English: Formulation of bus admittance and bus impedance matrices, symmetrical components, symmetrical and unsymmetrical faults, power flow, economic operation of power system.

Spanish: Formulación de las matrices de admitancia e impedancia, componentes simétricos y fallas asimétricas, flujo de potencia, operación económica de sistemas de potencia.

Pre/Co-requisites and other requirements:
- INEL 4103

Course Objectives:
This is a course for majors in electric power engineering. After successfully completing this course students will be able to formulate and solve the power flow problem, will understand the fundamentals of economic operation of a power system, and will be able to analyze a faulted electric power systems. The course includes fundamentals of power systems operation and design.

Instructional Strategies:
- [ ] conference
- [ ] discussion
- [ ] computation
- [ ] laboratory

- [ ] seminar with formal presentation
- [ ] seminar without formal presentation
- [ ] workshop

- [ ] art workshop
- [ ] practice
- [ ] trip
- [ ] thesis
- [ ] special problems
- [ ] tutoring

- [ ] research
- [ ] other, please specify: Students are required to use existing power flow programs and to program, using MATLAB, their own power flow, short circuit and economic dispatch programs. These programs will be used to solve homework problems.

Minimum or Required Resources Available:
- All students are expected to bring a solid background in electric power systems fundamentals. Students must always bring to class the textbook and a scientific calculator (preferably one that handles complex numbers).

Course time frame and thematic outline:

<table>
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<th>Outline</th>
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</tr>
<tr>
<td>Admittance Matrix Formulation and Network Calculations</td>
<td>3</td>
</tr>
<tr>
<td>Power Flow Analysis</td>
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<tr>
<td>Economic Operation of Power Systems</td>
<td>12</td>
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<tr>
<td>Impedance Matrix Formulation and Network Calculations</td>
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<td>Symmetrical Components</td>
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<tr>
<td>Symmetrical and unsymmetrical faults</td>
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Total hours: (equivalent to contact period) 45

Grading System
- [ ] Quantifiable (letters)
- [ ] Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Oral Reports</td>
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<td>Monographies</td>
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<td>Portfolio</td>
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</tbody>
</table>
Appendix

Projects: 3
Journals: 6
Other, specify: Homework: 

TOTAL: 100%

Bibliography:

Textbook:

References:

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
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<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tr>
</tbody>
</table>

Course Outcomes

- Possess sufficient knowledge of power system analysis fundamentals to enable understanding of the economic operation of electric power systems.
- Formulate and solve basic economic dispatch problems using calculus, programming and software packages.
- Learn and apply numerical analysis concepts to formulate and solve the electric power flow problem.
- Solve the electric power flow problem using commercially available software.
- Understand the physical constraints associated to a faulted electric power system to successfully model these conditions.
- Be capable to analyze a variety of faulted power system conditions using MATLAB.

Map to Program Outcomes

(a) Possess sufficient knowledge of power system analysis fundamentals to enable understanding of the economic operation of electric power systems.
(k) Formulate and solve basic economic dispatch problems using calculus, programming and software packages.
(a) Learn and apply numerical analysis concepts to formulate and solve the electric power flow problem.
(k) Solve the electric power flow problem using commercially available software.
(a) Understand the physical constraints associated to a faulted electric power system to successfully model these conditions.
(k) Be capable to analyze a variety of faulted power system conditions using MATLAB.

Person(s) who prepared this description and date of preparation:
Submitted by: Efrain O'Neill Nov 2006
General Information:
- Alpha-numeric codification: INEL 4416
- Course Title: Power Electronics
- Number of credits: 3
- Contact Period: 3 hours per week
- Elective course in INEL

Course Description:
- English: Introduction to power semiconductor devices, single-phase and three-phase diode and SCR-based rectifiers, ac voltage controllers, D.C to D.C converters, D.C choppers, single-phase and three-phase PWM inverters
- Spanish: Introducción de los dispositivos semiconductores de potencia. Análisis de rectificadores monofásicos y trifásicos con SCR, de controladores de voltage ac, D.C to D.C converters and choppers y de inversores monofásicos y trifásicos con PWM.

Pre/Co-requisites and other requirements:
- INEL 4102, INEL 4103 and INEL4201

Course Objectives:
The course presents fundamental concepts of ac-dc, dc-dc and dc-ac power converters. This is a three credit-hours course, open to Senior Electrical Engineering students. After completing the course, students will have a sound background on the analysis and design of power converters. And they will be able to apply the basic concepts to understand, analyze and design power electronics systems such as power supplies, motor drives, switching power amplifiers.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify: Several individual projects on analysis and design of power converters that require usage of circuit simulators and their analysis fixtures as well as mathematical software.

Minimum or Required Resources Available:
All students are expected to bring a solid background in circuit analysis, elementary differential equations, basic electronics, three-phase circuits.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to power electronics and applications</td>
<td>1</td>
</tr>
<tr>
<td>Introduction to Power semiconductor devices</td>
<td>4</td>
</tr>
<tr>
<td>Single phase uncontrolled and controlled rectifiers</td>
<td>6</td>
</tr>
<tr>
<td>Three phase uncontrolled and controlled rectifiers</td>
<td>4</td>
</tr>
<tr>
<td>D.C to D.C converters</td>
<td>9</td>
</tr>
<tr>
<td>D.C Choppers</td>
<td>2</td>
</tr>
<tr>
<td>A.C voltage controllers</td>
<td>2</td>
</tr>
<tr>
<td>Single phase inverters</td>
<td>5</td>
</tr>
<tr>
<td>Three phase inverters</td>
<td>6</td>
</tr>
<tr>
<td>Three class tests</td>
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</tr>
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<td>45</td>
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Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th></th>
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<th>Percent</th>
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<td>Final Exam</td>
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<td>Oral Reports</td>
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<td>Monographies</td>
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<td>Portfolio</td>
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</tr>
<tr>
<td>Projects</td>
<td>1</td>
<td>30</td>
</tr>
</tbody>
</table>
Appendix

| Journals | Other, specify: Homework | TOTAL: | 100% |

Bibliography:
Professor’s Notes
References:
Articles from IEEE Transactions on Power Electronics and Industrial Applications and other journals and conferences.

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

Course Outcomes
- Possess sufficient knowledge of circuit analysis and differential equations to enable understanding of the physical operation of power converters. (a)
- Be able to apply flux balance and charge balance principles together with circuit theory to analyze dc-dc PWM power converters. (a)
- Be capable of extracting specifications and physical constraints from power electronics verbal problems. (a)
- Be capable of designing power converters to meet specific needs. (c)
- Be capable of writing effectively and concisely project report on their work on analysis, design and evaluation of power converters (g)
- Be able to use information searching tools and resources necessary to be up to date in their discipline (i)
Be capable of using circuit simulators to help on designing power converters as well as on their analysis and evaluation. (k)

Map to Program Outcomes

Person(s) who prepared this description and date of preparation: ________________________________
Submitted by: Efrain O’Neill Nov 2006
### General Information:
- Alpha-numeric codification: INEL 4505
- Course Title: Introduction to Control Systems
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Required in INEL

### Course Description:
English: Analysis of control systems and their mathematical models; analysis and design of control systems for single-input single-output plants; computer solution of problems will be emphasized.
Spanish: Análisis de sistemas de control y sus respectivos modelos matemáticos; análisis y diseño de sistemas de control para procesos de una sola entrada y salida; se enfatiza el uso de la computadora para la solución de problemas.

### Pre/Co-requisites and other requirements:
INEL 4102

### Course Objectives:
Analyze and design modern control systems.

### Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

### Minimum or Required Resources Available:
Classroom.

### Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic definitions and classifications of control systems</td>
<td>3 lectures</td>
</tr>
<tr>
<td>System representations: Block diagrams and signal flow graphs</td>
<td>3 lectures</td>
</tr>
<tr>
<td>Mathematical models for translational and rotational mechanical systems and the DC motor.</td>
<td>5 lectures</td>
</tr>
<tr>
<td>State variable description for dynamic linear systems.</td>
<td>2 lectures</td>
</tr>
<tr>
<td>Control system characteristics: stability, steady state error, transient response, and disturbance rejection.</td>
<td>14 lectures</td>
</tr>
<tr>
<td>The root locus method and its applications.</td>
<td>6 lectures</td>
</tr>
<tr>
<td>Compensation methods using Bode plots and root locus</td>
<td>9 lectures</td>
</tr>
<tr>
<td>Exams</td>
<td>3 lectures</td>
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</tbody>
</table>

Total hours: (equivalent to contact period) 45

### Grading System
- Quantifiable (letters) [ ]
- Not Quantifiable [ ]

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Quantity</th>
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<tr>
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<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<td>Monographies</td>
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<td>Portfolio</td>
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<tr>
<td>Projects</td>
<td>1</td>
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<td>Journals</td>
<td></td>
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<tr>
<td>Other, specify:</td>
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</table>

TOTAL: 100%

### Bibliography:
According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

Course Outcomes

- Use of the Laplace transform to model mechanical, electrical and electromechanical systems. (a)
- Analyze the performance of a closed-loop, single input, single output control system. (a)
- Design controllers to improve the transient, steady-state and stability characteristics of control systems. (c)

Person(s) who prepared this description and date of preparation: Eduardo Juan, Submitted by Eduardo Juan, December 2006
**General Information:**
- **Alpha-numeric codification:** INEL 4995
- **Course Title:** Engineering Practice for COOP Students
- **Number of credits:** Zero to six credit hours. A minimum of two work periods is required for accreditation of the course, one of which must be a semester.
- **Contact Period:** Depends on the assignment
- **Elective in INEL**

**Course Description:**
English: Practical experience in electrical engineering in cooperation with private industry or government to be jointly supervised by the academic department, the co-op program coordinator, and an official from the cooperating organization. A written report will be required upon completion of each period of work.

Spanish: Experiencia practica en ingeniería eléctrica en cooperación con la industria privada o el gobierno. El trabajo del estudiante será conjuntamente supervisado por el departamento académico, el coordinador del plan cooperativo y un oficial de la organización cooperadora. Se requerirá un informe escrito al completar cada periodo de trabajo.

**Pre/Co-requisites and other requirements:**
- Consent of the Director of the Department.

**Course Objectives:**
Students will compare and contrast the theoretical aspects of electrical engineering with the real world practice. They will apply the fundamental concepts taught in the classroom and recognize their value in real practice. Students will experience and be exposed to the practical aspects of electrical engineering design.

**Instructional Strategies:**
- [ ] conference
- [ ] discussion
- [ ] computation
- [ ] laboratory
- [ ] seminar with formal presentation
- [ ] seminar without formal presentation
- [ ] workshop
- [ ] art workshop
- [ ] practice
- [ ] trip
- [ ] thesis
- [ ] special problems
- [ ] tutoring
- [ ] research
- [ ] other, please specify:

**Minimum or Required Resources Available:**

<table>
<thead>
<tr>
<th>Course time frame and thematic outline</th>
<th>Contact Hours</th>
</tr>
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<tbody>
<tr>
<td>Outline</td>
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<td>Varies with assignment</td>
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</table>

**Total hours: (equivalent to contact period)**

**Grading System**
- [x] Quantifiable (letters)
- [ ] Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Quantity</th>
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<tr>
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<td>[ ] Short Quizzes</td>
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<td>[ ] Monographies</td>
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<td>[ ] Portfolio</td>
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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
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<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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</tbody>
</table>

Course Outcomes

- Apply electrical engineering knowledge to conduct analysis and design of problems in a real engineering practice environment (a)
- Design and conduct experiments as well as analyze and interpret data in a real engineering practice environment (b)
- Design an and analyze electrical systems to meet an organizational need (c)
- Ability to participate and collaborate on multidisciplinary teams (d)
- Ability to communicate effectively in an organizational environment (g)
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k)
- Prepare work progress reports and document project work. (g)

Person(s) who prepared this description and date of preparation: José Colom February 1, 2008. Verified by: Raúl E. Torres.
General Information:
- Alpha-numeric codification: INEL 4998
- Course Title: UNDERGRADUATE RESEARCH
- Number of credits: 1 to 6 (Variable Credits)
- Contact Period: Three hours per credits each week.
- Elective in INEL

Course Description:
- English: Participation in a research project under the supervision of a faculty member.
- Spanish: Participación en un proyecto de investigación bajo la supervisión de un profesor.

Pre/Co-requisites and other requirements:
- Permission of the Director of the Department

Course Objectives:
- During the course, all students are expected to:
  - Gain experience in the research process.
  - Learn how to do literature review
  - Explore technologies related to the research topic.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:
- General Library, University Computer Centers, Laboratories, and any other necessary equipment related to the proposed research.

Course time frame and thematic outline
- Outline example for three credits
  - Literature Review  12
  - Laboratory work  30
  - Presentations or Publications  3
  - Total hours: (equivalent to contact period)  45

Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
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<td>Laboratory Work</td>
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<td>TOTAL:</td>
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Bibliography:
- Part of the problem solution is for the student to search the necessary reference materials. Library searches are encouraged.
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<table>
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<th>Contribution of Course to meeting the requirements of Criterion 5:</th>
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<tr>
<td>Math</td>
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<td></td>
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</tbody>
</table>

Relationship of the course with program outcomes

All projects should satisfy a representative subset of the following outcomes:

- Applying fundamentals of mathematics, science, probability and statistics to solve or to analyze an engineering problem when applicable. Economic aspects are considered as appropriate.
- Developing and conducting the laboratory work or simulation or prototyping and troubleshooting where applicable. Results and data are correctly interpreted.
- Following logical and orderly design procedures based on a set of specifications. Alternatives and decisions are clearly documented along the design process, and include considerations of codes, protocols, and engineering and safety standards related to the design area.
- Demonstrating an ability to organize the team assigning responsibilities, balancing the work load, and participating in regular meetings.
- Identifying and describing a problem that can be solved with the skills related to the field of study. Students are able to compare different alternatives to present a suitable solution. Their solution shows their ability of physical thinking, approximation and simplification.
- Evaluating any ethical aspects of the project. The ethical aspects can include the perspectives of the designer and the user or affected parties, and knowledge of any applicable code of ethics, such as, the CIAPR, the IEEE or ACM Codes of Ethics.
- Writing well organized project documents and presentations. The work should make proper use of language (Spanish or English), and use schematics, tables, graphics, mathematical equations, as appropriate.
- Analyzing the social and environmental impact. The analysis may discuss economic implications, such as entrepreneurship potential, sustainability, usability, and employment substitutions.
- Using information and bibliographic resources, and finding specialized tools, software or supplies necessary for the project. The reference list is included and discussed in the documents.
- Discussing contemporary issues related to the project such as innovations, business opportunities, and local needs.
- Making appropriate choice and use of specialized tools, software, or hardware to complete the design or to collect and analyze data.

Person(s) who prepared this description and date of preparation. Academic Affairs Committee, April 10, 2008. Submitted by: Raúl E. Torres, Committee Coordinator, April, 2008.
**General Information:**

Alpha-numeric codification: INEL 5029  
Course Title: TELECOMMUNICATIONS ELECTRONICS  
Number of credits: 3  
Contact Period: Two hours of lecture per week and one two-hour laboratory per week  
Electives in INEL

**Course Description:**

English: Study of the theory of operation of radio frequency (RF) and microwave devices and components and fundamentals of RF design, with the purpose of understanding the operation of the different components of telecommunications systems.

Spanish: Estudio de la teoría de operación de dispositivos y componentes de radio frecuencia (RF) y de microondas y los fundamentos de las técnicas de diseño de sistemas de RF con el propósito de entender la operación de los diversos componentes de sistemas de.

**Pre/Co-requisites and other requirements:**

Prerequisites: INEL 4301, INEL 4201, INEL 4152

**Course Objectives:**

After completing the course, the students should be able to use telecommunications theory principles, examine different applications and apply Fourier transforms, convolution, filtering, sampling, noise, modulation and demodulation, to solve communications electronics problems.

**Instructional Strategies:**

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

**Minimum or Required Resources Available:**

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio communication systems</td>
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<tr>
<td>Two-port networks</td>
<td>5</td>
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<tr>
<td>Impedance matching</td>
<td>8</td>
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<td>Noise in linear systems</td>
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<td>RF filters</td>
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<td>Oscillator circuits</td>
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<td>Phase Lock loops</td>
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<td>Mixer Circuits</td>
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<td>Frequency Synthesizers</td>
<td>5</td>
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<td>Modulators and Demodulators</td>
<td>4</td>
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**Grading System**

- Quantifiable (letters)  
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
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<tbody>
<tr>
<td>Exams</td>
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<tr>
<td>Final Exam</td>
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<tr>
<td>Short Quizzes</td>
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<tr>
<td>Oral Reports</td>
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<tr>
<td>Monographies</td>
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<td>Portfolio</td>
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<tr>
<td>Projects</td>
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<td>Journals</td>
<td></td>
</tr>
<tr>
<td>Other, specify: Lab work</td>
<td></td>
</tr>
</tbody>
</table>
### Bibliography:

| Microwave Circuit Design Using Linear and Nonlinear Techniques, Vendelin, Pavio and Rohde, John Wiley and Sons, 2005 |

### According to Law 51

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### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

### Course Outcomes

- Describe the components of a communication system and explain the purpose of each component in the system (b)
- Calculate the impedance, admittance, hybrid and scattering matrices for two-port networks (a)
- Design impedance matching networks (c)
- Design lumped element RF filters and RF amplifiers (a)
- Describe the operation of phase locked loops, frequency synthesizers, mixers and modulator and demodulator circuits (b)
- Design simple mixers and oscillator circuits (c)
- Design telecommunication electronics circuits using RF circuit simulators (k)

Person(s) who prepared this description and date of preparation: Rafael Rodríguez, September, 2007. Submitted by: Rafael Rodríguez.
**General Information:**
- Alpha-numeric codification: INEL 5046
- Course Title: Pattern Recognition
- Number of credits: 3
- Contact Period: 3 hours of lecture per week.
- Electives in INEL and ICOM

**Course Description:**
- English: An introduction to the field of Pattern Recognition: statistical decision making, non-parametric decision making, clustering, artificial neural networks, learning techniques, evaluation of classification rules and applications.
- Spanish: Una introducción al área de reconocimiento de patrones, incluyendo evaluación de decisiones estadísticas, evaluación de decisiones no-paramétricas, redes neuronales, técnicas de aprendizaje, evaluación de reglas de clasificación y aplicaciones.

**Pre/Co-requisites and other requirements:**
- ININ 4010

**Course Objectives:**
After completing the course, the student should be able to: classify data using parametric, non-parametric and neural network methods, cluster data, design pattern recognition based algorithms to analyze data.

**Instructional Strategies:**
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

**Minimum or Required Resources Available:**
Materials, equipment, and physical facilities needed to fulfill the course objectives.

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<td>Unsupervised Learning and Clustering</td>
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<tr>
<td>Applications</td>
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<td>Advanced Topics</td>
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**Grading System**
- Quantifiable (letters)
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<tr>
<td>Other, specify: Homework</td>
<td>varies</td>
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</table>

**TOTAL:** 100%

**Bibliography:**

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
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<th>General</th>
<th>Engineering Topic</th>
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<td><img src="csvfile" alt="General" /></td>
<td><img src="csvfile" alt="Engineering Topic" /></td>
</tr>
</tbody>
</table>

Course Outcomes

- Apply statistical techniques to compute decision boundaries (a)
- Apply histogram and kernel estimates to interpret data (b)
- Apply feature reduction methods (a)
- Apply similarity metrics and criteria to cluster data (k)
- Develop a classification system for given data (e)
- Train neural networks with different learning rules (a)
- Apply neural network to solve a classification problem (k)
- Perform literature survey on a pattern recognition topic (i)
- Perform the analysis of a pattern recognition system (g)
- Evaluate the performance of classifier systems on data (k)

Person (s) who prepared this description and date of preparation: Vidya Manian and Miguel Figueroa. Submitted by: Miguel Vélez, Julio 07
**General Information:**

- Alpha-numeric codification: INEL 5195
- Course Title: Design Project in Electrical Engineering
- Number of credits: 3
- Contact Period: 1 hour lecture, 4 hours laboratory per week
- Elective in INEL

**Course Description:**

English: Capstone design course in which students apply fundamental knowledge in Electrical Engineering to solve an engineering problem considering engineering standards and realistic constraints.

Spanish: Curso de experiencia de diseño en el cual los estudiantes aplican los fundamentos de Ingeniería Eléctrica para solucionar un problema de ingeniería, tomando en consideración los estándares de ingeniería y restricciones de diseño realistas.

**Pre/Co-requisites and other requirements:**

Permission of the Departmental Director

**Course Objectives:**

In this course, students should demonstrate their capacity to understand and manage all aspects related to the solution of a problem in Electrical Engineering, based on their knowledge acquired in previous courses. The student should demonstrate his/her capability to solve a real engineering problem.

**Instructional Strategies:**

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

**Minimum or Required Resources Available:**

The course includes 4 hours of laboratory work per week for the development, modeling and implementation of the project, depending on its scope and nature.

**Course time frame and thematic outline**

<table>
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<tr>
<th>Outline</th>
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<td>- Budgeting</td>
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<td>- Ethics</td>
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<td>- CAD Tools</td>
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<tr>
<td>- Environmental and social issues related to the Engineering Practice</td>
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<tr>
<td>- Project Management</td>
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<tr>
<td>- Any other as the design projects dictate</td>
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<td>Oral presentations</td>
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**Grading System**

☑ Quantifiable (letters) ☐ Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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</table>
Bibliography:
- Standard such as National Electric Code (NEC), Federal Comission of Communication (FCC), National Electric Safety Code (NESC), Federal Drug Asociation (FDA) regulations
- CRC ElectricalEngineeringNetbase: http://www.electricalengineeringnetbase.com/
- CRC ENGnetBASE: http://www.engnetbase.com/ejournals/categories/default.asp
- Electronic Design: http://electronicdesign.com/
- WEB-EE: http://web-ee.com/

Books:

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Contribution of Course to meeting the requirements of Criterion 5:

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<thead>
<tr>
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<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

Course Outcomes

Students must satisfy for all design projects the following outcomes by:

- Developing and conducting the laboratory work or simulation or prototyping and troubleshooting where applicable to evaluate the design. Results and data are correctly interpreted. (b)
- Following logical and orderly design procedures based on a set of specifications. Alternatives and decisions are clearly documented along the design process, and include considerations of codes, protocols, and engineering and safety standards related to the design area. (c)
- Identifying and describing a problem that can be solved with the skills related to the field of study. Students are able to compare different alternatives to present a suitable solution. Their solution shows their ability of physical thinking, approximation and simplification. (e)
- Writing well organized project documents and presentations. The work should make proper use of language (Spanish or English), and use schematics, tables, graphics, mathematical equations, as appropriate. (g)
- Analyzing the social and environmental impact. The analysis may discuss economic implications, such as entrepreneurship potential, sustainability, usability, and employment substitutions. (h)
- Using information and bibliographic resources, and finding specialized tools, software or supplies necessary for the project. The reference list is included and discussed in the documents. (i)
- Discussing contemporary issues related to the project such as innovations, business opportunities, and local needs. (j)
- Making appropriate choice and use of specialized tools, software, or hardware to complete the design or to collect and analyze data. (k)

Students may satisfy the following outcomes depending on the particular design project by:

- Applying fundamentals of mathematics, science, probability and statistics to solve or to analyze an engineering problem when applicable. Economic aspects are considered as appropriate. (a)
- Demonstrating an ability to organize the team assigning responsibilities, balancing the work load, and participating in regular meetings. (d)
- Evaluating any ethical aspects of the project. The ethical aspects can include the perspectives of the designer and the user or affected parties, and knowledge of any applicable code of ethics, such as, the CIAPR, the IEEE or ACM Codes of Ethics. (f)

General Information:
- Alpha-numeric codification: INEL 5205
- Course Title: Instrumentation
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in INEL

Course Description:
- English: Signals from transducers; signal conditioning, data conversion and transmission; effects of noise. Data storage and display; use of microprocessors in instrumentation.
- Spanish: Transductores y sus señales; acondicionamiento de señales, transmisión y conversión de datos; efectos de ruido. Despliegue y almacenamiento de datos; uso de microprocesadores para instrumentación.

Pre/Co-requisites and other requirements:
- INEL 4202 and INEL 4206

Course Objectives:
- Understand the principles of operation of various types of transducers.
- Analyze and design signal conditioning and transmission circuits.
- Design and implement an electronic measuring instrument that meets a given set of specifications.

Instructional Strategies:
- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

Minimum or Required Resources Available:
- Electronic measurement equipment, electronic components, data acquisition systems, personal computers.

Course time frame and thematic outline

<table>
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<tr>
<th>Outline</th>
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<tr>
<td>Introduction</td>
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<td>Operational Amplifiers and Configurations</td>
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</tr>
<tr>
<td>Signal Conditioning Circuits</td>
<td>8</td>
</tr>
<tr>
<td>Transducers (Temperature, displacement, pressure, flow, etc.)</td>
<td>15</td>
</tr>
<tr>
<td>Shielding and Grounding Practices</td>
<td>3</td>
</tr>
<tr>
<td>Optoelectronic devices</td>
<td>5</td>
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<td>Noise in Electronic Circuits</td>
<td>2</td>
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<td>Data Acquisition</td>
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Total hours: (equivalent to contact period) 45 hours

Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<tr>
<td>Other, specify: Homework</td>
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TOTAL: 100%

Bibliography:
According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

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<th>Engineering Topic</th>
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<tbody>
<tr>
<td>√</td>
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</tbody>
</table>

Course Outcomes

- Understand the principles of operation of various types of transducers. (a)
- Analyze and design signal conditioning and transmission circuits. (e)
- Use modern engineering tools (MATLAB, LabVIEW, PSPICE…) for the design and implementation of an electronic instrument. (k)
- Design and implement an electronic measuring instrument that meets a given set of specifications. (c)
- Preparation of an oral and written report about the final project. (g)
- Calibrate and test the instrument developed in class. (b)
- Work as part of a team. (d)

Person(s) who prepared this description and date of preparation: Eduardo J. Juan, Submitted by: Eduardo J. Juan, December, 2006.
General Information:
Alpha-numeric codification: INEL 5206
Course Title: Digital System Design
Number of credits: 3
Contact Period: 3 credit hours, 3 hours of lecture per week
Elective in INEL

Course Description:
English: Design methods in combinational and sequential systems. Use of programmable logic devices in digital systems design. Analysis and design of system controllers.
Spanish: Métodos de diseño para sistemas combinatorios y secuenciales. Utilización de dispositivos lógicos programables en el diseño de sistemas digitales. Análisis y diseño de controladores de sistema.

Pre/Co-requisites and other requirements:
INEL 4205. Required

Course Objectives:
To provide students with the basic tools required to design non-trivial digital systems.

Instructional Strategies:
☒ conference ☐ discussion ☐ computation ☐ laboratory
☐ seminar with formal presentation ☐ seminar without formal presentation ☐ workshop
☐ art workshop ☐ practice ☐ trip ☐ thesis ☐ special problems ☐ tutoring
☐ research ☐ other, please specify: Design project

Minimum or Required Resources Available:

Course time frame and thematic outline

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<th>Outline</th>
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<tr>
<td>Introduction to system controllers, design procedures</td>
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<tr>
<td>Use of MDS diagrams for system specification</td>
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<td>System controller design</td>
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<td>Use of decoders and multiplexers in system controller design.</td>
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<td>Combinational design with ROMs.</td>
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<td>Combinational design with programmable logic devices (PLD).</td>
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<tr>
<td>Use of ROMs in controller design.</td>
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<td>Use of PLDs in controller design.</td>
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<td>Design of system controllers based on shift registers and counters.</td>
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<tr>
<td>Introduction to asynchronous machines.</td>
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<tr>
<td>Design of asynchronous machines.</td>
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Grading System
☒ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies

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<td>☐ Project report</td>
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TOTAL: 100%

Bibliography:

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Contribution of Course to meeting the requirements of Criterion 5:

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<tr>
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<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

Course Outcomes

| Design and analysis of digital systems | (a) |
| Digital systems characteristics and limitations | (b) |
| Design of applications to solve problem | (e) |
| Be aware of Ethical Considerations | (f) |
| Present a project and give demonstrations explaining the design and the decisions taken | (g) |
| Project design must take into account safety. | (h) |
| Information research and gathering, such as reference papers, manuals and theory | (i) |
| A report including g cost of the project is done | (j) |

Person(s) who prepared this description and date of preparation: Jaime Arbona, Feb 2007
Submitted by: Gladys O. Ducoudray, June 2008
Appendix

General Information:

- Alpha-numeric codification: INEL 5207
- Course Title: Analog Design with Operational Amplifiers and Integrated Circuits
- Number of credits: 3
- Contact Period: 3 credit hours, 3 hours of lecture per week
- Elective in INEL

Course Description:

English: This course focuses on the design of analog integrated circuits’ applications. It covers the characteristics and limitations of operational amplifiers in detail. Linear and non-linear applications, such as signal generators, voltage references, voltage regulators, A-D and D-A converters, logarithmic amplifiers, phase-lock-loops and analog filters are also discussed.

Spanish: Este curso está enfocado al diseño de aplicaciones de circuitos análogos integrados. Cubre en detalle las características y limitaciones de los amplificadores operacionales. También discute aplicaciones lineares y no lineares, tales como generadores de onda, reguladores de voltaje, Voltajes de referencia, Convertidores AD y DA, amplificadores logarítmicos, PLLs y filtros análogos.

Pre/Co-requisites and other requirements:

INEL 4202. Required

Course Objectives:

- Design and analysis of applications using operational Amplifiers

Instructional Strategies:

- [✓] conference  [ ] discussion  [ ] computation  [ ] laboratory
- [✓] seminar with formal presentation  [ ] seminar without formal presentation  [ ] workshop
- [ ] art workshop  [ ] practice  [ ] trip  [ ] thesis  [ ] special problems  [ ] tutoring
- [ ] research  [ ] other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

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<td>2. Operational Amplifier (OA) Fundamentals (Chapter 1 in textbook;)</td>
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<tr>
<td>3. Examples of Linear OA Circuits (Instructor notes;)</td>
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<td>4. Examples of Non-linear OA Circuits (Instructor notes;)</td>
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<td>5. OA Limitations (Chapter 5 in textbook;)</td>
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<td>6. Stability and Frequency Compensation (Ch. 6 in textbook)</td>
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<td>7. Noise (Chapter 14 in textbook)</td>
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<td>8. Current-feedback amplifiers (Instructor notes)</td>
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<td>9. OA Building Blocks and Analog Integrated Circuits</td>
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<tr>
<td>a) Active filters types and design methods (Chapters 3 and 4 in textbook)</td>
<td>6</td>
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<tr>
<td>b) Signal generator (Chapter 8 in textbook)</td>
<td>3</td>
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<tr>
<td>c) Voltage references (Chapter 9 in textbook)</td>
<td>3</td>
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<tr>
<td>d) D/A and A/D Converters (Chapter 11 in textbook)</td>
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<td>e) Logarithmic Amplifiers (Chapter 12 in textbook)</td>
<td>3</td>
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<td>f) Phase-lock loops (instructor notes)</td>
<td>3</td>
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<td>g)</td>
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<td>h)</td>
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Grading System

[✓] Quantifiable (letters)  [ ] Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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Oral Reports
Monographies
Portfolio
Projects
Other, specify:
TOTAL: 100%

Bibliography:

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Contribution of Course to meeting the requirements of Criterion 5:

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<tr>
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</table>

Course Outcomes

- Design and analysis of amplifiers
- Analog characteristics and limitations
- Design of applications to solve problem
- Be aware of Ethical Considerations

Map to Program Outcomes

(a)
(b)
(e)
(f)

Person(s) who prepared this description and date of preparation: Manuel Toledo,
Submitted by: Gladys O. Ducoudray, Feb 2007
General Information:

Alpha-numeric codification: INEL 5208
Course Title: Principles of Biomedical Instrumentation
Number of credits: 4
Contact Period: 3 hours of lecture and 2 hours of laboratory per week
Elective in INEL

Course Description:

English: Theoretical and practical aspects of the methods used to measure physiological events with emphasis in the cardiovascular, pulmonary, and nervous systems.

Spanish: Aspectos teóricos y prácticos relacionados a los métodos utilizados para medir eventos fisiológicos, con énfasis en los sistemas cardiovascular, respiratorio y nervioso.

Pre/Co-requisites and other requirements:

INEL 4202 or consent of Department Head

Course Objectives:

- Recognize and understand the basic anatomy and physiology of the cardiovascular, respiratory, and nervous system.
- Gain a theoretical and practical perspective of the techniques used to measure physiological events.
- Apply engineering concepts to solve medical problems.

Instructional Strategies:

- conference
- discussion
- computation
- laboratory

- seminar with formal presentation
- seminar without formal presentation
- workshop

- art workshop
- practice
- trip
- thesis
- special problems
- tutoring

- research
- other, please specify:

Minimum or Required Resources Available:

Personal computers with data acquisition boards and software. Electrical measurements equipment, tissue stimulators, force transducers, electronic components and miscellaneous equipment and materials.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction: biomedical engineering, organization of the human body</td>
<td>3</td>
</tr>
<tr>
<td>Biopotentials: origin, measurement (amplifiers, sensors, signal processing)</td>
<td>10</td>
</tr>
<tr>
<td>Cardiovascular System: anatomy and physiology, ECG, measurement of arterial blood pressure and cardiac output, cardiac arrhythmias, fibrillation and defibrillation</td>
<td>10</td>
</tr>
<tr>
<td>Pulmonary System: anatomy and physiology, measurements of the respiratory system</td>
<td>6</td>
</tr>
<tr>
<td>Nervous System: anatomy and physiology, the electroencephalogram (EEG), nerve impulse propagation</td>
<td>7</td>
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<tr>
<td>Medical Imaging Systems</td>
<td>3</td>
</tr>
<tr>
<td>Electrical Safety</td>
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<td>Exams</td>
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LABORATORIES

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<tr>
<td>Introduction to LabVIEW Programming</td>
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<tr>
<td>Advanced LabVIEW Programming</td>
<td>2</td>
</tr>
<tr>
<td>Measurement of Physiological Events (Calibration, gain adjustment, offset adjustment, etc.)</td>
<td>2</td>
</tr>
<tr>
<td>Practical Aspects of Data Acquisition Systems</td>
<td>2</td>
</tr>
<tr>
<td>Electrodes</td>
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</tr>
<tr>
<td>ECG Measurement System</td>
<td>4</td>
</tr>
<tr>
<td>Indirect Measurement of Blood Pressure</td>
<td>4</td>
</tr>
<tr>
<td>Stimulation of Excitable Tissue (Strength-Duration Curves)</td>
<td>4</td>
</tr>
<tr>
<td>Measurements in the Respiratory System</td>
<td>6</td>
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</table>

Total hours: (equivalent to contact period) 75

Grading System

- Quantifiable (letters)
- Not Quantifiable
**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
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<td>Short Quizzes</td>
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<tr>
<td>Oral Reports</td>
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<td></td>
</tr>
<tr>
<td>Monographies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portfolio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Journals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☑ Other, specify: Homework</td>
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<tr>
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<td>Variable</td>
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**Bibliography:**

**According to Law 51**
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**Contribution of Course to meeting the requirements of Criterion 5:**

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

**Course Outcomes**
Apply knowledge of mathematics, science, and engineering to understand the principles of operation of various types of medical instruments.
Design and conduct experiments related to the measurement of at least three of the following: electrocardiograms, arterial blood pressure, respiratory flows and volumes, nerve conduction velocity, stimulation thresholds for tissue, and cardiac force of contraction.
Analyze and design signal conditioning circuits and data acquisition systems to perform physiological measurements.
Use modern engineering tools (MATLAB, LabVIEW, PSPICE…) for the design and implementation of an electronic instrument.

**Map to Program Outcomes**
(a)
(b)
(e)
(k)

Person(s) who prepared this description and date of preparation: Eduardo J. Juan. Submitted by: Eduardo J. Juan, June, 18, 2008
General Information:
- Alpha-numeric codification: INEL 5209
- Course Title: Introduction to Solid State Electronics
- Number of credits: 3
- Contact Period: 3 credit hours, 3 hours of lecture per week
- Elective in INEL

Course Description:
English: Energy levels in atoms. Crystal properties, energy bands and charge carriers, semiconductors, transport properties of bulk materials. P-n junction diodes, bipolar transistors, field effect transistors
Spanish: Niveles de energía en átomos. Propiedades de cristales, bandas de energía, portadores de carga, semiconductores, propiedades de transporte de sustratos. Diodos de juntas p-n, transistores bipolares y transistores de efecto de campo.

Pre/Co-requisites and other requirements:
- INEL 4201

Course Objectives:
In this course the student will:
- Determine the probability that an energy state at energy E is occupied by an electron, carrier statistics of semiconductor and Fermi-Dirac statistics.
- Acquire the fundamental understanding of semiconductor physics that will allow them to designing semiconductor devices.
- Solve the Schrödinger wave equation for particular situations.
- Design solid-state transistors, and diodes, given a list of materials to select.
- Be introduced to the most recent advances in solid-state electronics and micro-electro-mechanical systems.
- Search for scientific articles and analyze them in terms of their scientific content and potential applications of the technology described.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:
- COMSOL Multiphysics software

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
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<tbody>
<tr>
<td>Semiconductor Crystal Structures</td>
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</tr>
<tr>
<td>Electronic Structure and Quantum Effects</td>
<td>4</td>
</tr>
<tr>
<td>Charge Carriers and Energy Band</td>
<td>7</td>
</tr>
<tr>
<td>Excess Carriers</td>
<td>5</td>
</tr>
<tr>
<td>The p-n Junction</td>
<td>7</td>
</tr>
<tr>
<td>Field Effect Transistors</td>
<td>5</td>
</tr>
<tr>
<td>Bipolar Junction Transistors</td>
<td>5</td>
</tr>
<tr>
<td>Optoelectronics</td>
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<tr>
<td>Tests</td>
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Total hours: (equivalent to contact period) 45

Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
Appendix

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Map to Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student will be able to determine the probability that an energy state at energy E is occupied by an electron, carrier statistics of semiconductor and Fermi-Dirac statistics. The student will acquire the fundamental understanding of semiconductor physics that will allow them to design semiconductor devices. The student will be able to solve the Schodinger wave equation for particular situations.</td>
<td>(a)</td>
</tr>
<tr>
<td>The student will be able to design solid-state transistors, and diodes, given a list of materials to select.</td>
<td>(e)</td>
</tr>
<tr>
<td>Students will be introduced to the most recent advances in solid-state electronics and micro-electro-mechanical systems.</td>
<td>(j)</td>
</tr>
<tr>
<td>The students will search for scientific articles and analyze them in terms of their scientific content and potential applications of the technology described.</td>
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</tbody>
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Exams

<table>
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<th>Weight</th>
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<tr>
<td>Final Exam</td>
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<tr>
<td>Short Quizzes</td>
<td>25</td>
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<td>Oral Reports</td>
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<tr>
<td>Portfolio</td>
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</tr>
<tr>
<td>Projects</td>
<td>15%</td>
</tr>
</tbody>
</table>

TOTAL: 100%

Bibliography:


According to Law 51

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Contribution of Course to meeting the requirements of Criterion 5:
General Information:
Alpha-numeric codification: INEL 5265
Course Title: Analog Integrated Circuit Design
Number of credits: 3
Contact Period: 3 credit hours, 3 hours of lecture per week
Elective in INEL and ICOM

Course Description:
English: Design and Analysis of analog and mixed signal integrated circuits through the usage of analytical circuit design techniques and advanced CAD tools. Discussion of issues involved in the layout and test of analog IC's.
Spanish: Análisis y Diseño de circuitos analógicos y de tecnología mixta (analógico-digital) mediante el uso de técnicas de diseño analíticas y herramientas avanzadas de diseño asistido por computadoras. Discusión de tópicos referentes al diseño físico y desarrollo de pruebas funcionales de circuitos integrados analógicos.

Pre/Co-requisites and other requirements:
INEL 4205 and INEL 4201.

Course Objectives:
To develop in the students the fundamental skills in the design and analysis of analog and mixed signal integrated circuits using advanced CAD tools, and to provide an understanding of the central issues involved in the layout and test of such a type of circuits.

Instructional Strategies:
☒conference ☒discussion ☐computation ☒laboratory
☒seminar with formal presentation ☐seminar without formal presentation ☐workshop
☐art workshop ☐practice ☐trip ☐thesis ☒special problems ☐tutoring
☐research ☐other, please specify:

Minimum or Required Resources Available:
Basic Knowledge of Cadence Design Tools. All students are expected to have basic notions on:
1- Design techniques for digital circuits
2- Familiarity with transistor operation
3- Spice circuit modeling and simulation

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Models for large and small signal IC devices.</td>
<td>3</td>
</tr>
<tr>
<td>Model considerations in evolving technological trends.</td>
<td>3</td>
</tr>
<tr>
<td>Introduction to CAD tools for analog design.</td>
<td>6</td>
</tr>
<tr>
<td>Concepts of analog layout, Bipolar, MOS, and BiCMOS technologies.</td>
<td>2</td>
</tr>
<tr>
<td>Basic integrated circuit amplifiers: Darlington, differential pairs, and cascode configurations.</td>
<td>2</td>
</tr>
<tr>
<td>Dynamic range considerations in integrated amplifier circuits.</td>
<td>1</td>
</tr>
<tr>
<td>Current sources, active loads, and reference circuits.</td>
<td>3</td>
</tr>
<tr>
<td>Operational amplifier architectures: analysis and design considerations</td>
<td>3</td>
</tr>
<tr>
<td>Frequency response of ICs, feedback analysis, and stability.</td>
<td>1</td>
</tr>
<tr>
<td>Issues in the design of mixed signal ICs.</td>
<td>2</td>
</tr>
<tr>
<td>Test and measurement techniques of analog and mixed signal ICs.</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total hours: (equivalent to contact period)</strong></td>
<td><strong>28</strong></td>
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Grading System
☒Quantifiable (letters) ☐Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
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<th>Quantity</th>
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<tr>
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<td>☐ Short Quizzes</td>
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<td>☒ Oral Reports</td>
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<td>☐ Monographies</td>
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<td>☐ Portfolio</td>
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<tr>
<td>☒ Projects</td>
<td>1</td>
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</tbody>
</table>
Appendix

Journals
Other, specify:

TOTAL: 100%

Bibliography:

According to Law 51
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<table>
<thead>
<tr>
<th>Contribution of Course to meeting the requirements of Criterion 5:</th>
<th>Map to Program Outcomes</th>
</tr>
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<tbody>
<tr>
<td>Math</td>
<td>Basic Science</td>
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</table>

Course Outcomes
- Analysis of medium complexity Analog and Mixed Signal Circuits (b)
- Competence in Cadence Tools for Analog Environment (k)
- Design Layout Mask generation of analog circuits (c)

Person(s) who prepared this description and date of preparation: Gladys O. Ducoudray, Nov. 2006
**General Information:**

- Alpha-numeric codification: INEL 5295
- Course Title: Design Project in Electronic Systems and Embedded Hardware
- Number of credits: 3
- Contact Period: 1 hour lecture, 4 hours laboratory per week
- Elective in INEL

**Course Description:**

- English: Capstone design course in which students apply fundamental knowledge in Electronic Systems and Embedded Hardware to solve an engineering problem considering engineering standards and realistic constraints.
- Spanish: Curso de experiencia de diseño en el cual los estudiantes aplican los fundamentos de Sistemas Electrónicos y Hardware Embebido para solucionar un problema de ingeniería, tomando en consideración los estándares de ingeniería y restricciones de diseño realistas.

**Pre/Co-requisites and other requirements:**

Permission of the Departmental Director

**Course Objectives:**

In this course, students should demonstrate their capacity to understand and manage all aspects related to the solution of a problem in Electronic Systems and Embedded Hardware based on their knowledge acquired in previous courses. The student should demonstrate his/her capability to solve a real engineering problem.

**Instructional Strategies:**

- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

**Minimum or Required Resources Available:**

The course includes 4 hours of laboratory work per week for the development, modeling and implementation of the project, depending on its scope and nature.

**Course time frame and thematic outline**

<table>
<thead>
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<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Introduction to Capstone Design</td>
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<td>Seminars on topics such as:</td>
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<tr>
<td>- Product specification</td>
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<td>- Budgeting</td>
<td></td>
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<td>- Ethics</td>
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<tr>
<td>- CAD Tools</td>
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</tr>
<tr>
<td>- Environmental and social issues related to the Engineering Practice</td>
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<td>- Project Management</td>
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<td>- Any other as the design projects dictate</td>
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<td>Oral presentations</td>
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<td>Laboratory project work</td>
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Total hours: (equivalent to contact period) 75

**Grading System**

- Quantifiable (letters) ☑ Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
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<td>Short Quizzes</td>
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<td>Oral Report</td>
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<tr>
<td>Other (Specify): Progress Report</td>
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</table>

**TOTAL:** 100%
Bibliography:
- Standard such as National Electric Code (NEC), Federal Comission of Communication (FCC), National Electric Safety Code (NESC), Federal Drug Association (FDA) regulations
- CRC ElectricalEngineeringNetbase: http://www.electricalengineeringnetbase.com/
- CRC ENGnetBASE: http://www.engnetbase.com/ejournals/categories/default.asp
- Electronic Design: http://electronicdesign.com/
- WEB-EE: http://web-ee.com/

Books:

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Contribution of Course to meeting the requirements of Criterion 5:

<table>
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<tr>
<th>Math</th>
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<th>General</th>
<th>Engineering Topic</th>
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<tbody>
<tr>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Course Outcomes

Students must satisfy for all design projects the following outcomes by:

Developing and conducting the laboratory work or simulation or prototyping and troubleshooting where applicable to evaluate the design. Results and data are correctly interpreted.

Following logical and orderly design procedures based on a set of specifications. Alternatives and decisions are clearly documented along the design process, and include considerations of codes, protocols, and engineering and safety standards related to the design area.

Identifying and describing a problem that can be solved with the skills related to the field of study. Students are able to compare different alternatives to present a suitable solution. Their solution shows their ability of physical thinking, approximation and simplification.

Writing well organized project documents and presentations. The work should make proper use of language (Spanish or English), and use schematics, tables, graphics, mathematical equations, as appropriate.

Analyzing the social and environmental impact. The analysis may discuss economic implications, such as entrepreneurship potential, sustainability, usability, and employment substitutions.

Using information and bibliographic resources, and finding specialized tools, software or supplies necessary for the project. The reference list is included and discussed in the documents.

Discussing contemporary issues related to the project such as innovations, business opportunities, and local needs.

Making appropriate choice and use of specialized tools, software, or hardware to complete the design or to collect and analyze data.

Students may satisfy the following outcomes depending on the particular design project by:

Applying fundamentals of mathematics, science, probability and statistics to solve or to analyze an engineering problem when applicable. Economic aspects are considered as appropriate.

Demonstrating an ability to organize the team assigning responsibilities, balancing the work load, and participating in regular meetings.

Evaluating any ethical aspects of the project. The ethical aspects can include the perspectives of the designer and the user or affected parties, and knowledge of any applicable code of ethics, such as, the CIAPR, the IEEE or ACM Codes of Ethics.

Person (s) who prepared this description and date of preparations: Department Faculty, March, 25, 2008.

General Information:
Alpha-numeric codification: INEL 5305
Course Title: ANTENNA THEORY AND DESIGN
Number of credits: 3
Contact Period: 3 hours of lecture per week
Elective in INEL

Course Description:
English: Radiation mechanisms, radiation patterns, Impedance concepts, Wire antennas, Antenna arrays, Frequency independent antennas, Antenna measurements and design.
Spanish: Mecanismos de radiación, patrones de radiación, concepto de impedancia; antenas de alambre, arreglos de antenas, antenas independientes de frecuencia, antenas de abertura, medidas y diseño de antenas.

Pre/Co-requisites and other requirements:
Prerequisite INEL 4301 & INEL 4152

Course Objectives:
After completing the course, the student should be able to describe the radiation mechanisms and the fundamental antenna principles and parameters and use them to understand different types of antennas and to analyze antenna systems. The students should also be able to choose the best type of antenna for different situations and to design antenna systems given a set of specifications.

Instructional Strategies:
conference
discussion
computation
laboratory

seminar with formal presentation
seminar without formal presentation
workshop

art workshop
practice
trip
thesis
special problems
tutoring

research
other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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</thead>
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<tr>
<td>Fundamental parameters</td>
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<tr>
<td>Radiation integrals and vector potentials</td>
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</tr>
<tr>
<td>Linear dipoles</td>
<td>5</td>
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<tr>
<td>Loop antennas</td>
<td>5</td>
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<td>Antenna arrays and mutual impedance</td>
<td>8</td>
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<tr>
<td>Impedance matching</td>
<td>5</td>
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<tr>
<td>Broadband antennas, frequency independent antennas</td>
<td>4</td>
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<td>Aperture, Horn and Reflector antennas</td>
<td>5</td>
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<td>Microstrip patches</td>
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<td>Exams</td>
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Grading System
☑ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
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Course Outcomes

<table>
<thead>
<tr>
<th>Map to Program</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>Basic Science</td>
</tr>
<tr>
<td>Apply circuit analysis techniques to understand the physical operation of a electrical circuit system.</td>
<td>a</td>
</tr>
<tr>
<td>Perform basic power calculations applying complex variable concepts.</td>
<td>a</td>
</tr>
<tr>
<td>Perform transient and steady state calculations in RC, RL and RLC circuits.</td>
<td>a</td>
</tr>
<tr>
<td>Interpretation of the results of simulation of electrical circuits</td>
<td>c,e</td>
</tr>
<tr>
<td>Be able to interpret and draw electrical schematic diagrams.</td>
<td>b,c</td>
</tr>
<tr>
<td>Be able to communicate graphically where appropriate.</td>
<td>a</td>
</tr>
<tr>
<td>Simulate electrical circuits using commercially available software for circuit analysis.</td>
<td>c,e</td>
</tr>
<tr>
<td>Simulate electrical circuits using commercially available software for circuit analysis.</td>
<td>c,k</td>
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<tr>
<td>Simulate electrical circuits using commercially available software for circuit analysis.</td>
<td>k</td>
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</tbody>
</table>

Person who prepared this description and date of preparation: Electromagnetic Committee, March, 12, 2008. Submitted by: Dr. Rafael Rodríguez, Committee Coordinator, March, 12, 2008.
**General Information:**
- Alpha-numeric codification: INEL 5306
- Course Title: Microwave Engineering
- Number of credits: 3
- Contact Period: 3 hours of lecture
- Elective in INEL

**Course Description:**
- English: Rectangular and circular waveguides; passive components; tubes and solid state devices used in microwave systems.
- Spanish: Guías de onda rectangulares y circulares; componentes pasivos; tubos y dispositivos de estado sólido utilizados en sistemas de microondas.

**Pre/Co-requisites and other requirements:**
- INEL 4152,

**Course Objectives:**
This course is intended to provide senior students with the theory of operation of microwave devices and components, and with fundamentals of microwave transistor amplifier design, with the purpose of understanding the operation of microwave systems and circuits.

**Instructional Strategies:**
- conference ☑
discussion 🔑
computation ☑
laboratory ☑

- seminar with formal presentation ☑
seminar without formal presentation ☑
workshop ☑

- art workshop ☑
practice ☑
trip ☑
thesis ☑
special problems ☑
tutoring ☑

- research ☑
other, please specify: Student presentations, Seminar by Industry Professionals (if available).

**Minimum or Required Resources Available:**
Individual and group assignments requiring the use of software packages to design and analyze microwave circuits. Software: HP Advanced Design System (ADS) available for the students.

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review: Transmission lines</td>
<td>2</td>
</tr>
<tr>
<td>Review: Smith Chart, load matching</td>
<td>2</td>
</tr>
<tr>
<td>Review: Microstrip lines</td>
<td>2</td>
</tr>
<tr>
<td>Scattering Parameters</td>
<td>3</td>
</tr>
<tr>
<td>ABCD matrix</td>
<td>2</td>
</tr>
<tr>
<td>Impedance matching</td>
<td>3</td>
</tr>
<tr>
<td>Noise in microwave circuits</td>
<td>2</td>
</tr>
<tr>
<td>Basic amplifier design</td>
<td>5</td>
</tr>
<tr>
<td>Power Dividers</td>
<td>3</td>
</tr>
<tr>
<td>Couplers and Hybrids</td>
<td>6</td>
</tr>
<tr>
<td>Microwave Filters</td>
<td>5</td>
</tr>
<tr>
<td>Waveguides</td>
<td>2</td>
</tr>
<tr>
<td>Mixers, switches</td>
<td>4</td>
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<td>Microwave Systems</td>
<td>2</td>
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<td>Exams</td>
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**Grading System**
- ☑ Quantifiable (letters) ☑ Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
Bibliography:


According to Law 51

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Contribution of Course to meeting the requirements of Criterion 5:

<table>
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<tr>
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<th>Engineering Topic</th>
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</thead>
<tbody>
<tr>
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<td></td>
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</tr>
</tbody>
</table>

Course Outcomes

- Describe the importance and necessity of microwave systems and circuits.
- Analyse active microwave components (amplifier)
- Analyze passive microwave components (filters, dividers, couplers)
- Analyze and derive S-parameters for different components.
- Use of state of the art CAD tools for simulation of microwave active and passive components

MAP to ABET Outcomes

- d, g, j
- a, e
- a, e
- a, e
- k

Person who prepared this description and date of preparation: Electromagnetic Committee, March, 12, 2008. Submitted by: Dr. Rafael Rodríguez, Committee Coordinator, March, 12, 2008
**General Information:**

- Alpha-numeric codification: INEL 5307
- Course Title: Optical Communication
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in INEL and ICOM

**Course Description:**

- Spanish:

**Pre/Co-requisites and other requirements:**

- Prerequisite INEL 4301 & INEL 4152

**Course Objectives:**

- This course is designed to introduce 5th year students to important results from the fields of optics and wave travel, fiber optic devices and systems, technology of combining optic components onto a single substrate, fiber as a waveguide, light sources, detectors, couplers, and distribution networks. After completing the course the student should be able to design and specify systems and to choose and evaluate system components such as fibers, light sources, detectors, and couplers.

**Instructional Strategies:**

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

**Minimum or Required Resources Available:**


**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>FIBER OPTIC COM. SYSTEMS</td>
<td>5</td>
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<tr>
<td>OPTICS REVIEW</td>
<td>5</td>
</tr>
<tr>
<td>LIGHT WAVE FUNDAMENTALS</td>
<td>10</td>
</tr>
<tr>
<td>INTEGRATED OPTIC WAVEGUIDES</td>
<td>5</td>
</tr>
<tr>
<td>OPTIC FIBER WAVEGUIDES</td>
<td>5</td>
</tr>
<tr>
<td>LIGHT SOURCES</td>
<td>5</td>
</tr>
<tr>
<td>LIGHT DETECTORS</td>
<td>4</td>
</tr>
<tr>
<td>DISTRIBUTION NETWORKS</td>
<td>3</td>
</tr>
<tr>
<td>Exams</td>
<td>3</td>
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</table>

**Grading System**

- Quantifiable (letters) ☑
- Not Quantifiable ☐

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
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<th>Percent</th>
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<tr>
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<td>☐ Short Quizzes</td>
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<tr>
<td>☐ Oral Reports</td>
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<tr>
<td>☐ Monographies</td>
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<tr>
<td>☐ Portfolio</td>
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<td>☑ Projects</td>
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<td>☐ Journals</td>
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<td>☐ Other, specify:</td>
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</tr>
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</table>

**TOTAL:** 100%
Bibliography:
Optical Fiber Communications principles and practices John M. Senior, Prentice Hall
Optical Fiber Communications Gerd Keiser 2nd edition, McGraw Hill

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Course Outcomes

- Learn the application of fiber optics in communications (a)
- Ability to use optics and trace correctly a ray through them (a)
- Ability to analyze and understand how ray and wave theories can be used to explain the behavior of light in a fiber (b)
- Know the functioning of integrated optics (a)
- Understand the functioning of different fibers as communication waveguides. (a)
- Ability to determine the data rate in different types of fibers (b)
- Know how the light sources (lasers) work and how they can be modulated either in a digital or analog format (b)
- Know how different light detectors work (a)
- Ability to design a complete optical fiber system for a given data rate (k)
- Learn to use optical devices such as directional couplers, star couplers, etc. to create an optical distribution network

Person(s) who prepared this description and date of preparation: Hamed Parsiani. Submitted by: Miguel Vélez, July, 07.
General Information:
- Alpha-numeric codification: INEL5309
- Course Title: Digital Signal Processing
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in INEL and ICOM

Course Description:
- English: Signal Classification; Z-transform and discrete Fourier transform; matrix representation of digital filters and digital systems; digital filter design; discrete Fourier transform algorithms.
- Spanish: Clasification de señales, transformada de Z y transformada discreta de fourier; representaciones matriciales de filtros y sistemas digitales; diseño de filtros digitales; algoritmos de la transformada discreta de fourier.

Pre/Co-requisites and other requirements:
- INEL 4301

Course Objectives:
- After completing the course, the student should be able to: analyze discrete signals and systems using the DFT, DTFT and Z transforms; design FIR and IIR discrete filters; analyze discrete signals using the DFT.

Instructional Strategies:
- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tr>
<td>Introduction to DSP</td>
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<tr>
<td>Discrete Signals</td>
<td>4</td>
</tr>
<tr>
<td>Discrete Systems</td>
<td>4</td>
</tr>
<tr>
<td>Discrete Time Fourier Transform</td>
<td>4</td>
</tr>
<tr>
<td>Discrete Fourier Transform</td>
<td>4</td>
</tr>
<tr>
<td>Spectral Analysis</td>
<td>2</td>
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<tr>
<td>Z Transform</td>
<td>5</td>
</tr>
<tr>
<td>Frequency Representation of systems</td>
<td>3</td>
</tr>
<tr>
<td>Sampling and Reconstruction</td>
<td>3</td>
</tr>
<tr>
<td>Filter Specifications</td>
<td>3</td>
</tr>
<tr>
<td>IIR filter design</td>
<td>5</td>
</tr>
<tr>
<td>FIR filter design</td>
<td>4</td>
</tr>
<tr>
<td>Exams</td>
<td>3</td>
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</table>

Total hours: (equivalent to contact period) 45

Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
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<th>Quantity</th>
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<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<tr>
<td>Monographies</td>
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<td>Portfolio</td>
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<td>Projects</td>
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<td>Other, specify: Homeworks</td>
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</table>
Appendix 105

<table>
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<th>Bibliography:</th>
</tr>
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According to Law 51

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Course Outcomes

- Compute the DFT, DTFT and Z transforms (a)
- Apply the DFT and DTFT for the spectral analysis of discrete signals (b)
- Apply the DTFT and Z-transform for the analysis of discrete systems (a)
- Perform operations such as convolution, addition and multiplication of sequences (a)
- Determine system properties such as linearity, causality, time invariance,… (a)
- Calculate the transfer function and frequency response of discrete LTI systems (a)
- Use and explain the Nyquist theorem for sampling and reconstruction of continuous band limited signals (a)
- Design discrete IIR and FIR filters based on specifications (c)
- Use of MATLAB for analysis and design of discrete time systems (k)
- Determine the inverse Z transform using the partial fractions expansion method (a)

Person (s) who prepared this description and date of preparation: Shawn Hunt. Submitted by: Miguel Vélez, Jul 07.
General Information:
Alpha-numeric codification: INEL 5315
Course Title: Theory of Communications II
Number of credits: 3
Contact Period: 3 hours of lecture
Elective in INEL

Course Description:

Pre/Co-requisites and other requirements:
ININ 4011 and INEL 4301

Course Objectives:
Theory of communications II (INEL 5315) helps students to discover the theoretical Underpinnings of modern telecommunication systems. After studying random processes the student should be able to: analyze systems driven by random signals and subjected to noise, calculate the information content of signals to help attain efficient transmission, discuss various error-control mechanisms for reliable communications over noisy channels.

Instructional Strategies:
☒ conference ☐ discussion ☐ computation ☐ laboratory
☐ seminar with formal presentation ☐ seminar without formal presentation ☐ workshop
☐ art workshop ☐ practice ☐ trip ☐ thesis ☐ special problems ☐ tutoring

☐ research ☐ other, please specify: (Short) Project. Take-home problems.

Minimum or Required Resources Available:
Materials, equipment, and physical facilities needed to fulfill the course objectives.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background and preview</td>
<td>1</td>
</tr>
<tr>
<td>Random processes: Stationary processes; Ergodic processes; Power spectral density; Gaussian process</td>
<td>6</td>
</tr>
<tr>
<td>Random processes: Narrowband noise. Representations in-phase and in-quadrature, envelope and phase. Application: flat fading channel</td>
<td>4</td>
</tr>
<tr>
<td>Elements of information theory: Entropy and information. Source-coding theorem. Data compaction.</td>
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</tr>
<tr>
<td>Error-control coding: Linear block codes. Cyclic codes. Convolutional codes. Trellis-coded modulation</td>
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</tr>
<tr>
<td>Error-control coding: Introduction to compound codes (Turbo codes)</td>
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<tr>
<td>Baseband and passband digital transmission</td>
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<td>Spread-spectrum modulation</td>
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Grading System
☒ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>☒ Projects</td>
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<td>☐ Journals</td>
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</tbody>
</table>
Bibliography:

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Contribution of course to meeting the requirements of Criterion 5

<table>
<thead>
<tr>
<th>Math</th>
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<th>Engineering Topic</th>
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Course Outcomes

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Map to ABET Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply random process models for the analysis of communication systems</td>
<td>a</td>
</tr>
<tr>
<td>Develop analytical and computational skills to analyze data transmission in white Gaussian noise.</td>
<td>a, k</td>
</tr>
<tr>
<td>Analyze the importance of M-ary data communication systems.</td>
<td>a</td>
</tr>
<tr>
<td>Evaluate communication systems using information theory.</td>
<td>a</td>
</tr>
<tr>
<td>Apply methods that provide data integrity using forward error correcting codes.</td>
<td>a</td>
</tr>
</tbody>
</table>

Person who prepared this description and date of preparation: Mario Ierkic. Aproved by Miguel Vélez April 08.
### General Information:
- Alpha-numeric codification: INEL 5316
- Course Title: Wireless Communications
- Number of credits:
- Contact Period: 3 hours of lecture
- Elective in INEL

### Course Description:


### Pre/Co-requisites and other requirements:
- Theory of Communications I (INEL 4301), Electromagnetics II (INEL 4152)

### Course Objectives:
Wireless Communications (INEL 5316) aims to give the student a solid theoretical, and some practical, exposure to fundamental concepts and techniques of wireless radio. After this course the student should be able to address problems associated with the design of a wireless communication system. Explains propagation models to account for large-scale and short-scale (fading) variations of the signal intensity. Supplements basic knowledge in modulation schemes. Makes students aware of diversity, channel coding, and multiple access techniques for wireless communications. Introduces wireless networking, and wireless systems and standards. Enables the student to appreciate the importance of: the agencies charged with promoting the vitality of telecommunications in the USA, the new telecommunications law of 1996, health issues associated with electromagnetic fields. After the course the student should appreciate the deleterious effects of fading and to understand the strategies to mitigate it.

### Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- fieldtrip
- thesis
- special problems
- tutoring
- research
- other, please specify: Student presentations, Seminar by Industry Professionals (if available).

### Minimum or Required Resources Available:
Materials, equipment, and physical facilities needed to fulfill the course objectives.

### Course time frame and thematic outline
Grading System

- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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**TOTAL:** 100%

Bibliography:


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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>MAP to ABET Outcomes</th>
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<tbody>
<tr>
<td>1. Describe the evolution toward modern wireless communication systems</td>
<td>d, g, j</td>
</tr>
<tr>
<td>2. Describe and justify the cellular concept</td>
<td>a, e, k</td>
</tr>
<tr>
<td>3. Analyze mobile radio propagation large-scale path loss</td>
<td>a, e</td>
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</table>
Person who prepared this description and date of preparation: Electromagnetics Committee, March, 12, 2008.
Submitted by: Dr. Rafael Rodríguez, Committee Coordinator, March, 12, 2008
### General Information:

Alpha-numeric codification: INEL 5325  
Course Title: COMMUNICATION SYSTEM DESIGN: CIRCUITS AND ANTENNAS  
Number of credits: 3  
Contact Period: 1 hour of lecture plus 2 sessions of 2 hours of lab per week  
Elective in INEL

### Course Description:

**English:** Design of communication circuits and antennas. Several design projects including: specification, evaluation and selection of alternatives and implementation. Written reports and computer use required.  
**Spanish:** Diseño de circuitos de comunicaciones y antenas. Varios proyectos de diseño que incluyen: especificación, evaluación y selección de alternativas e implantación. Se requieren informes escritos y uso de computadora.

### Pre/Co-requisites and other requirements:

INEL 5305 or INEL 5306

### Course Objectives:

To unify the concepts from various courses in the Applied Electromagnetic option and to provide students the opportunity to design several system components and to integrate them in a system, following a given set of specifications.

### Instructional Strategies:

- conference  
- discussion  
- computation  
- laboratory  
- seminar with formal presentation  
- seminar without formal presentation  
- workshop  
- art workshop  
- practice  
- trip  
- thesis  
- special problems  
- tutoring  
- research  
- other, please specify: oral presentation of a design project.

### Minimum or Required Resources Available:

Network analyzer, spectrum analyzer, signal generators and other microwave equipment. Use of commercial communication systems and several software packages.

### Course time frame and thematic outline

<table>
<thead>
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<th>Outline</th>
<th>Contact Hours</th>
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<td>This is a project-oriented course, which includes specifying a systems,</td>
<td>75</td>
</tr>
<tr>
<td>considering alternatives, considering cost factors, and implementing</td>
<td></td>
</tr>
<tr>
<td>a design using software packages. Written and oral reports will be</td>
<td></td>
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<tr>
<td>required.</td>
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<tr>
<td>Labs and field experiments with commercial equipment</td>
<td>30</td>
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<td>Review of courses of the Applied EM option.</td>
<td>5</td>
</tr>
<tr>
<td>Project specifications, FCC, ITU-R, IEEE regulations and standards</td>
<td>5</td>
</tr>
<tr>
<td>Use of software packages (i.e., Radio Mobil) for system design</td>
<td>5</td>
</tr>
<tr>
<td>Use of Matlab to simulate signals and determine link reliability</td>
<td>5</td>
</tr>
<tr>
<td>Identify providers and cost of required equipment and components</td>
<td>5</td>
</tr>
<tr>
<td>Discussion of project design, and of the state of the art and future</td>
<td>15</td>
</tr>
<tr>
<td>trends of telecommunication systems</td>
<td></td>
</tr>
<tr>
<td>Design project oral presentations and exams</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total hours: (equivalent to contact period)</strong></td>
<td>75</td>
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### Grading System

- Quantifiable (letters)  
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

### Course Outcomes

- Develops a literature search on recent publications regarding current issues in engineering solutions of communications problems.
- Applies the information gathered into the system design
- Identifies the characteristics of the signals to be transmitted and received by the system
- Identify frequency and radio propagation mechanisms to be used
- Use software package to analyze system components.
- Do experimental measurements.
- Identify the best suppliers of equipment and components required by the system.
- Determine if the system complies with the human safety standards for EM radiation.
- Determine if the system complies with the FCC, FAA, ITU requirements.
- Prove that the system could be easily upgraded with the availability of new technologies.
- Indicate the special efforts of each member of the team in the elaboration of particular aspects of the project.
- Do executive summary and oral and written presentation of the project.

Bibliography:


According to Law 51

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Person who prepared this description and date of preparation: Electromagnetic Committee, March, 12, 2008. Submitted by: Dr. Rafael Rodriguez, Committee Coordinator, March, 12, 2008.
Appendix

General Information:
Alpha-numeric codification: INEL5326
Course Title: Communication Systems Design: Digital Signal Processing
Number of credits: 5
Contact Period: 1 hour lecture, 4 hours laboratory per week
Elective in INEL and ICOM

Course Description:
English: Capstone course in which student teams design a project to solve a complete Communication or Signal Processing Engineering Problem considering engineering standards and realistic constraints.
Spanish: Curso integrador en la cual equipos de estudiantes diseñan un proyecto para resolver un problema completo de Ingeniería en comunicaciones o prosesamiento de señales, tomando en consideración estándares de ingeniería y restricciones realistas.

Pre/Co-requisites and other requirements:
INEL5309

Course Objectives:
After completing the course, students should understand and be able to manage different aspects of the design of a communication or signal processing system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

Instructional Strategies:
[ ] conference [ ] discussion [ ] computation [ ] laboratory
[ ] seminar with formal presentation [ ] seminar without formal presentation [ ] workshop
[ ] art workshop [ ] practice [ ] trip [ ] thesis [ ] special problems [ ] tutoring
[ ] research [ ] other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tr>
<td>Introduction to design</td>
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<tr>
<td>Introduction to proposal preparation</td>
<td>3</td>
</tr>
<tr>
<td>Ethics Seminar</td>
<td>2</td>
</tr>
<tr>
<td>Guidelines for Literature Review</td>
<td>3</td>
</tr>
<tr>
<td>Revision, discussion and update of proposals</td>
<td>8</td>
</tr>
<tr>
<td>Algorithm Design, Testing and implementation</td>
<td>30</td>
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<tr>
<td>Design process</td>
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<td>Periodic and Final Project Presentations</td>
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Total hours: (equivalent to contact period) 75

Grading System
[ ] Quantifiable (letters) [ ] Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Final Exam</td>
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<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<td>Monographies</td>
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<tr>
<td>Portfolio</td>
<td></td>
</tr>
<tr>
<td>Projects</td>
<td></td>
</tr>
</tbody>
</table>
### Bibliography:

- IEEE Standards.
- ISO Standards.
- Selected publications depending on project topic.

### According to Law 51

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Course Outcomes

- Identify the problem to be solved via a communications or signal processing solution
- Analyze and discuss the problem along with previous and related work
- Write a project proposal to solve an communications or signal processing problem specifying the proposed solution, the work breakdown structure, and realistic constraints.
- Organize the teamwork and define individual tasks and responsibilities
- Design, implement and test the a system to solve the desired needs, identify and design the components within realistic constraints and using engineering standards
- Design a test plan for the system
- Evaluate the ethical and some of the legal, environmental, social, health and safety and other impacts of the system and propose the mitigation, or compensation measures when necessary
- Write effective technical documentation, progress and final reports using engineering standards. Present the results and make demonstrations of system functionality.
- Use electrical engineering tools for analysis of the problem, computer aided design, debugging, implementation and testing of the system.
- Make project decisions based on current literature and state-of-the-art tools available on campus, or provided by client/user when applicable

### Map to Program Outcomes

- (e) Identify the problem to be solved via a communications or signal processing solution
- (a) Analyze and discuss the problem along with previous and related work
- (e) Write a project proposal to solve an communications or signal processing problem specifying the proposed solution, the work breakdown structure, and realistic constraints.
- (d) Organize the teamwork and define individual tasks and responsibilities
- (c) Design, implement and test the a system to solve the desired needs, identify and design the components within realistic constraints and using engineering standards
- (b) Design a test plan for the system
- (f) Evaluate the ethical and some of the legal, environmental, social, health and safety and other impacts of the system and propose the mitigation, or compensation measures when necessary
- (g) Write effective technical documentation, progress and final reports using engineering standards. Present the results and make demonstrations of system functionality.
- (k) Use electrical engineering tools for analysis of the problem, computer aided design, debugging, implementation and testing of the system.
- (i) Make project decisions based on current literature and state-of-the-art tools available on campus, or provided by client/user when applicable

Person(s) who prepared this description and date or preparation: Shawn Hunt. Submitted by: Dr. Miguel Vélez, Julio 07
Appendix 115

General Information:
- Alpha-numeric codification: INEL5327
- Course Title: Image Processing
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in INEL and ICOM

Course Description:

Pre/Co-requisites and other requirements:
INEL 5309, Digital Signal Processing

Course Objectives:

Instructional Strategies:
- [ ] conference
- [ ] discussion
- [ ] computation
- [ ] laboratory
- [ ] seminar with formal presentation
- [ ] seminar without formal presentation
- [ ] workshop
- [ ] art workshop
- [ ] practice
- [ ] trip
- [ ] thesis
- [ ] special problems
- [ ] tutoring
- [ ] research
- [ ] other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

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<th>Outline</th>
<th>Contact Hours</th>
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<td>Introduction</td>
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<td>Digital Image fundamentals</td>
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<td>Image Enhancement in Spatial domain</td>
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<tr>
<td>Image Enhancement in Frequency domain</td>
<td>8</td>
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<td>Image Restoration</td>
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<tr>
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<td>Total hours: (equivalent to contact period)</td>
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Grading System
- [ ] Quantifiable (letters)
- [ ] Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Oral Reports</td>
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Bibliography:
According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Map to Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing, acquisition, sampling, and relationships in Digital image</td>
<td>(a)</td>
</tr>
<tr>
<td>Describe relationships in Digital image</td>
<td>(b)</td>
</tr>
<tr>
<td>Ability to enhance images using spatial transformations &amp; spatial filters</td>
<td>(k)</td>
</tr>
<tr>
<td>Ability to smoothen &amp; sharpen images using frequency domain filters</td>
<td>(k)</td>
</tr>
<tr>
<td>Restoration of images due to noise and degradations</td>
<td>(k)</td>
</tr>
<tr>
<td>Compression of images using different coding techniques</td>
<td>(k)</td>
</tr>
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</table>

Person(s) who prepared this description and date of preparation: Hamed Parsiani. Submitted by: Miguel Vélez, July 07
General Information:
Alpha-numeric codification: INEL 5406
Course Title: DESIGN OF TRANSMISSION AND DISTRIBUTION SYSTEMS
Number of credits: 3
Contact Period: 45
Elective in INEL

Course Description:
English: Design of electric power distribution systems with special attention to distribution transformer connections and energy rates. Transmission line design with emphasis on conductor selection, sag and tension. Review of transmission line parameters.

Spanish: Diseño de sistemas de distribución con énfasis en conexión de transformadores y tarifas de energía. Diseño de líneas de transmisión con énfasis en la selección de conductores, tensión y vano en la línea. Repaso de parámetros de líneas de transmisión.

Pre/Co-requisites and other requirements:
Prerequisite: INEL 4415

Course Objectives:
The purpose of this course is to prepare students to be proficient in designing interior and exterior illumination systems.

Instructional Strategies:

☐ conference  ☑ discussion  ☐ computation  ☐ laboratory
☐ seminar with formal presentation  ☐ seminar without formal presentation  ☐ workshop
☐ art workshop  ☐ practice  ☐ trip  ☐ thesis  ☐ special problems  ☐ tutoring
☐ research  ☐ other, please specify:

Minimum or Required Resources Available:
All students are expected to bring a solid background in electric systems analysis. Students must work on projects by applying the technics discussed in class.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light, eye, and vision</td>
<td>1.5</td>
</tr>
<tr>
<td>Color</td>
<td>1.5</td>
</tr>
<tr>
<td>Photometric units and terminology</td>
<td>2</td>
</tr>
<tr>
<td>Light sources</td>
<td>10</td>
</tr>
<tr>
<td>Optics and control of light</td>
<td>3</td>
</tr>
<tr>
<td>Luminaries</td>
<td>3</td>
</tr>
<tr>
<td>Lighting economics</td>
<td>3</td>
</tr>
<tr>
<td>Interior lighting design</td>
<td>9</td>
</tr>
<tr>
<td>Exterior lighting design</td>
<td>9</td>
</tr>
<tr>
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Grading System

☑ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
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<th>Quantity</th>
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<td>☐ Short Quizzes</td>
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<td>☐ Oral Reports</td>
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<td>☐ Monographies</td>
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<td>☐ Portfolio</td>
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<td>☑ Projects</td>
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<td>☐ Other, specify: Homework</td>
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<td><strong>TOTAL:</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
### Bibliography:


### According to Law 51

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### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

### 12. Course Outcomes

- The student is able to apply mathematics and science fundamentals to solve or to analyze an engineering problem or principle within the course material. (a)
- The students are able to follow logical and orderly design procedures, and complete a design to meet the given set of specification. The students document the design process, and include considerations of codes and engineering standards related to the design area. (c)
- Students are able to compare different alternatives to present a suitable solution. Their solution shows their ability of physical thinking, approximation and simplification. (e)
- The work complies with safety standards, and their final design solution avoids ethical compromises. (f)
- The students work reflect proper use of the language (Spanish or English) and their ability to communicate graphically using schematics, tables, mathematical equations, and any necessary technical documentation. (g)
- Students prove their ability to find information related to their discipline by including a reference list of articles related to their course work. (i)
- Students discuss different alternatives to solve their problem with emerging technologies and their associated cost, and comment on their importance and how they cope with the needs of their design. (j)
- Students are able to make an appropriate choice and use of specialized tools, and software to complete a design. (k)

Person(s) who prepared this description and date of preparation: Lionel R. Orama. Submitted by: Lionel R. Orama, June, 19, 2008, Committee Coordinator.
**General Information:**

- Alpha-numeric codification: INEL 5407
- Course Title: COMPUTER AIDED POWER SYSTEM DESIGN
- Number of credits: 3
- Contact Period: 45
- Elective in INEL

**Course Description:**

English: Design of power systems using digital computers; load flow, economic load dispatch, symmetrical and unsymmetrical faults. Selection of breakers.

Spanish: Diseño de sistemas de potencia haciendo uso de la computadora digital: flujo de potencia, despacho económico de generación, fallas simétricas y asimétricas, selección de interruptores.

**Pre/Co-requisites and other requirements:**

INEL 4415

**Course Objectives:**

This course is designed to give students in electric power engineering a comprehensive experience in the computer aided design of power systems. The students will apply knowledge gained from previous courses in the solution of practical problems.

**Instructional Strategies:**

- conference ☑
- discussion ☐
- computation ☐
- laboratory ☐
- seminar with formal presentation ☐
- seminar without formal presentation ☐
- workshop ☐
- art workshop ☐
- practice ☐
- trip ☐
- thesis ☐
- special problems ☐
- tutoring ☐
- research ☐
- other, please specify: ☐

**Minimum or Required Resources Available:**

All students are expected to bring a solid background in electric power systems analysis. Students must work on projects by applying the algorithms discussed in class.

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Representation of power system components</td>
<td>2</td>
</tr>
<tr>
<td>Load flow solution using computers</td>
<td>11</td>
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<tr>
<td>Symmetrical and unsymmetrical fault analysis</td>
<td>11</td>
</tr>
<tr>
<td>Economic load dispatch</td>
<td>11</td>
</tr>
<tr>
<td>Calculation of interrupting duty of breakers</td>
<td>10</td>
</tr>
<tr>
<td>Total hours: (equivalent to contact period)</td>
<td>45</td>
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**Grading System**

- ☑ Quantifiable (letters) ☐ Not Quantifiable

**Evaluation Strategies:** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
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<td>Projects</td>
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<td>Journals</td>
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<tr>
<td></td>
<td>Other, specify: Homework</td>
</tr>
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Appendix 120

Bibliography:

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
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<th>General</th>
<th>Engineering Topic</th>
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<tr>
<td>(k)</td>
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</tbody>
</table>

Course Outcomes

- Possess sufficient knowledge of power system analysis and operation, including short circuits to plan system expansion.
- Be able to apply computer simulation and analysis to the solution of power system problems.
- Students are able to compare different alternatives to present a suitable solution. Their solution shows their ability of physical thinking, approximation and simplification.
- Students are able to write a project report or paper for each mini-project.
- Students prove their ability to find information related to the stated problems by including a reference list of articles related to their course work. The references are included and discussed in their report.
- Students discuss different alternatives to solve their problem.
- Students are able to make an appropriate choice and use of specialized tools, software, or hardware to complete a design or to collect and analyze data.

Person(s) who prepared this description and date of preparation: Lionel R. Orama.
Submitted by: Lionel R. Orama, Jun 2008
General Information:
Alpha-numeric codification: INEL 5408
Course Title: Electric Motors Control
Number of credits: 3
Contact Period: 3 hours of lecture per week
Elective in INEL

Course Description:
English: Electric motor drive systems, modeling of D.C and A.C machines, Characteristics and selection, analysis and design of converter fed open loop and closed loop D.C and A.C drive systems, design of controllers, braking methods
Spanish:

Pre/Co-requisites and other requirements:
INEL4405, INEL4416 and INEL4505

Course Objectives:
After completing the course, students will be able to understand the basic architecture and methodology for the design of open loop and closed loop electric drives. Students will also be able to select drives according to applications, taking into consideration mechanical load and operational characteristics needed.

Institutional Strategies:
conference discussion computation laboratory

seminar with formal presentation seminar without formal presentation workshop

art workshop practice trip thesis special problems tutoring

research other, please specify:

Minimum or Required Resources Available:
P-Spice, MATLAB, and demonstration of Practical Drive Systems in Laboratory

Course time frame and thematic outline

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<tr>
<th>Outline</th>
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<td>Introduction to Electric Drive Systems</td>
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<td>Mechanical system requirements</td>
<td>2</td>
</tr>
<tr>
<td>Review of power converters for drive systems</td>
<td>3</td>
</tr>
<tr>
<td>Modeling of D.C motors</td>
<td>2</td>
</tr>
<tr>
<td>Phase and chopper controlled D.C drives</td>
<td>6</td>
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<tr>
<td>Feedback controller design</td>
<td>3</td>
</tr>
<tr>
<td>Polyphase induction motors-Review of steady state analysis</td>
<td>2</td>
</tr>
<tr>
<td>Performance calculation of voltage and current source inverter fed induction motors, static rotor resistance control, slip power recovery control, closed loop control of induction motor drives</td>
<td>10</td>
</tr>
<tr>
<td>Polyphase synchronous motors-Review of steady state analysis</td>
<td>2</td>
</tr>
<tr>
<td>Open loop and closed loop synchronous motor drives</td>
<td>4</td>
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<tr>
<td>Introduction to reluctance and permanent magnet motor drives</td>
<td>Three class tests</td>
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Grading System
☒ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Quantity</th>
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<td>Exams</td>
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<td>Final Exam</td>
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<td>Short Quizzes</td>
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<tr>
<td>Oral Reports</td>
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<tr>
<td>Monographies</td>
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<td>Portfolio</td>
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<td>Projects</td>
<td>1 10</td>
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<tr>
<td>Journals</td>
<td></td>
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<tr>
<td>Other, specify:</td>
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</tbody>
</table>
### Bibliography:


### According to Law 51

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

### Course Outcomes

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Map to Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical system requirements for electric drives</td>
<td>(a)</td>
</tr>
<tr>
<td>Modeling of D.C Motors</td>
<td>(a)</td>
</tr>
<tr>
<td>Phase and chopper controlled D.C Drives</td>
<td>(a)</td>
</tr>
<tr>
<td>Design of feedback controllers for D.C Drives</td>
<td>(c)</td>
</tr>
<tr>
<td>Design of feedback controllers for D.C Drives</td>
<td>(k)</td>
</tr>
<tr>
<td>VSI and CSI fed induction motor drives-performance calculation</td>
<td>(a)</td>
</tr>
<tr>
<td>Closed loop control and static slip power recovery scheme for induction motors</td>
<td>(a)</td>
</tr>
<tr>
<td>Closed loop induction motor drives</td>
<td>(e)</td>
</tr>
<tr>
<td>Synchronous motor drives-Performance calculation</td>
<td>(a)</td>
</tr>
<tr>
<td>Closed loop control of a synchronous motor drive system</td>
<td>(e)</td>
</tr>
</tbody>
</table>

Person(s) who prepared this description and date of preparation: ____________________

Submitted by:  Efrain O’Neill Nov 2006
General Information:

- Alpha-numeric codification: INEL 5415
- Course Title: Power System Protection
- Number of credits: 3
- Contact Period: 45
- Electives in INEL

Course Description:

English: Design and selection of protective devices used in generation, transmission, and distribution for electrical systems: relays, fuses, breakers, reclosers, arresters. Protection coordination. Selection of other system components such as sectionalizers and throw-overs. Insulation coordination.


Pre/Co-requisites and other requirements:

- INEL 4415

Course Objectives:

This is a course for majors in electric power engineering. After completing the course, the student should be able to specify and set up relays for the protection of a power system.

Instructional Strategies:

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:

All students are expected to bring a solid background in electric power systems fundamentals. Students must always bring to class the textbook and a scientific calculator (preferably one that handles complex numbers).

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protective Relaying Introduction &amp; Philosophy</td>
<td>3</td>
</tr>
<tr>
<td>CT Performance</td>
<td>3</td>
</tr>
<tr>
<td>Operating Principles of Electro-Magnetic Relays</td>
<td>3</td>
</tr>
<tr>
<td>Current Differential Relaying, Transformer Protection, Bus Protection</td>
<td>7</td>
</tr>
<tr>
<td>Electromagnetic Induction Relays</td>
<td>3</td>
</tr>
<tr>
<td>Directional Relays, Application of Overcurrent Relays, Case Studies</td>
<td>9</td>
</tr>
<tr>
<td>Distance Relays, Application Case Study</td>
<td>5</td>
</tr>
<tr>
<td>Step Distance Protection, Pilot Relaying, Case Study</td>
<td>9</td>
</tr>
<tr>
<td>Generator Protection Survey</td>
<td>3</td>
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<tr>
<td>Total hours: (equivalent to contact period)</td>
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Grading System

- Quantifiable (letters) ☑️ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
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<th>Quantity</th>
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<td>☑️ Journals</td>
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</tr>
<tr>
<td>Professor’s Notes.</td>
<td></td>
</tr>
</tbody>
</table>

**According to Law 51**

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<table>
<thead>
<tr>
<th>Contribution of Course to meeting the requirements of Criterion 5:</th>
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</thead>
<tbody>
<tr>
<td>Math</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>✔</td>
</tr>
</tbody>
</table>

**Course Outcomes**

- Possess sufficient knowledge of power system analysis and operation, including short circuits to specify the set up and coordination of protective relaying.
- Understand faulted electric power system to successfully to identify applicable protection schemes.
- Be able to apply complex variable concepts to the solution of relaying coordination problems.
- Be able to follow logical and orderly design procedures to choose the best solution for the relaying of the power system.
- Be able to determine criteria to compare the designed outcome.
- Be aware of modern protection schemes using combination of microprocessor based relays.

**Map to Program Outcomes**

- (a)
- (a)
- (a)
- (c)
- (c)
- (k)

Person (s) who prepared this description and date of preparation: Lionel Orama, Submitted by Lionel Orama, October 2007
General Information:

Alpha-numeric codification: INEL 5495
Course Title: DESIGN PROJECTS IN POWER SYSTEMS
Number of credits: 3
Contact Period: One hour of lecture, two laboratory periods per week (two hours each).
Elective in INEL

Course Description:

English: Major design experience in electric power systems. Application of power system fundamentals to the design of a system incorporating engineering standards and realistic constraints. Use of computational tools for the design and analysis of power electronics systems electric power systems

Spanish: Experiencia mayor de diseño en sistemas de potencia eléctrica con énfasis en el uso de computadoras. Aplicación de los fundamentos de sistemas de potencia al diseño de un sistema considerando estándares de ingeniería y restricciones de diseño realistas.

Pre/Co-requisites and other requirements:
Knowledge of three-phase circuit analysis, phasor analysis, fault analysis, and per-unit calculations. Requires authorization from the Department Head.

Course Objectives:
The purpose of the course is to provide students a major design experience in power systems that prepares them for engineering practice. This is an upper-level course open to both undergraduate and graduate students.

Instructional Strategies:

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Introduction to Capstone Design</td>
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</tr>
<tr>
<td>Seminars on topics such as product specification; selection between different system alternatives; social, ethical and policy issues in power systems design; tools for computer aided design of power systems</td>
<td>12</td>
</tr>
<tr>
<td>Major design project on one of the following areas: Residential/commercial buildings Industrial complex Transmission system Generation, dispatch, operation, or control of power systems</td>
<td>30</td>
</tr>
<tr>
<td>Oral presentation presentation</td>
<td>2</td>
</tr>
<tr>
<td>Total hours: (equivalent to contact period)</td>
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</tr>
</tbody>
</table>

Grading System

- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies

(Suggested); The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Evaluation Strategy</th>
<th>Quantity</th>
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<td>Exams</td>
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<tr>
<td>Final Exam</td>
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<tr>
<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<tr>
<td>Monographies</td>
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<tr>
<td>Portfolio</td>
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</tr>
<tr>
<td>Projects</td>
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<td>100%</td>
</tr>
<tr>
<td>Journals</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Other, specify: Progress Reports</td>
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</tr>
<tr>
<td>TOTAL:</td>
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<td>100%</td>
</tr>
</tbody>
</table>

Bibliography:
References:
1. Papers from professional publications such as IEEE Transactions and Conference Proceedings
3. Puerto Rico Electric Power Authority regulation manuals on rates, underground and overhead power lines, transmission line design and complementary electrical design.
8. Standards such as:
   National Electric Code (NEC)
   National Electric Safety Code (NESC)
   OSHA
   Local regulations (e.g., Natural Resources Department, ARPE construction codes)

According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

Course Outcomes

1. Apply power system fundamentals to the design of a system that meet specific needs (a).
2. Use phasor techniques in the analysis of power systems (a).
3. Use at least one of the following engineering standards: National Electric Code (NEC), National Electric Safety Code (NESC) or Puerto Rico Electric Power Authority Regulations (c).
4. Prepare a report describing the design process followed (c).
5. Select a solution following the corresponding design standards (addressing the problem specifications) (c).
6. Master the design process, the multiplicity of answers to a problem, and the need for physical thinking, approximation, and simplification to decide on a solution (e).
7. Describe the problem based on the needs presented in class (e).
8. Design a power system solution based on the problem requirements and realistic constraints (e).
9. Compare different alternatives in order to present a responsible solution (e).
10. Present a list of materials and study the feasibility of the proposed design (e).
11. Apply ethical analysis in the evaluation of the proposed design (f).
12. Be aware of the CIAPR and the IEEE Codes of Ethics (f).
13. Prepare four written documents: a proposal, two progress report and a final report (g).
14. Present orally their designs at the end of the semester to the UPRM academic community (g).
15. Interpret data from tables and graphs, as well as apply power engineering formulas to complete their designs (g).
16. Make an assessment of the impact of their design in the environment, as well as the social and ethical implications related to the design (h).
17. Recognize the changing nature of the electrical system characteristics, and thus the importance of keeping abreast with changes in electrical codes, safety guidelines and new design standards in power systems (i).
18. Be aware of the role of the CIAPR and the IEEE in regulating engineering practice (i).
19. Student will understand current and emerging issues in the design of electric power systems, including load characteristics, mechanical and electrical considerations in selecting system solutions (j).
20. Be aware of applicable socio-economic considerations and implications regarding their engineering design (j).
21. Students will be aware of the social context in which engineering is practiced (j).
<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Map to Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>22. Use tools such as AutoCAD, Matlab, spreadsheets, and power system analysis software to complete their designs</td>
<td>(k)</td>
</tr>
</tbody>
</table>

Person(s) who prepared this description and date of preparation: ______________________
Submitted by: Efrain O'Neill Nov 2006
General Information:
- Alpha-numeric codification: INEL 5496
- Course Title: Design Projects in Power Electronics
- Number of credits: 3
- Contact Period: one hour of lecture and four laboratory hours per week
- Elective in INEL

Course Description:
English: Application of Power Electronics fundamentals to the design of a closed loop power electronic system to meet certain specifications and conforming to manufacturing standards. Performance evaluation through P-Spice or Simulink.

Spanish:

Pre/Co-requisites and other requirements:
INEL 4416

Course Objectives:
The purpose of the course is to provide students with a major design experience in Power Electronic systems that prepares them for engineering practice. A major design experience will involve the identification of an engineering problem, providing potential solutions using power electronics, selecting a solution, and designing a power electronic system. Validation of designs would be carried out through simulations and/or hardware implementation. Electric, magnetic and thermal designs would conform to industrial standards and materials.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:
P-Spice, MATLAB, Power Electronics Laboratory

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topologies used in switching power supplies</td>
<td>5</td>
</tr>
<tr>
<td>Modeling, small signal analysis and transfer functions</td>
<td>3</td>
</tr>
<tr>
<td>Magnetic design, design equations, output filter and transformer design</td>
<td>3</td>
</tr>
<tr>
<td>Diodes, BJTs, Power MOSFETs and IGBTs: Characteristics and selection, Heat sinks</td>
<td>1</td>
</tr>
<tr>
<td>Feedback loop design</td>
<td>3</td>
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Total hours: (equivalent to contact period) 15

Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
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<tbody>
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<td>Final Exam</td>
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<td>Short Quizzes</td>
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<td>Oral Reports</td>
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<td>Monographies</td>
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<td>Projects</td>
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<td>Journals</td>
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<tr>
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Bibliography:
4. Professor's notes

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<tbody>
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</table>

Course Outcomes

Apply Power Electronic fundamentals to the design of a power supply system that meets certain needs.

Use of differential equations and small signal equations for modeling power converters and control circuits.

Use of engineering standards, preparation of a report describing the design process and selection of the optimal design to meet specifications and performance requirements.

Master the design process, the multiplicity of answers to a problem and the need for physical thinking, approximation and simplification to decide on a solution. Comparison of different alternatives in order to present a responsible solution.

Be aware of CIAPR and IEEE Code of Ethics.

Proposal, project report and oral report.

Make an assessment of the impact of their design in the environment as well as the social and ethical implications related to the design.

Recognition of new developments in magnetic materials, power switching devices, design standards and design methods using information searching tools.

Students will understand current and emerging issues in the design of power electronic systems.

Use of power electronics design tools, P-Spice and MATLAB-Simulink to complete the design and simulations.

Be able to prototype to test design concepts of power circuits.

Person(s) who prepared this description and date of preparation: Krishnaswamy Venkatesan.

Submitted by: Lionel Orama (Power Committee) by means of Raúl E. Torres jun 08.
General Information:
- Alpha-numeric codification: INEL 5505
- Course Title: Linear System Analysis
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in INEL

Course Description:
- English: Linear spaces and matrices; state variables representations for linear continuous and discrete time systems; the Z-transform and its applications; stability; controllability and observability; state estimators.
- Spanish: Espacios lineales y matrices, representación de sistemas lineales de tiempo continuo y discreto mediante variables de estado, la Transformada Z y sus aplicaciones, estabilidad, controlabilidad y observabilidad, estimadores de estado.

Pre/Co-requisites and other requirements:
- INEL 4505.

Course Objectives:
- Analyze linear systems and design of state-feedback controllers.
- Develop dynamical models for simple linear systems using state-space representation.
- Evaluate and interpret properties of linear systems such as stability, controllability, and observability.
- Design state-feedback controllers for single-input single-output linear systems.
- Implement the controllers using digital computers and validate its performance.

Instructional Strategies:
- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

Minimum or Required Resources Available:
- Eight workstations equipped with mechanical systems to be controlled, electrical measurements equipment, personal computers with data acquisition boards and software (Matlab, Simulink, RTW, and LabVIEW).

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tr>
<td>System classification and structures</td>
<td>2</td>
</tr>
<tr>
<td>Introduction to linear algebra</td>
<td>8</td>
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<tr>
<td>Mathematical description of systems and examples of physical systems</td>
<td>3</td>
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<tr>
<td>The solution of the state equation</td>
<td>5</td>
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<tr>
<td>Linearization of dynamical systems</td>
<td>2</td>
</tr>
<tr>
<td>Discrete time systems, difference equations, and the Z-transform and its application</td>
<td>4</td>
</tr>
<tr>
<td>Discretization of continuous time systems</td>
<td>2</td>
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<td>Stability of continuous and discrete time linear systems</td>
<td>4</td>
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<tr>
<td>Controllability and Observability</td>
<td>7</td>
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<tr>
<td>State feedback an pole placement</td>
<td>4</td>
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<tr>
<td>State estimators</td>
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<td>Exams</td>
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Grading System
- Quantifiable (letters)
- Not Quantifiable

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<td>Portfolio</td>
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</tr>
<tr>
<td>Projects</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix

Journals

Other, specify: Homework Sets 4 10
TOTAL: 100%

Bibliography:

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<table>
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<tbody>
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</tbody>
</table>

Course Outcomes

- Analyze linear systems and design of state-feedback controllers. (a)
- Develop dynamical models for simple linear systems using state-space representation. (a)
- Evaluate and interpret properties of linear systems such as stability, controllability, and observability. (a)
- Design state-feedback controllers for single-input single-output linear systems. (c)
- Implement the controllers using digital computers and validate its performance. (b)
- Use modern engineering tools (MATLAB, LabVIEW, PSPICE…) for the design and implementation of a control system. (k)
- Work as part of a team. (d)
- Preparation of a written report about the final project. (g)

Person(s) who prepared this description and date of preparation: Gerson Beauchamp,
Submitted by: Eduardo J. Juan Feb 2007
### General Information:
- Alpha-numeric codification: INEL 5506
- Course Title: PROCESS INSTRUMENTATION AND CONTROL ENGINEERING
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in INEL 5506

### Course Description:
English: Design of process instrumentation and control systems, based on analog and digital instruments and mini or microcomputers. Standards and practical considerations emphasized.
Spanish: Diseño de sistemas de instrumentación y control de procesos basados en instrumentación analógica y digital y en mini o microcomputadoras. Enfasis en normas establecidas y consideraciones prácticas.

### Pre/Co-requisites and other requirements:
INEL 4505 Y INEL 4206

### Course Objectives:
Design of practical process instrumentation and control systems using computers and analog and/or digital instruments. Selection of measurement systems, controllers, and final control elements necessary to achieve system design specifications while satisfying standards and established practices.

### Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

### Minimum or Required Resources Available:
- Electrical measurement equipment, electronic components, personal computers with data acquisition boards and software.

### Course time frame and thematic outline
<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elements in process control standards and practical consideration</td>
<td>9</td>
</tr>
<tr>
<td>Transducers</td>
<td>12</td>
</tr>
<tr>
<td>Analog and digital signal conditioning</td>
<td>4</td>
</tr>
<tr>
<td>PID control: practical considerations for both analog and digital controllers</td>
<td>10</td>
</tr>
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<td>Discrete-state process control programmable controllers and industrial applications</td>
<td>9</td>
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<tr>
<td>Mid-term exam</td>
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</table>

Total hours: (equivalent to contact period) 45

### Grading System
- Quantifiable (letters)
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
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<th>Percent</th>
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<td>Short Quizzes</td>
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</tr>
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<td>Oral Reports</td>
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<td>Monographies</td>
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<td>Journals</td>
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</table>

**Other, specify:**
TOTAL: 100%

### Bibliography:
According to Law 51

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

**Contribution of Course to meeting the requirements of Criterion 5:**

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**Course Outcomes**

- Analyze and design signal conditioning and transmission circuits.
- Understand the principles of operation of various types of transducers.
- Design of practical process instrumentation and control systems using computers and analog and/or digital instruments.
- Selection of measurement systems, controllers, and final control elements necessary to achieve system design specifications while satisfying standards and established practices.
- Preparation of an oral and written report about the final project.
- Work as part of a team.
- Learn about the role and scope of regulating agencies such as the Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPA), and the Food and Drug Administration (FDA).
- Learn about the role and scope of professional societies such as Instrumentation, systems and Automation (ISA) society and the Institute of Electrical and Electronics Engineers (IEEE).
- Implementation and testing of a process control and instrumentation system.
- Understanding of professional and ethical responsibility.
- Use modern engineering tools (MATLAB, LabVIEW, PSPICE…) for the design and implementation of a process control and instrumentation system.

Person(s) who prepared this description and date of preparation: Eduardo J. Juan,
Submitted by: Eduardo J. Juan, Feb 2007
General Information:

Alpha-numeric codification: INEL 5508
Course Title: Digital Control Systems
Number of credits: 3
Contact Period: 3 hours of lecture per week
Elective in INEL 5508

Course Description:

English: Analysis and design of digital control systems. Stability, controllability, and observability of discrete systems. Practical considerations when implementing a digital control system.

Spanish: Análisis y diseño de sistemas de control digital. Se estudian la estabilidad, controlabilidad y observabilidad de sistemas de tiempo discreto. Se enfatizan consideraciones prácticas para la implantación de los sistemas de control digital.

Pre/Co-requisites and other requirements:

INEL 4505

Course Objectives:

Analyze, design and implement digital control systems for single-input single-output physical systems.
Discretize simple physical systems and specify performance criteria.
Design a single-input single-output feedback controller capable of achieving the design criteria for the system.
Implement a digital controller using a digital computer and software, and validate the performance of the closed-loop system.

Instructional Strategies:

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:

Eight workstations equipped with mechanical systems to be controlled, electrical measurements equipment, personal computers with data acquisition boards and software (Matlab, Simulink, RTW, and LabVIEW).

Course time frame and thematic outline

| Outline                                                        | Contact Hours |
|                                                               |               |
| Modeling of digital and discrete systems                      | 3             |
| Discrete Time Systems and the Z-transform                    | 6             |
| State space representation of discrete systems. Properties of the models | 4             |
| Sampling and reconstruction                                  | 7             |
| Analysis of sampled data open-loop and closed-loop control systems | 5             |
| System time-response characteristics                          | 5             |
| Stability analysis                                            | 3             |
| Digital controller design                                     | 9             |
| Exams                                                         | 3             |
| Total hours: (equivalent to contact period)                   | 45            |

Grading System

- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Oral Reports</td>
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<td>Monographies</td>
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<td>Portfolio</td>
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Bibliography:

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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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</thead>
<tbody>
<tr>
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</table>

Course Outcomes
- Analyze, design and implement digital control systems for single-input single-output physical systems.
- Discretize simple physical systems and specify performance criteria.
- Design a single-input single-output feedback controller capable of achieving the design criteria for the system.
- Implement a digital controller using a digital computer and software.
- Validate the performance of the closed-loop system.
- Work as part of a team.
- Preparation of a written report about the final project.
- Use modern engineering tools (MATLAB, LabVIEW, PSPICE…) for the design and implementation of a process control and instrumentation system.

Map to Program Outcomes
(a) (a) (c) (e) (b) (d) (g) (k)

Person(s) who prepared this description and date of preparation: Gerson Baeuchamp, Submitted by: Eduardo J. Juan Feb 2007
Appendix 136

General Information:

- Alpha-numeric codification: INEL 5516
- Course Title: AUTOMATION AND ROBOTICS
- Number of credits: 3
- Contact Period: 3 hours of lecture per week and 12 hours of laboratory in the semester
- Elective in INEL

Course Description:

- English: Analysis and design of automated pneumatic systems using programmable controllers.
- Programming of industrial robots.
- Spanish: Analisis y diseño de sistemas neumáticos usando controladores programables. Programación de brazos mecánicos industriales.

Pre/Co-requisites and other requirements:

- Prerequisites: INEL 4206 and INEL 4102 or
- For students in Industrial Engineering: ININ 4057 or being in graduate standing.
- For students in Mechanical Engineering: INME 4009, INEL 4076, INEL 4077 and INGE 3016, or being in graduate standing.

- Prerequisites by topic:
  - Programming and design of flowchart algorithms.
  - Transfer functions, and physics (concepts such as pressure, temperature, fluid flow, voltage, current, electromagnetism, etc.)
  - Synchronous sequential machines and state diagrams.
  - Calculus and matrices math. Knowledge of MATLAB is encouraged.

Course Objectives:

- After completing the course, the student should be able to understand, analyze and design automatic control systems for manufacturing processes using pneumatic equipment, programmable controllers and robotic arms.

Instructional Strategies:
- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

Minimum or Required Resources Available:

- Labs are considered a major part of the class, and all students are expected to participate.
- Radios, tape recorders, and other audio or video equipment are not permitted in the lab or classroom at any time.
- Smoking is not permitted in any area other than those areas designated for smoking.

Laboratory Projects:

- Familiarization with programmable controllers. Demonstrations on how to use the equipment and applications. Small projects are required.
- Familiarization with the CRS A255 or equivalent robot system. Demonstrations on how to use the equipment and applications. Small projects are required.
- A final design project is required.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automation: definitions and manufacturing terminology, equipment used, and justifications</td>
<td>3</td>
</tr>
<tr>
<td>Manufacturing process simulation and design for assembly techniques</td>
<td>3</td>
</tr>
<tr>
<td>Industrial on-off sensors and actuators such as stepper and DC motors</td>
<td>5</td>
</tr>
<tr>
<td>Pneumatic systems: compressors, valves, cylinders, and air preparation devices</td>
<td>4</td>
</tr>
<tr>
<td>Programmable controllers</td>
<td>17</td>
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<tr>
<td>Robotics</td>
<td>12</td>
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<td>Test</td>
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Grading System

- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the
evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Oral Reports</td>
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<td>Laboratory Report</td>
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<td>Assignment</td>
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<td>TOTAL:</td>
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</tbody>
</table>

Bibliography:

Professor notes and Supplemental Reading

According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Course Outcomes
Relationship of the course with program outcomes
Outcome (a) Ability to apply knowledge of mathematics, science, and engineering necessary to carry out analysis and design appropriate to electrical engineering problems.
The student must show sufficient knowledge of the basic physical and engineering sciences to implement a control project either by using pneumatic systems, robotic arms, or automation using PLC.
Extra credits will be awarded in this outcome if numerical cost analysis is included in the final report.
Extra credits will be awarded if a combination of technologies is presented in the final project.
Outcome (b) Ability to design and conduct experiments, as well as analyze and interpret data
Students will conduct laboratory works. Data will be collected and analyze in four laboratory reports. Part of the grade on this report includes the presentation and analysis of the data collected. These reports will not be collected for ABET purposes unless the final project does not reflect competency of this outcome.
The student will provide a final project of an original idea proposed by his group. Implementation is a major portion of the grade of the course.
Outcome (c) Ability to design a system, component, or process to meet desired needs
The students must show that they follow logical and orderly design procedures, choosing the best solution for their criteria.
Students must provide a final report that reflects competency documenting their work.
Outcome (d) Ability to function on multidisciplinary teams
Groups no greater of four members will be working towards all laboratory and project work. Peer evaluation will be asset, and an individual interview with the professor will be required previous to grant the final grade.
Each group must show originality in their work, the procedure to subdivide a complex problem in parts, and finally combining peer work into the final solution.
Appendix

Outcome (e) Ability to identify, formulate, and solve engineering problems
Students will identify a problem where the automation skills could be applied.
Their idea, along with a plausible procedure, will be submitted by the working group in a proposal. The final report will include the explanation of the idea in the introduction part of the report.

Outcome (f) Understanding of professional and ethical responsibility.
Students should be able to identify the ethical issues faced on the solution of their final project.
Laboratory reports will provide practice to identify ethical and social issues. In the cases that the final report does not show evidence of competency on this outcome, one of this laboratory works will be provided as evidence.

Outcome (g) Ability to communicate effectively
Project groups must present an oral presentation and a written final report of their work.
Oral presentation and working demonstration of the students work is open to the public, and therefore should be understandable for the interested parties. Mathematical derivation and technical content is allowed in oral presentations. Attendants to these sessions should at least understand why the derivation is needed although fully comprehension is not expected.

Outcome (h) Broad education necessary to understand the impact of engineering solutions in a global and societal context
Ideas for projects should reflect awareness of societal needs.
Students should comment the impact to society reflected by acceptance of their design into society, impact in low skills personnel being replaced by their solution, impact to the environment, or benefits to the intended group of person.

Outcome (i) Recognition of the need for, and an ability to engage in lifelong learning
Student must include enough references to prove their ability to search for information. This information could be reflected in the theory part of the report, or in the finding of a technical tool or part not easily found in hardware store (as for example, an inductive sensor, or pneumatic valve).

Outcome (j) Knowledge of contemporary issues
Student should comment on different alternatives to solve their problem. These alternatives should include emerging technologies and their associated cost, although they are not implemented.

Outcome (k) Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
Student must be able to program a PLC, or a robotic arm using the tools presented in class. The ladder logic diagram or the structured robotic program should go beyond the examination exercise by using them in the solution of their final project.

Relationship of the course with program objectives
Objective 1: Obtain a broad educational experience necessary to understand the impact of electrical engineering problems and solutions within a global and societal context.
Related Activity: Laboratory work and project.

Objective 2: Posses a combination of knowledge and analytical, computational, and experimental skills necessary to solve practical engineering problems.
Basic engineering design skills and in-depth knowledge of at least one EE area: (control).
Physical thinking, approximation, and simplification
Ability to integrate knowledge and skills across discipline boundaries.
Physical thinking, approximation and simplification.
Ability to integrate knowledge and skills across discipline boundaries.
Related Activity: Laboratory work, project, and assignments.

Objective 3: Have adequate communications skills both as an individual and as part of a team.
Ability to communicate effectively verbally and in writing in English and Spanish.
Ability to interpret graphical, numerical, and textual data
Ability to communicate effectively technical information to varied audiences in oral, written and graphical forms, both in English and Spanish
Ability to organize information
Ability to work in groups and to interact with the social environment
Ability to lead effectively.
Related Activity: Written proposal, oral presentation, laboratory reports and final project report.

Objective 4: Value the importance of lifelong learning.
Knowing how to ask questions and that there may be multiple answers.
Commitment to constantly upgrading fundamental knowledge and skills
Understanding that every situation is an opportunity for learning
Related Activity: Laboratory work and project.

Objective 5: Be aware of contemporary issues and thus be able to make decisions taking into consideration professional and societal needs, and ethical implications.
Consciousness of the ethical and societal aspects of their profession.
Related Activity: Laboratory work and project.

Person(s) who prepared this description and date of preparation: Raúl E. Torres, Submitted by: Raúl Torres, April, 07
General Information:
- Alpha-numeric codification: INEL 5595
- Course Title: Design Project in Control Systems
- Number of credits: 3
- Contact Period: 1 hour lecture, 4 hours laboratory per week
- Elective in INEL

Course Description:
- English: Capstone design course in which students apply fundamental knowledge in Control Systems to solve an engineering problem considering engineering standards and realistic constraints.
- Spanish: Curso de experiencia de diseño en el cual los estudiantes aplican los fundamentos de sistemas de control para solucionar un problema de ingeniería, tomando en consideración los estándares de ingeniería y restricciones de diseño realistas.

Pre/Co-requisites and other requirements:
- Permission of the Departmental Director

Course Objectives:
In this course, students should demonstrate their capacity to understand and manage all aspects related to the solution of a problem in control systems, based on their knowledge acquired in previous courses. The student should demonstrate his/her capability to solve a real engineering problem.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:
The course includes 4 hours of laboratory work per week for the development, modeling and implementation of the project, depending on its scope and nature.

Course time frame and thematic outline

<table>
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<td>Introduction to Capstone Design</td>
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<td>- Any other as the design projects dictate</td>
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Grading System
- Quantifiable (letters)  Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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Appendix 140

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Bibliography:
- Standard such as National Electric Code (NEC), Federal Comission of Communication (FCC), National Electric Safety Code (NESC), Federal Drug Association (FDA) regulations
- CRC ElectricalEngineeringNetbase: http://www.electricalengineeringnetbase.com/
- CRC ENGnetBASE: http://www.engnetbase.com/ejournals/categories/default.asp
- Electronic Design: http://electronicdesign.com/
- WEB-EE: http://web-ee.com/

Books:

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Contribution of Course to meeting the requirements of Criterion 5:

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Map to Program Outcomes

Course Outcomes

Students must satisfy for all design projects the following outcomes by:

- Developing and conducting the laboratory work or simulation or prototyping and troubleshooting where applicable to evaluate the design. Results and data are correctly interpreted. (b)
- Following logical and orderly design procedures based on a set of specifications. Alternatives and decisions are clearly documented along the design process, and include considerations of codes, protocols, and engineering and safety standards related to the design area. (c)
- Identifying and describing a problem that can be solved with the skills related to the field of study. Students are able to compare different alternatives to present a suitable solution. Their solution shows their ability of physical thinking, approximation and simplification. (e)
- Writing well organized project documents and presentations. The work should make proper use of language (Spanish or English), and use schematics, tables, graphics, mathematical equations, as appropriate. (g)
- Analyzing the social and environmental impact. The analysis may discuss economic implications, such as entrepreneurship potential, sustainability, usability, and employment substitutions. (h)
- Using information and bibliographic resources, and finding specialized tools, software or supplies necessary for the project. The reference list is included and discussed in the documents. (i)
- Discussing contemporary issues related to the project such as innovations, business opportunities, and local needs. (j)
- Making appropriate choice and use of specialized tools, software, or hardware to complete the design or to collect and analyze data. (k)

Students may satisfy the following outcomes depending on the particular design project by:

- Applying fundamentals of mathematics, science, probability and statistics to solve or to analyze an engineering problem when applicable. Economic aspects are considered as appropriate. (a)
- Demonstrating an ability to organize the team assigning responsibilities, balancing the work load, and participating in regular meetings. (d)
- Evaluating any ethical aspects of the project. The ethical aspects can include the perspectives of the designer and the user or affected parties, and knowledge of any applicable code of ethics, (f)
such as, the CIAPR, the IEEE or ACM Codes of Ethics.

### General Information:
- **Alpha-numeric codification:** INEL 5995
- **Course Title:** Special Problems
- **Number of credits:** One to six credit hours.
- **Contact Period:** Depends on the assignment.
- **Elective in INEL**

### Course Description:
- **English:** Investigations and Special Problems In Electrical Engineering Orrelated Fields. Open to Outstanding Electrical Engineering Students.
- **Spanish:** Investigación o Problemas Especiales de Ingeniería Eléctrica y Ramas afines. Abierto a estudiantes sobresalientes de Ingeniería Eléctrica.

### Pre/Co-requisites and other requirements:
- Consent of the Director of the Department.

### Course Objectives:
Students will compare and contrast the theoretical aspects of electrical engineering with the real world practice. They will apply the fundamental concepts taught in the classroom and recognize their value in real practice. Students will experience and be exposed to the practical aspects of electrical engineering design.

### Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

### Minimum or Required Resources Available:

### Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varies with assignment</td>
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</tbody>
</table>

| Total hours: (equivalent to contact period) | |

### Grading System

- [ ] Quantifiable (letters)
- [x] Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th></th>
<th>Quantity</th>
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<td>[ ] Short Quizzes</td>
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<tr>
<td>[ ] Oral Reports</td>
<td></td>
<td></td>
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<tr>
<td>[ ] Monographies</td>
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<tr>
<td>[x] Projects</td>
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<tr>
<td>[ ] Journals</td>
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<td>[ ] Other, specify:</td>
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<td>Final Report</td>
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**TOTAL:** 100%

### Bibliography:

According to Law 51
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### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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<tbody>
<tr>
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</tbody>
</table>

**Course Outcomes**

Varies with the assigned special problem.

Person(s) who prepared this description and date of preparation: Raúl E. Torres, April 9, 2008. Submitted by: Academic Affairs Committee.
**General Information:**
- Alpha-numeric codification: ICOM4009
- Course Title: Software Engineering
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in ICOM

**Course Description:**
English: Techniques used during the software development cycle; specification, design, testing, documentation and maintenance. Use of a procedure oriented language in the design and implementation of a software project.

Spanish: Técnicas usadas durante el ciclo de desarrollo de software; especificación, diseño, prueba, documentación y mantenimiento. Uso de un lenguaje procedimental en el diseño e implementación de un proyecto de software.

**Pre/Co-requisites and Other Requirements:**
Prerequisite ICOM4035

**Course Objectives:**
Provide the students with analysis, design, coding, testing and documentation skills and techniques necessary in the software development process. Learn to use the UML language in requirements specification and design.

**Instructional Strategies:**
- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify: Team Project

**Minimum or Required Resources Available:**

**Course Time Frame and Thematic Outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to the course</td>
<td>1</td>
</tr>
<tr>
<td>The Software Lifecycle</td>
<td>3</td>
</tr>
<tr>
<td>Estimation: Cost, Effort and Agenda</td>
<td>3</td>
</tr>
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<td>Planning and Tracking</td>
<td>3</td>
</tr>
<tr>
<td>Risk Analysis and Management</td>
<td>2</td>
</tr>
<tr>
<td>User Interface Design</td>
<td>1</td>
</tr>
<tr>
<td>The UML Language</td>
<td>4</td>
</tr>
<tr>
<td>Requirements Analysis and Specification</td>
<td>5</td>
</tr>
<tr>
<td>Design Principles and Concepts, System Design</td>
<td>6</td>
</tr>
<tr>
<td>Testing</td>
<td>4</td>
</tr>
<tr>
<td>Exams, Lab Sessions and Discussions</td>
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<td><strong>Total hours: (equivalent to contact period)</strong></td>
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**Grading System**
- Quantifiable (letters)
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Projects</td>
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<td>Journals</td>
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**Bibliography:**
According to Law 51

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**Contribution of Course to meeting the requirements of Criterion 5:**

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Map to Program Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Ability to design prototypes to test design concepts</td>
<td>(b)</td>
</tr>
<tr>
<td>Competency in determining and producing design specifications of computer software</td>
<td>(c)</td>
</tr>
<tr>
<td>Competency in determining the scope of hardware and software development project</td>
<td>(c)</td>
</tr>
<tr>
<td>Ability to follow logical and orderly design procedures, choosing the best solution for a given set of criteria and considering design constraints and tradeoffs, in the design of software systems</td>
<td>(c)</td>
</tr>
<tr>
<td>Ability to articulate teamwork principles (group dynamics)</td>
<td>(d)</td>
</tr>
<tr>
<td>Be comfortable breaking up a complex problem into separate tasks, delegating tasks to other team members, and integrating the composite effort of the group into a final solution.</td>
<td>(d)</td>
</tr>
<tr>
<td>Ability to communicate effectively with other team members</td>
<td>(d)</td>
</tr>
<tr>
<td>Ability to effectively describe a problem in a way that can lead to the construction of the solution</td>
<td>(e)</td>
</tr>
<tr>
<td>Be capable of defining a possible solution</td>
<td>(e)</td>
</tr>
<tr>
<td>Ability to determine the reasonableness of a solution within the physical and ethical context of the problem</td>
<td>(e)</td>
</tr>
<tr>
<td>Identify the applicability of the Software Engineering Code of Ethics</td>
<td>(f)</td>
</tr>
<tr>
<td>Ability to write effectively and be understood by technical and non- technical audiences</td>
<td>(g)</td>
</tr>
<tr>
<td>Be aware of emerging technologies and their impact in the future development of their field of study</td>
<td>(j)</td>
</tr>
<tr>
<td>Ability to use Software development and Computer-Aided Software Engineering (CASE) tools.</td>
<td>(k)</td>
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</tbody>
</table>

Person(s) who prepared this description and date of preparation: Javier Arroyo. Submitted by: Manuel Rodríguez March 2007
General Information:
- Alpha-numeric codification: ICOM 4015
- Course Title: Advanced Programming
- Number of credits: 4
- Contact Period: 3 hours of lecture and 2 hours of laboratory per week
- Required in ICOM

Course Description:
English: Advanced programming techniques applied to the solution of engineering problems; extensive use of subprograms, logical and specifications statements. Principles of multiprogramming, multiprocessing, and real-time systems.


Pre/Co-requisites and other requirements:
- Pre-requisite: INGE 3016

Course Objectives:
The student will learn how to use sub-routines, arrays, classes, and other object-oriented techniques for the design, implementation, and analysis of complex software systems used in Computer Science, Computer Engineering, and Software Engineering.

Instructional Strategies:
- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

Minimum or Required Resources Available:
Students will use the Departmental computer laboratories to complete course projects.

Course Time Frame and Thematic Outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction: Discussion of the organization of the course, general view of the topics to be covered, and ethical behavior of the computing professional.</td>
<td>1</td>
</tr>
<tr>
<td>Introduction to Computing: Introduction to the computer language to be used, and how to get it. General format of a computer program, compilation and execution of a program, and recognition of errors.</td>
<td>1.5</td>
</tr>
<tr>
<td>Fundamental Data Types, Operations, Expressions, and I/O: The numeric data types, strings, characters, and booleans. Variables, constants and literals of each of these primitive data types. The assignment statement, mathematical expressions, mathematical functions, type conversions, and comparison between primitive data types and objects. The String data type. Text based I/O.</td>
<td>2.5</td>
</tr>
<tr>
<td>Decisions: Review the topic of decisions in programs, this time in the context of the programming language used. We study selection constructs, the if-statement and the switch-statement. We also study about Boolean expressions and grouping of statements in a program.</td>
<td>1.5</td>
</tr>
<tr>
<td>Iteration: Review the topic of iterations in programs, the while and for loops.</td>
<td>1.5</td>
</tr>
<tr>
<td>Functions: Review of functions in a program, by-reference and by-value parameters, returning values, the activation record. Use of functions in procedural abstractions.</td>
<td>3</td>
</tr>
<tr>
<td>Arrays: Introduction to arrays – one-dimension and two-dimensional arrays. Different applications and typical operations with these structures are discussed.</td>
<td>3</td>
</tr>
<tr>
<td>Introduction to ADTs: Study of the concept of ADT and their application in describing new data types. The following ADTs are studied: Strings and lists. Different applications are discussed.</td>
<td>3</td>
</tr>
<tr>
<td>Object-Oriented Concepts: Study of objects, classes, interfaces, inheritance, virtual functions, polymorphism, and language constructs for their support. Emphasis is given to their application in the implementation of ADT's.</td>
<td>4</td>
</tr>
<tr>
<td>Object Oriented Design: Study of the object-oriented techniques applied to the software development process. In particular: the software life cycle, discovery of classes and member functions, cohesion and coupling, UML class diagrams.</td>
<td>4</td>
</tr>
</tbody>
</table>
modularization, and the development of complex programs.

<table>
<thead>
<tr>
<th>Input/Output and File Management:</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recursive Algorithms:</td>
<td>Study of recursion, the implementation mechanisms commonly used in programming languages, and its use in deriving algorithmic solutions to problems. Particular cases are studied: iteration by recursion and exhaustive searches.</td>
</tr>
<tr>
<td>Sorting Algorithms:</td>
<td>Sorting algorithms for array-based containers; selection-sort, merge-sort, and quick-sort. Comparison of performance.</td>
</tr>
<tr>
<td>Searching Algorithms:</td>
<td>Study of search algorithms over data containers based on arrays – sequential and binary search.</td>
</tr>
<tr>
<td>Introduction to the Analysis of Algorithms:</td>
<td>Complexity issues in data structures and algorithms: correctness, execution time, and space requirements. Asymptotic notation. Particular algorithms are analyzed in sorting and searching.</td>
</tr>
<tr>
<td>Exams and discussions</td>
<td>3</td>
</tr>
<tr>
<td>Total hours: (equivalent to contact period)</td>
<td>45</td>
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</table>

### Grading System

- **Quantifiable (letters)**
- **Not Quantifiable**

**Evaluation Strategies (Suggested):** The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Quantity</th>
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<tbody>
<tr>
<td>☑ Exams</td>
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<tr>
<td>☑ Final Exam</td>
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</tr>
<tr>
<td>☑ Short Quizzes</td>
<td>1</td>
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<tr>
<td>☑ Oral Reports</td>
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<tr>
<td>☑ Monographies</td>
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<td>☑ Portfolio</td>
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<td>☑ Projects</td>
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<td>☑ Journals</td>
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<td>☑ Other, specify: Laboratory</td>
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</table>

**TOTAL:** 100%

### Bibliography:


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### Contribution of Course to meeting the requirements of Criterion 5:

<table>
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<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

### Course Outcomes

- Knowledge of the contemporary issues in discipline of Computer Science and Engineering
- **Ability to apply knowledge of math in the analysis and design of fundamental algorithms.**
- **Knowledge of the programming process.**
- Ability to apply abstraction techniques including structured naming, procedures, encapsulation, classes and polymorphism to the design and development of complex software systems.
- **Use of a modern structured programming language.**
- **Ability to apply good programming style practices.**
- Ability to use a software development toolkit: editor, compiler and debugger, to implement software modules or a complete system within the allotted time specified by **deadline for a deliverable.**
**General Information:**

- Alpha-numeric codification: ICOM 4017
- Course Title: Computer-based Information Systems
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in INEL

**Course Description:**


**Spanish:** Análisis y Diseño de Sistemas de Información Basados en Computadoras Electrónicas; Teoría de Comunicaciones y el Flujo de Información en Organizaciones; Métodos y Procedimientos Para Recopilar, Dismeninar y Controlar Información; Sistemas Integrados de Procesamiento de Datos Versus Sistemas de Procesamiento en Tandas; Desarrollo e Instalación de Sistemas de Procesamiento de Información.

**Pre/Co-requisites and other requirements:**

Prerequisite ICOM 4035

**Course Objectives:**

Students will learn how to develop database applications, starting with the E-R model, then mapping it to the relational model, and implementing this latter model with an application. Students will also gain an understanding of basic database management systems architectures.

**Instructional Strategies:**

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

**Minimum or Required Resources Available:**

Students will use the Departmental computer laboratories to complete course projects.

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Database Systems and DBMS Architectures</td>
<td>2</td>
</tr>
<tr>
<td>Web-based Application Development for Databases</td>
<td>3</td>
</tr>
<tr>
<td>E-R Model and UML</td>
<td>5</td>
</tr>
<tr>
<td>Relational Model and Algebra</td>
<td>6</td>
</tr>
<tr>
<td>E-R to Relational Mappings</td>
<td>2</td>
</tr>
<tr>
<td>Structured Query Language (SQL)</td>
<td>6</td>
</tr>
<tr>
<td>Normalization and Integrity</td>
<td>3</td>
</tr>
<tr>
<td>Storage and File Systems</td>
<td>3</td>
</tr>
<tr>
<td>Indexing and Access Methods</td>
<td>2</td>
</tr>
<tr>
<td>Query Evaluation and Optimization</td>
<td>3</td>
</tr>
<tr>
<td>Transaction Processing</td>
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<td>Exams</td>
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**Total hours: (equivalent to contact period)**

45

**Grading System**

☑ Quantifiable (letters) ☐ Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>☑ Final Exam</td>
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<td>☐ Short Quizzes</td>
<td></td>
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</table>
Oral Reports
Monographies
Portfolio
Projects  variable  35%
Journals
Other, specify:

TOTAL: 100%

Bibliography:

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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

Course Outcomes
Describe and analyze the E-R model for a given enterprise. (a)
Design an E-R Model from a set of customer requirements. (c)
Describe and analyze a relational schema that is complaint with a given E-R Model. (a)
Design a mapping of an E-R model into a relational schema. (c)
Use SQL to create a relational schema and formulate queries against it. (c)
Implement a relational application based an E-R model and its corresponding relational schema. (e)

Person(s) who prepared this description and date of preparation: Manuel Rodríguez, June, 2008. Submitted by: Manuel Rodríguez, Committee Coordinator, June 20, 2008.
General Information:
   Alpha-numeric codification: ICOM4029
   Course Title: Compiler Construction
   Number of credits: 3
   Contact Period: 3 hours of lecture per week
   Elective in ICOM

Course Description:
   English: Techniques involved in the analysis of source languages and the generation of efficient object codes with emphasis on the components of a compiler.
   Spanish: Técnicas envueltas en el análisis de los lenguajes fuente y la generación de códigos eficientes con énfasis en los componentes de un compilador.

Pre/Co-requisites and other requirements:
   ICOM 4036

Course Objectives:
   To introduce and provide programming experience in the techniques involved in the analysis of source languages and the generation of efficient object codes with emphasis on the components of a compiler

Instructional Strategies:
   ■ conference  ■ discussion  □ computation  □ laboratory
   ■ seminar with formal presentation  □ seminar without formal presentation  □ workshop
   □ art workshop  □ practice  □ trip  □ thesis  □ special problems  □ tutoring
   □ research  □ other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<td>Introduction and structure of a basic compiler</td>
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</tr>
<tr>
<td>Lexical analysis and the lexical analyzer generator lex</td>
<td>3</td>
</tr>
<tr>
<td>Trees (especially search trees)</td>
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</tr>
<tr>
<td>Parsing techniques and context-free grammars</td>
<td>3</td>
</tr>
<tr>
<td>LL parsing</td>
<td>2</td>
</tr>
<tr>
<td>Operator-precedence grammars</td>
<td>2</td>
</tr>
<tr>
<td>LR and LALR parsing and the parser generator yacc</td>
<td>3</td>
</tr>
<tr>
<td>Syntax-directed translation</td>
<td>2</td>
</tr>
<tr>
<td>Intermediate and target code generation</td>
<td>3</td>
</tr>
<tr>
<td>Object file formats and optimization</td>
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<td>Mini languages</td>
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| Total hours: (equivalent to contact period)       | 30

Grading System
   □ Quantifiable (letters)  ■ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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Appendix 152

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<th>Journals</th>
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Bibliography:

Alfred V. Aho, Ravi Sethi, and Jeffrey D. Ullman, Compilers - Principles, Techniques and Tools, Addison-Wesley, 1986

According to Law 51

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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

Course Outcomes

Apply the basic concepts of compilation and translation
Knowledge of alternative algorithms used in the implementation of the various phases of a compiler
Explain the fundamental issues arising from the implementation of contemporary programming languages
Use these concepts in construction of a working compiler or interpreter
Ability to work in a team to implement a fully-functional compiler

Map to Program Outcomes

(a) (a) (e) (c) (d)

Person(s) who prepared this description and date of preparation: Bienvenido Vélez. Submitted by: Manuel Rodríguez, March 2007.
**General Information:**
- Alpha-numeric codification: ICOM 4035
- Course Title: Data Structures
- Number of credits: 4
- Contact Period: 3 hours of lecture and 2 hours of laboratory per week
- Required in ICOM

**Course Description:**
**English:** Data structures in programming languages; representation of information as data; lists in linear, orthogonal, string, and array form; tree structures; techniques for storage allocation, distribution, collection, and sorting of data.

**Spanish:** Estructuras de datos en lenguajes de programación; representación de información en forma de datos; listas de forma lineal, ortogonal, en sucesión y en arreglo; estructuras tipo árbol; técnicas para el almacenamiento, la distribución, la recolección y el

**Pre/Co-requisites and other requirements:**
- Pre-requisite: ICOM 4015 and MATE 3031

**Course Objectives:**
Students will learn how to implement fundamental data structures such as linked lists, hash tables, and trees. Using this knowledge, students will write programs whose major components are built using the data structures previously implemented.

**Instructional Strategies:**
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

**Minimum or Required Resources Available:**
Students will use the Departmental computer laboratories to complete course projects.

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
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<tbody>
<tr>
<td>Review of arrays, pointers, classes, inheritance and templates</td>
<td>3</td>
</tr>
<tr>
<td>Container classes: Vector, Bag, and Set</td>
<td>3</td>
</tr>
<tr>
<td>Discrete Mathematics: Induction and Basic Set Theory</td>
<td>2</td>
</tr>
<tr>
<td>Computational Complexity</td>
<td>3</td>
</tr>
<tr>
<td>Linked Lists</td>
<td>3</td>
</tr>
<tr>
<td>Stacks</td>
<td>2</td>
</tr>
<tr>
<td>Queues</td>
<td>2</td>
</tr>
<tr>
<td>Trees</td>
<td>5</td>
</tr>
<tr>
<td>Binary Search Trees</td>
<td>3</td>
</tr>
<tr>
<td>AVL-trees</td>
<td>2</td>
</tr>
<tr>
<td>B-trees</td>
<td>2</td>
</tr>
<tr>
<td>Maps and Hash Tables</td>
<td>3</td>
</tr>
<tr>
<td>Heaps and Priority Queues</td>
<td>3</td>
</tr>
<tr>
<td>Graphs and their implementation</td>
<td>2</td>
</tr>
<tr>
<td>Graph Traversal Algorithms</td>
<td>2</td>
</tr>
<tr>
<td>Sorting</td>
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</tr>
<tr>
<td>Exams</td>
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**Total hours: (equivalent to contact period)**  

<table>
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**Grading System**
- Quantifiable (letters)  
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the
This will be done within the first week of classes.

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<td>Oral Reports</td>
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<tr>
<td>Monographies</td>
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<td>Journals</td>
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</table>

Bibliography:


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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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</thead>
<tbody>
<tr>
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</tbody>
</table>

Course Outcomes

- Analyze techniques for data structure usage in computer applications. (a)
- Apply techniques for data structure usage in computer applications. (c)
- Analyze the behavior of different data structures. (a)
- Design different data structures. (c)

Person(s) who prepared this description and date of preparation: Manuel Rodríguez. Submitted by: Manuel Rodríguez, March 2007
General Information:
- Alpha-numeric codification: ICOM4036
- Course Title: Programming Languages
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in ICOM

Course Description:
Spanish: Estudio comparativo de estilos de programación, incluyendo Programación imperativa, de objetos, funcional, lógica y concurrente. Conceptos de encapsulación de datos y herencia. Especificación formal de la estructura sintáctica de un lenguaje. Gramáticas de contexto libre y árboles de análisis.

Pre/Co-requisites and other requirements:
- ICOM 4035

Course Objectives:
To teach students how to evaluate and understand a language based on its characteristics.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:
Course time frame and thematic outline

<table>
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<th>Outline</th>
<th>Contact Hours</th>
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<tr>
<td>Introduction</td>
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<tr>
<td>Syntactic structure</td>
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<td>Imperative Programming</td>
<td>6</td>
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<td>Object-oriented Programming</td>
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<td>Functional Programming</td>
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<td>Logic Programming</td>
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<td>Concurrent Programming</td>
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Total hours: (equivalent to contact period) 45

Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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<td>Short Quizzes</td>
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### Oral Reports

### Monographies

### Portfolio

- **Projects**  
  3-5  
  20%

### Journals

### Other, specify:

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**Contribution of Course to meeting the requirements of Criterion 5:**

<table>
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<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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</thead>
</table>

**Course Outcomes**

- Apply different programming languages paradigms.
- Ability to select appropriate programming languages for specific applications.
- Ability to evaluate features of different languages.
- Ability to design a simple scanner and parser.

**Map to Program Outcomes**

- (a)
- (k)
- (a)
- (c)

Person(s) who prepared this description and date of preparation: Bienvenido Vélez.

Submitted by: Manuel Rodríguez, March 2007
**General Information:**

- Alpha-numeric codification: ICOM 4048
- Course Title: Practical Experience in Computer Engineering
- Number of credits: 3
- Contact Period: Depends on the assignment
- Elective in ICOM

**Course Description:**

**English:** Provide the students with practical experience in Computer Engineering projects, in collaboration with private industry and government. The student's work will be supervised by a member of the department and by a professional with experience in supervisory positions in the agency or company. A written and oral report are required from the student at the end of the project. This course is available only to students working in private industry or governments as Coop or internship.

**Spanish:** Provee experiencia práctica en proyectos de Ingeniería de Computadoras al estudiante, en cooperación con la industria privada y gobierno. La labor del estudiante será supervisada por un miembro del departamento y un profesional con experiencia en posiciones de supervisión de la agencia o compañía. Un informe oral y escrito será requerido al estudiante al finalizar su proyecto. El curso estará disponible solo para estudiantes que están trabajando en la industria privada o gobierno en posiciones de Coop o internado.

**Pre/Co-requisites and other requirements:**

Consent of the Director of the Department.

**Course Objectives:**

Students will compare and contrast the theoretical aspects of computer engineering with the real world practice. They will apply the fundamental concepts taught in the classroom and recognize their value in real practice. Students will experience and be exposed to the practical aspects of computer engineering design.

**Instructional Strategies:**

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

**Minimum or Required Resources Available:**

**Course time frame and thematic outline**

<table>
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<th>Outline</th>
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**Grading System**

- Quantifiable (letters)
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the
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<table>
<thead>
<tr>
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<th>Engineering Topic</th>
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<tbody>
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</tbody>
</table>

Course Outcomes

- Apply computer engineering knowledge to conduct analysis and design of problems in a real engineering practice environment  
- Design and conduct experiments as well as analyze and interpret data in a real engineering practice environment  
- Design and analyze computer systems to meet an organizational need  
- Ability to participate and collaborate on multidisciplinary teams  
- Ability to communicate effectively in an organizational environment  
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice  
- Prepare work progress reports and document project work.

Person(s) who prepared this description and date of preparations: José Borges. Submitted by: Isidoro Couvertier, Comité Timón, October, 2007.
General Information:
- Alpha-numeric codification: ICOM 4066
- Course Title: Software Project Management
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in ICOM

Course Description:
English: Introduction to the concepts and techniques of project management for software systems. Discussion of issues related to planning, organization, and monitoring of all software life cycle phases. Topics on project management tools. Students will apply software management and assessment techniques.

Spanish: Introducción a los conceptos y técnicas de la administración de proyectos de software. Discusión de temas relacionados a la planificación, organización y monitoreo de todas las fases del ciclo de vida de los sistemas de software. Tópicos sobre herramientas de administración de proyectos. Los estudiantes podrán aplicar técnicas de gestión y evaluación de proyectos de software.

Pre/Co-requisites and other requirements:
- ICOM 4009

Course Objectives:
- Student will apply project management concepts to software projects, develop software plans, manage resources, identify and manage risks, estimate software projects, and monitor project status.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Overview of project management</td>
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<tr>
<td>Software Development models</td>
<td>3</td>
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<td>Initiation and Planning</td>
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<td>Estimation and scheduling</td>
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<td>Risk management</td>
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<td>Project personnel and organization</td>
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<td>Monitoring and control</td>
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Grading System
- Quantifiable (letters)
- Not Quantifiable

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<td>Oral Reports</td>
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<td>Portfolio</td>
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<td>Projects</td>
<td>variable</td>
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<td>Journals</td>
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<td>Other, specify:</td>
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</table>
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<table>
<thead>
<tr>
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<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

Course Outcomes

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Map to Program</th>
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</thead>
<tbody>
<tr>
<td>Describe the role of project managers and their importance to an organization.</td>
<td>(h)</td>
</tr>
<tr>
<td>Explain and understand the activities or tasks required to do a project.</td>
<td>(e)</td>
</tr>
<tr>
<td>Compare and contrast the different project organizational structures.</td>
<td>(a)</td>
</tr>
<tr>
<td>Compare and contrast the different software development models and identify those appropriate for the development of diverse software products and organizations.</td>
<td>(a)</td>
</tr>
<tr>
<td>Prepare a Work Breakdown Structure.</td>
<td>(e)</td>
</tr>
<tr>
<td>Prepare estimates of size and effort for a software project.</td>
<td>(e)</td>
</tr>
<tr>
<td>Analyze and develop schedules based on the CPM and Critical Chain methods.</td>
<td>(e)</td>
</tr>
<tr>
<td>Identify risks in a software project and formulate a management plan.</td>
<td>(e)</td>
</tr>
<tr>
<td>Recognize the important aspects of human resources management in a project context.</td>
<td>(h)</td>
</tr>
</tbody>
</table>

Person (s) who prepared this description and date of preparation: José Borges. Submitted by: José F. Vega, June, 20, 2008
**General Information:**
- Alpha-numeric codification: ICOM 4075
- Course Title: Fundamentals of Computing
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Required in ICOM

**Course Description:**
English: Discrete structures in computer sciences and engineering with emphasis on problem-solving skills and algorithms. Topics include: set theory, logic and proof techniques, graph theory, computability, and discrete probability applied to computing problems.

**Spanish**: Estructuras discretas en ciencia de computación e ingeniería con énfasis en destrezas de solución de problemas y algoritmos. Los temas incluyen: teoría de conjuntos, lógica y técnicas de demostración, teoría de grafos, computabilidad y probabilidad discreta aplicada a problemas de computación.

**Pre/Co-requisites and other requirements:**
- Pre-requisite: INGE 3016

**Course Objectives:**
Students will learn the fundamental mathematical and logical concepts and algorithms used in the modeling and analysis of computing systems.

**Instructional Strategies:**
- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

**Minimum or Required Resources Available:**
Students will use Departmental facilities to complete course homeworks.

**Course time frame and thematic outline**

<table>
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<th>Contact Hours</th>
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<tr>
<td>Proof techniques</td>
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<tr>
<td>Sets and set operations</td>
<td>2</td>
</tr>
<tr>
<td>Ordered structures: tuples and lists</td>
<td>4</td>
</tr>
<tr>
<td>Counting formulas and techniques</td>
<td>3</td>
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<tr>
<td>Graphs and trees</td>
<td>4</td>
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<td>Relations and functions</td>
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<td>2</td>
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<tr>
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<td>2</td>
</tr>
<tr>
<td>Topological sorting and well-founded orders</td>
<td>3</td>
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<tr>
<td>Inductively defined sets</td>
<td>2</td>
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<tr>
<td>Recursive functions</td>
<td>3</td>
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<td>Proofs by induction</td>
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**Grading System**
- Quantifiable (letters) [x] Not Quantifiable [ ]

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
Exams
Final Exam
Short Quizzes
Oral Reports
Monographies
Portfolio
Projects
Journals
Other, specify:

TOTAL: 100%

Bibliography:


According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Course Outcomes
-Understanding of models based on discrete mathematics. (a)
-Ability to design and analyze basic mathematical models for computing problems using discrete mathematics. (a)
-Ability to design and analyze mathematical proofs for computing problems. (a)

Person(s) who prepared this description and date of preparation: Jaime Seguel. Submitted by: Manuel Rodríguez, Jun 07
General Information:
- Alpha-numeric codification: ICOM 4215
- Course Title: Computer Architecture and Organization
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Required in ICOM and Elective in INEL

Course Description:
English: Architectural aspects of general purpose computers: instruction sets, addressing modes, data types, registers, support for programming languages and operating systems. Comparative study of commercial architectures. Organizational aspects of general purpose computers: central processing unit, control unit, microprogramming, arithmetic and logic units, memory systems, input/output systems.

Spanish: Aspectos arquitecturales de computadoras de propósito general: sets de instrucciones, modos de direccionamiento, tipos de datos, registros, apoyo para lenguajes de programación y sistemas operativos. Estudio comparativo de arquitecturas comerciales. Aspectos organizacionales de computadoras de propósito general: unidad central de procesamiento, unidad de control, microprogramación, unidades aritméticas y lógicas, sistemas de memoria, sistemas entrada/salida.

Pre/Co-requisites and other requirements:
- Prerequisite: INEL 4206

Course Objectives:
The objective is to provide the student with various architectural philosophies in defining hardware and software interface within a computer system. In addition, the student will learn how to design a simple CPU.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify: Team work in software and computer hardware design

Minimum or Required Resources Available:
Computer labs, high level languages compilers, simulator for digital systems.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction to computer architecture</td>
<td>5</td>
</tr>
<tr>
<td>2. RISC and CISC architectures</td>
<td>3</td>
</tr>
<tr>
<td>3. Contemporary RISC microprocessors</td>
<td>3</td>
</tr>
<tr>
<td>4. Data paths</td>
<td>1</td>
</tr>
<tr>
<td>5. Control unit</td>
<td>6</td>
</tr>
<tr>
<td>6. Microprogramming</td>
<td>3</td>
</tr>
<tr>
<td>7. Arithmetic units</td>
<td>3</td>
</tr>
<tr>
<td>8. Caches</td>
<td>2</td>
</tr>
<tr>
<td>9. Virtual memory</td>
<td>2</td>
</tr>
<tr>
<td>10. Project</td>
<td>15</td>
</tr>
<tr>
<td>11. Exams</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total hours:</strong> (equivalent to contact period)</td>
<td><strong>45</strong></td>
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</table>

Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
Final Exam 1 20
Short Quizzes
Oral Reports
Monographies
Portfolio
Projects 3 60
Journals
Other, specify:
TOTAL: 100%

Bibliography:

According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

Course Outcomes

- Describe different computer architectures  (a)
- Compare different computer architectures  (a)
- Design a computer program to simulate the operation of a simple CPU  (c)
- Design the hardware for a simple CPU  (c)
- Represent CPU specifications using RTN or Metalanguages  (k)
- Use a digital circuits simulator to test a CPU design  (k)

Person(s) who prepared this description and date of preparations: José Navarro. Submitted by: Isidoro Couvertier, Comité Timón, October 2007.
**General Information:**
- Alpha-numeric codification: ICOM/INEL 4308
- Course Title: Networking and Routing Fundamentals
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in INEL and ICOM

**Course Description:**
**English:** The terminology of computer networks and its protocols, IP protocol addressing, network design introduction, and networking standards will be studied. Several routing protocols will be introduced, studied, and configured.

**Spanish:** Se estudiará la terminología de redes de computadoras y sus protocolos, direccionamiento del protocolo IP, introducción al diseño de redes y estándares de redes. Se presentará, estudiará y configurará varios protocolos de enrutamiento.

**Pre/Co-requisites and other requirements:**
- Co-requisite: MATE 3063 Calculus III or equivalent for Engineering majors, or COMP 4006 Systems Organization and Programming for Arts and Sciences majors
- Pre-requisite: SICI 4088 Analysis, Design, and Management of an Information Network or equivalent for Business Administration majors.

**Course Objectives:**
After successfully completing this course, the student will be able to: apply the fundamentals of computer networks by designing a small network, configuring the devices and routing protocols to implement it, and test it in the laboratory.

**Instructional Strategies:**
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

**Minimum or Required Resources Available:**
A computer lab is required in order to administer the online assessments. Materials and tools such as CAT5 or above UTP cable, RJ45 connectors, wire strippers, wire cutters, crimping tools, cable testers, both male and female V.35 cables, and any other appropriate cables are also required. A computer that can be opened for show and tell is also needed. A working computer projector and a working computer are required in the classroom. A computer projector is also required in the lab. The networking lab requires at least six (6) routers, three (3) switches, and at least six (6) computer workstations. The routers need a minimum of one (1) FastEthernet interface and two (2) type V.35 serial cable interfaces. The routers need the capacity to run several routing protocols such as RIP v1 and v2, EIGRP, IS-IS, BGP, and OSPF and to handle at least the 801.1q standard. The switches must be able to handle at least the 801.1q standard and have no less than 12 ThinEthernet and two (2) FastEthernet LAN interfaces.

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networking Fundamentals</td>
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</tr>
<tr>
<td>Networking Media</td>
<td>3</td>
</tr>
<tr>
<td>Networking Standards</td>
<td>3</td>
</tr>
<tr>
<td>Ethernet Switching</td>
<td>3</td>
</tr>
<tr>
<td>TCP/IP Protocol Suite</td>
<td>2</td>
</tr>
<tr>
<td>IP Addressing and Routing</td>
<td>3</td>
</tr>
<tr>
<td>WANs and routers</td>
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</tr>
<tr>
<td>Routing and routing protocols</td>
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<td>Distance and Link state routing protocols</td>
<td>5</td>
</tr>
<tr>
<td>Controlling access to the router</td>
<td>5</td>
</tr>
<tr>
<td>Exams</td>
<td>6</td>
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</table>

**Total hours: (equivalent to contact period)**

**Grading System**
- Quantifiable (letters)
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
<table>
<thead>
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<th>Quantity</th>
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<tr>
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**Appendix**

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<th>Exams</th>
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<table>
<thead>
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<th>Short Quizzes</th>
<th>Quantity</th>
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<table>
<thead>
<tr>
<th>Oral Reports</th>
<th>Quantity</th>
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<table>
<thead>
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<table>
<thead>
<tr>
<th>Portfolio</th>
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<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Projects</th>
<th>Quantity</th>
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<table>
<thead>
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<tbody>
<tr>
<td>At least 1</td>
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</tbody>
</table>

**Bibliography:**


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**Contribution of Course to meeting the requirements of Criterion 5:**

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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<tbody>
<tr>
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<td></td>
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<td>✓</td>
</tr>
</tbody>
</table>

**Course Outcomes**

- Use basic procedures to design and implement a computer network.
- Configure the set of protocols needed for Internet connection
- Use basic procedures to test an Internet connection

**Map to Program Outcomes**

(a)

(b)

(e)

Person (s) who prepared this description and date of preparation: Isidoro Couvertier. Submitted by: Miguel Vélez, julio 07
### General Information:

- **Alpha-numeric codification:** ICOM 4995
- **Course Title:** Engineering Practice for COOP Students
- **Number of credits:** Zero to six credit hours. A minimum of two work periods is required for accreditation of the course, one of which must be a semester.
- **Contact Period:** Depends on the assignment
- **Elective in ICOM**

### Course Description:

**English:** Practical experience in computer engineering in cooperation with private industry or government to be jointly supervised by the academic department, the Co-op Program Coordinator, and an official from the cooperating organization.

**Spanish:** Experiencia practica en Ingenieria de Computadoras en cooperacion con la industria privada o gobierno a ser supervisada en conjunto por el departamento academic, el coordinador del programa COOP y un ofical de la organización cooperando.

### Pre/Co-requisites and other requirements:
- Consent of the Director of the Department.

### Course Objectives:

Students will compare and contrast the theoretical aspects of computer engineering with the real world practice. They will apply the fundamental concepts taught in the classroom and recognize their value in real practice. Students will experience and be exposed to the practical aspects of computer engineering design.

### Instructional Strategies:

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

### Minimum or Required Resources Available:

### Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Varies with assignment</td>
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</table>

**Total hours:** (equivalent to contact period)

### Grading System

- ✔ Quantifiable (letters)
- □ Not Quantifiable

### Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams</td>
<td></td>
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</tbody>
</table>
### Final Exam

- Short Quizzes
- Oral Reports
- Monographies
- Portfolio
- Projects
- Journals
- Other, specify:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Progress Report</td>
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<td>Supervisor Evaluation</td>
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<tr>
<td>Final Report</td>
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<td><strong>TOTAL:</strong></td>
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<td><strong>100%</strong></td>
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### Bibliography:

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### Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td>√</td>
</tr>
</tbody>
</table>

### Course Outcomes

- Apply computer engineering knowledge to conduct analysis and design of problems in a real engineering practice environment
- Design and conduct experiments as well as analyze and interpret data in a real engineering practice environment
- Design and analyze computer systems to meet an organizational need
- Ability to participate and collaborate on multidisciplinary teams
- Ability to communicate effectively in an organizational environment
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- Prepare work progress reports and document project work.

Person(s) who prepared this description and date of preparations: José Borges          Submitted by: Isidoro Couvertier, Comité Timón, October 2007
**General Information:**

<table>
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<th>Alpha-numeric codification: ICOM4998</th>
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<tbody>
<tr>
<td>Course Title: Undergraduate Research</td>
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<td>Number of credits: 3-6</td>
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<tr>
<td>Contact Period: 3 hours per week</td>
</tr>
<tr>
<td>Elective in ICOM</td>
</tr>
</tbody>
</table>

**Course Description:**

English: Participation, under the supervision of a faculty member acting as an investigator, in a research project.

Spanish: Participacion, bajo la supervision de un miembro de la facultad, en un proyecto de investigacion.

**Pre/Co-requisites and other requirements:**

Fourth or fifth year student and consent of the Director of the Department

**Course Objectives:**

Students will work under the supervision of a faculty member to define a research project, and then conduct experiments, field studies, and the necessary literature survey to complete a report on the project outcomes.

**Instructional Strategies:**

- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

**Minimum or Required Resources Available:**

Students will use Departmental computer laboratories to complete course projects.

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to research plan and strategies</td>
<td>6</td>
</tr>
<tr>
<td>Topics depending on specific research projects</td>
<td>37</td>
</tr>
<tr>
<td>Oral presentation and technical report</td>
<td>2</td>
</tr>
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<td>Total hours: (equivalent to contact period)</td>
<td>45</td>
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**Grading System**

- Quantifiable (letters)
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Item</th>
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<tbody>
<tr>
<td>Exams</td>
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<td></td>
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<tr>
<td>Final Exam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Quizzes</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Journals</td>
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<tr>
<td>Other, specify: Review of research papers</td>
<td>variable</td>
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</tr>
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</table>
Bibliography:
Depending on the specific research project

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<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

**Course Outcomes**

- Construct an appropriate hypothesis or problem statement
- Describe, select, and analyze an appropriate design plan for a given system or process
- Write and present a demonstration or technical paper in the area of research
- Review, analyze and discuss recent research papers in the field of discussion

**Map to Program Outcomes**

- (b)
- (c)
- (g)
- (i)

General Information:

Alpha-numeric codification: ICOM 5007
Course Title: Operating Systems
Number of credits: 4
Contact Period: 3 hours of lecture and three hours of laboratory per week
Required in ICOM

Course Description:


Spanish: Conceptos de Sistemas Operativos, Multiprogramacion, Multiprocesamiento- Miento, Procesamiento Por Lotes, Por Tiempo Compartido y Por Tiempo Real. Organizacion y Manejo de Sistemas de Archivo. Estudio de la Teoria de Colas y Del Control de Flujo de Informacion.

Pre/Co-requisites and other requirements:
Prerequisites ICOM4035, ICOM 4206

Course Objectives:

Students will gain an understanding of the various modules in an operating system, and their relationship with the underlying computer architecture. In addition, students will design and implement various software modules for a simple operating system.

Instructional Strategies:

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify: project

Minimum or Required Resources Available:

Students will use Departmental computer laboratories to complete course projects.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Introduction: operating system structures and function</td>
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</tr>
<tr>
<td>Processes, threads, and concurrency:</td>
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</tr>
<tr>
<td>Memory management and virtual memory</td>
<td>4.5</td>
</tr>
<tr>
<td>CPU scheduling</td>
<td>3</td>
</tr>
<tr>
<td>I/O management and the disk block cache</td>
<td>3</td>
</tr>
<tr>
<td>File systems</td>
<td>3</td>
</tr>
<tr>
<td>Distributed processing and network implementation</td>
<td>9</td>
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<tr>
<td>Security issues</td>
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<td>Project in-class reports (definition and requirements, design, implementation and verification)</td>
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<tr>
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Grading System

- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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According to Law 51
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Contribution of Course to meeting the requirements of Criterion 5:

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<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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<tbody>
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</table>

Map to Program Outcomes

Course Outcomes
Understand the different resource types of an operating system (a)
Analyze the differences between contemporary operating system structure (b)
Analyze the organization of a particular open source OS code and describe how it accommodates various platforms and I/O devices (b)
Program and analyze performance of representative concurrency examples (c)
Relate memory management techniques to process structure and reliable OS functioning (b)
Analyze a typical device driver, understanding methods to link it to the OS as a whole (b)
Program a threaded application in a language supporting monitors such as Java (c)
Relate system security aspects to OS internals (b)
Analyze malware and hacking attacks as they relate to OS (b)
Define, implement and test a significant OS project (c)
Coordinate group accomplishment of the project (d)

Person(s) who prepared this description and date of preparation: Thomas Noack. Submitted by: Manuel Rodríguez, March, 2007
General Information:
- Alpha-numeric codification: ICOM5015
- Course Title: Artificial Intelligence
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in ICOM

Course Description:
- English: An Introduction to The Field of Artificial Intelligence: LISP Language, search Techniques, Games, Vision,
  Representation of Knowledge, Inference and Process of Proving Theorems, Natural Language Understanding.
- Spanish: Introducción al Campo de la Inteligencia Artificial: Lenguaje Lisp, Técnicas de Búsqueda, Juegos, Visión,
  Representacion del Conocimiento, inferencia y Proceso de Prueba de Teoremas, Entendimiento de Lenguaje Natural.

Pre/Co-requisites and other requirements:
- Prerequisite ICOM4036

Course Objectives:
- Introduce the students to the fundamental concepts of artificial intelligence and provide them the ability to analyze and
design intelligent systems.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring

Minimum or Required Resources Available:

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
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<td>Programming in LISP language</td>
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<td>Problem representation and search techniques</td>
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<td>Search in game trees</td>
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<td>Vision: scene analysis and the blocks world</td>
<td>7</td>
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<td>Knowledge representation techniques</td>
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<td>Natural language understanding</td>
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<td>Application of AI in various fields</td>
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<td>Exams and discussions</td>
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Total hours: (equivalent to contact period) 45

Grading System
- ☑ Quantifiable (letters)
- ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the
evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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TOTAL: 100%

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Contribution of Course to meeting the requirements of Criterion 5:

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**Course Outcomes**

- Analyze and apply different search techniques
- Describe, analyze and apply techniques for constraint satisfaction problems
- Describe, analyze and apply knowledge representation techniques including semantic networks, propositional and first-order logic
- Describe, analyze and apply techniques for planning
- Describe, analyze and apply uncertain reasoning techniques
- Describe and explain learning algorithms
- Design an application of Artificial Intelligence
- Review and discuss current AI literature
- Write and present a demonstration of and a technical paper about the AI system designed

**Map to Program Outcomes**

(a) Analyze and apply different search techniques
(b) Describe, analyze and apply techniques for constraint satisfaction problems
(a) Describe, analyze and apply knowledge representation techniques including semantic networks, propositional and first-order logic
(a) Describe, analyze and apply techniques for planning
(a) Describe, analyze and apply uncertain reasoning techniques
(a) Describe and explain learning algorithms
(c) Design an application of Artificial Intelligence
(i) Review and discuss current AI literature
(g) Write and present a demonstration of and a technical paper about the AI system designed

Person(s) who prepared this description and date of preparation: José F. Vega. Submitted by: Manuel Rodríguez, June 07
**General Information:**

- Alpha-numeric codification: ICOM 5016
- Course Title: Database Systems
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in ICOM

**Course Description:**


**Pre/Co-requisites and other requirements:**
- Prerequisite ICOM 4035
- Co-requisite ICOM 5007

**Course Objectives:**
Students will learn how to develop database applications, starting with the E-R model, then mapping it to the relational model, and implementing this latter model with an application. Students will also gain an understanding of basic database management systems architectures.

**Instructional Strategies:**
- Conference
- Discussion
- Computation
- Laboratory
- Seminar with formal presentation
- Seminar without formal presentation
- Workshop
- Art workshop
- Practice
- Trip
- Thesis
- Special problems
- Tutoring
- Research
- Other, please specify:

**Minimum or Required Resources Available:**
Students will use the Departmental computer laboratories to complete course projects.

**Course time frame and thematic outline**

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<td>E-R Model and UML</td>
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<td>Relational Model and Algebra</td>
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<td>E-R to Relational Mappings</td>
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<td>Normalization and Integrity</td>
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<td>Storage and File Systems</td>
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<td>Indexing and Access Methods</td>
<td>2</td>
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<td>Query Evaluation and Optimization</td>
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<td>Transaction Processing</td>
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**Total hours: (equivalent to contact period)**

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**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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Bibliography:
Addison-Wesley, 2004

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Contribution of Course to meeting the requirements of Criterion 5:

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</table>

Course Outcomes

- Describe and analyze the E-R model for a given enterprise.  (a)
- Design an E-R Model from a set of customer requirements.  (c)
- Describe and analyze a relational schema that is compliant with a given E-R Model.  (a)
- Design a mapping of an E-R model into a relational schema.  (c)
- Use SQL to create a relational schema and formulate queries against it.  (c)
- Implement a relational application based an E-R model and its corresponding relational schema.  (e)

Person(s) who prepared this description and date of preparation: Manuel Rodríguez. Submitted by: Manuel Rodríguez, May 2007
General Information:

Alpha-numeric codification: ICOM5017
Course Title: System and Network Administration and Security
Number of credits: 3
Contact Period: 2 hours of lecture and three hours of laboratory per week
Elective in ICOM

Course Description:

English:
This course introduces and provides practical experience in system and network administration and security issues.

Spanish: Este curso introduce y provee una experiencia practica en la administracion de Sistemas de Redes y Temas de Seguridad.

Pre/Co-requisites and other requirements:
ICOM 5007 and INEL 4307 or relevant experience

Course Objectives:

Students will learn how to use the software tools developed for the administration of computer operating systems. In addition, students will learn how to develop countermeasures for security attacks.

Instructional Strategies:

conference  discussion  computation  laboratory

seminar with formal presentation  seminar without formal presentation  workshop

art workshop  practice  trip  thesis  special problems  tutoring

research  other, please specify:

Minimum or Required Resources Available:
Students will use Departmental computer laboratories to complete course projects.

Course time frame and thematic outline

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<th>Contact Hours</th>
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<td>Introduction to system administration</td>
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<tr>
<td>System, user, and file system configuration and backup</td>
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<tr>
<td>Installation, event logging and problem investigation</td>
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<td>Administering network configuration and services</td>
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<td>User services and maintenance</td>
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<tr>
<td>Cryptographic basics and secure socket and other layers</td>
<td>6</td>
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<td>Hacking methods, intrusion and virus countermeasures</td>
<td>9</td>
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<tr>
<td>Legal and ethical issues</td>
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Total hours: (equivalent to contact period) 45

Grading System

Quantifiable (letters)  Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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TOTAL: 100%
Bibliography:

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Contribution of Course to meeting the requirements of Criterion 5:

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</table>

Course Outcomes
- Perform basic system administration tasks (a)
- Install an operating system such as Linux or FreeBSD (b)
- Configure individual systems including network setup (b)
- Identify and become aware of the state-of-the-art of representative computer hardware (j)
- Obtain and select from various options for providing a service, for example electronic mail (a)
- Configure and update typical system services (a)
- Identify characteristics of a typical hacking attack (e)
- Perform forensic analysis of intrusion attempts using system tools (a)
- Relate ethical, legal and social issues to formulating system administration policies (f)
- Define, implement and test a significant project relating to system administration or security (c)
- Coordinate group accomplishment of the project (d)
- Prepare and give oral and written project reports (g)

Person(s) who prepared this description and date of preparation: Thomas Noack.
Submitted by: Manuel Rodríguez, March 2007
General Information:

- Alpha-numeric codification: ICOM 5018
- Course Title: Network Security and Cryptography
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in ICOM

Course Description:

English: Theoretical and practical aspects of Computer System and Network Security. Threat models and vulnerabilities of Computers Systems and Networks to attacks: hackers, malicious code, Trojan Horses, Viruses, and Worms. Methods and techniques to defend against attacks and minimize their damage. Cryptographic techniques, physical and operational security policies, and management related issues.

Spanish: Aspectos teoricos y practicos de seguridad de Computacion y Redes. Modelos de amenazas a la Seguridad, descripcicon y de cuan vulnerables son los sistemas de redes a ataques: Hackers, Codigo Malicioso, Caballos de Troya, Virus y "worms". Metodos y tecnicas para defender los sistemas de ataques y minimizar su potencial impacto. Tecnicas criptograficas, politicas operacionales de seguridad y temas relacionados sobre la administracion de sistemas.

Pre/Co-requisites and other requirements:

Prerequisite ICOM5007, INEL4307 or equivalent experience

Course Objectives:

Students will learn to identify security threats and the cryptographic algorithms used to protect computer data and network communications. Then, students will use these algorithms to develop schemes to protect computer systems against typical security threats.

Instructional Strategies:

- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research
- other, please specify:

Minimum or Required Resources Available:

Students will use Departmental computer laboratories to complete course projects.

Course time frame and thematic outline

<table>
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<th>Outline</th>
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<tr>
<td>Modern algebra and private-key cryptography</td>
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<td>Contemporary symmetric ciphers</td>
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<td>Number theory and public-key algorithms</td>
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<td>Key management and distribution</td>
<td>3</td>
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<td>Authentication, signature, and electronic commerce protocols</td>
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<tr>
<td>Secure layers in the protocol stack</td>
<td>6</td>
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<td>Security in applications, mail and web, Malware and countermeasures</td>
<td>6</td>
</tr>
<tr>
<td>Legal and Social Issues - Current legislation</td>
<td>3</td>
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<tr>
<td>Project presentations</td>
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Grading System

- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
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Contribution of Course to meeting the requirements of Criterion 5:
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<th>Math</th>
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<th>General</th>
<th>Engineering Topic</th>
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</table>

Course Outcomes
- Understand and contrast various symmetric algorithms (a)
- Understand computational complexity aspects of cryptographic and cryptoanalytic methods (a)
- Apply modern algebra and number theory to understanding of cryptographic algorithms and vulnerabilities (a)
- Analyze attacks, such as person-in-the-middle, on cryptosystems (b)
- Understand and analyze functionality and weaknesses of signature and authentication protocols (b)
- Describe and analyze key exchange protocols (a)
- Understand and analyze functionality and weaknesses of security layer protocols (c)
- Relate hacking and intrusion techniques to OS and network characteristics (a)
- Relate current legal and social issues to cryptographic applications and usage (j)
- Define, implement and test a significant project relating to cryptography or its application (e)
- Coordinate group accomplishment of the project (d)
- Prepare and give oral and written project reports (g)

Person(s) who prepared this description and date of preparation: Thomas Noack.
Submitted by: Manuel Rodríguez, March 2007
General Information:
Alpha-numeric codification: ICOM 5025  
Course Title: Object-Oriented Software Development  
Number of credits: 3  
Contact Period: 3 hours of lecture per week  
Elective in ICOM

Course Description:


Pre/Co-requisites and other requirements:
Pre-requisites: ICOM 4036

Course Objectives:
Students will learn techniques for object-oriented software design and apply these by completing the design of a software system during the course of the semester.

Instructional Strategies:
☒ conference ☐ discussion ☐ computation ☐ laboratory
☐ seminar with formal presentation ☐ seminar without formal presentation ☐ workshop
☐ art workshop ☐ practice ☐ trip ☐ thesis ☐ special problems ☐ tutoring
☐ research ☐ other, please specify:

Minimum or Required Resources Available:
Students will use Departmental computer laboratories to complete course projects.

Course time frame and thematic outline

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<td>Design principles</td>
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<td>Design patterns and software architectures</td>
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Grading System
☒ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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Bibliography:
Partha Kuchana, *Software Architecture Design Patterns in Java*, Auerbach, 2004
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Contribution of Course to meeting the requirements of Criterion 5:

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Course Outcomes

- Describe and analyze the UML and OO model for a given problem. (a)
- Design software from a set of customer requirements. (c)
- Design modules and test units for software system. (c)
- Use an OO language to implement and test software system. (e)

Person (s) who prepared this description and date of preparations: Manuel Rodríguez, June, 2008. Submitted by: Manuel Rodríguez, Committee Coordinador, June, 20, 2008.
Appendix

General Information:

- Alpha-numeric codification: ICOM 5026
- Course Title: Computer Networks
- Number of credits: 3
- Contact Period: 3 hours of lecture per week
- Elective in ICOM

Course Description:

**English:** Most relevant aspects of computer communication including the OSI and Internet layering models and networking protocols at Subnetwork, Network, Transport, and Application Layers. The course will also cover different Computer Networks media and standards as well as the software, hardware, and terminology associated with Data Communications.

**Spanish:** Aspectos mas importantes de la comunicación entre computadoras incluyendo modelos de capas OSI y del Internet y los protocolos de Redes en las capas de Subred, Red, Transporte y Aplicación. El curso cubrirá además diferentes medios y estándares aplicados a las redes de computadoras así Como el Software, Hardware y la terminología asociada con comunicaciones de datos.

Pre/Co-requisites and other requirements:

- Pre-requisite ICOM 5007.

Course Objectives:

- Students will learn about the Fundamental protocols for network design, implementation and testing. They will design secure network systems and analyze the performance of communication protocols.

Instructional Strategies:

- conference
- discussion
- computation
- laboratory

- seminar with formal presentation
- seminar without formal presentation
- workshop

- art workshop
- practice
- trip
- thesis
- special problems
- tutoring

- research
- other, please specify:

Minimum or Required Resources Available:

- Students will use the Departmental computer laboratories to complete homeworks.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Computer Networks</td>
<td>4</td>
</tr>
<tr>
<td>The Physical Layer</td>
<td>4</td>
</tr>
<tr>
<td>The Data Link Layer</td>
<td>8</td>
</tr>
<tr>
<td>The Medium Access Control Sublayer</td>
<td>7</td>
</tr>
<tr>
<td>The Network Layer</td>
<td>6</td>
</tr>
<tr>
<td>The Transport Layer</td>
<td>6</td>
</tr>
<tr>
<td>The Application Layer</td>
<td>2</td>
</tr>
<tr>
<td>Network Security</td>
<td>3</td>
</tr>
<tr>
<td>Review</td>
<td>3</td>
</tr>
<tr>
<td>Exam</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total hours: (equivalent to contact period)</strong></td>
<td>45</td>
</tr>
</tbody>
</table>

Grading System

- Quantifiable (letters) [ ] Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.
Bibliography:

According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

Course Outcomes
Describe the layered model in computer networks. (a)
Analyze the structure of computer networks. (a)
Analyze the protocols in computer networks. (a)
Evaluate the performance of protocols in computer networks. (a)
Find the networking standards through Internet. (j)

Person (s) who prepared this description and date of preparation: Yi Qian. Submitted by: Manuel Rodríguez, March 2007
General Information:
Alpha-numeric codification: ICOM5047
Course Title: Design Project in Computer Engineering
Number of credits: 3
Contact Period: 1 hour lecture, 4 hours laboratory per week
Required in ICOM

Course Description:
English: Capstone course in which student teams design a project to solve a complete Computer Engineering Problem considering engineering standards and realistic constraints. The project should integrate both hardware and software.
Spanish: Curso integrador en el cual equipos de estudiantes diseñan un proyecto para resolver un problema completo de Ingeniería de Computadoras, tomando en consideración estándares de ingeniería y restricciones realistas. El proyecto debe integrar conceptos de “hardware” y “software.”

Pre/co-requisites and other requirements:
(INEL4215 and ICOM5007) or consent of the Director of Department

Course Objectives:
After completing the course, students should understand and manage all aspects related to the solution of a problem in Computer Engineering, thus demonstrating the knowledge acquired in previous courses. The student should demonstrate his/her capability to solve a real engineering problem.

Instructional Strategies:
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring
- research

Minimum or Required Resources Available:
The course includes 4 hours of laboratory work per week for the development, modeling and implementation of the project, depending on its scope and nature.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Management and use of MS Project</td>
<td>3</td>
</tr>
<tr>
<td>Budgeting</td>
<td>1</td>
</tr>
<tr>
<td>Writing proposals</td>
<td>1</td>
</tr>
<tr>
<td>Teamwork</td>
<td>1</td>
</tr>
<tr>
<td>Effective meetings</td>
<td>1</td>
</tr>
<tr>
<td>Document and Information Management</td>
<td>1</td>
</tr>
<tr>
<td>Conflict Management</td>
<td>1</td>
</tr>
<tr>
<td>Oral Communications</td>
<td>1</td>
</tr>
<tr>
<td>Creativity</td>
<td>1</td>
</tr>
<tr>
<td>Report writing</td>
<td>1</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>1</td>
</tr>
<tr>
<td>New product development strategy</td>
<td>4</td>
</tr>
<tr>
<td>Ethics</td>
<td>2</td>
</tr>
<tr>
<td>Demonstrations</td>
<td>6</td>
</tr>
<tr>
<td>Oral presentations</td>
<td>6</td>
</tr>
<tr>
<td>Laboratory project work</td>
<td>44</td>
</tr>
<tr>
<td><strong>Total hours: (equivalent to contact period)</strong></td>
<td><strong>75</strong></td>
</tr>
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Grading System
- Quantifiable (letters)
- Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th></th>
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<th>Percent</th>
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<tbody>
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<tr>
<td>☑ Demonstration 2</td>
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<td>10%</td>
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<tr>
<td>☑ Final Demonstration</td>
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<tr>
<td>☑ Proposal</td>
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Appendix 186

<table>
<thead>
<tr>
<th>Progress Report</th>
<th>1</th>
<th>15%</th>
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</thead>
<tbody>
<tr>
<td>Project Report</td>
<td>1</td>
<td>20%</td>
</tr>
<tr>
<td>Attendance &amp; Punctuality</td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>Other (Specify): Discussion participation</td>
<td></td>
<td>5%</td>
</tr>
</tbody>
</table>

**TOTAL:** 100%

**Bibliography:**
- IEEE Standards.
- ISO Standards.
- Selected publications depending on project topic.

**According to Law 51**
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

**Contribution of Course to meeting the requirements of Criterion 5:**

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

**Course Outcomes**

<table>
<thead>
<tr>
<th>Identify a problem or opportunity for a computer engineering solution or innovation and define realistic and measurable objectives as well as detailed technical specifications with the user/customer or based on market expectations</th>
<th>(e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critically review and analyze literature related to and in the context of the problem defined, including prior work on the project or similar ones</td>
<td>(a)</td>
</tr>
<tr>
<td>Carry out a work breakdown structure for a project and organize the teamwork, assessing required effort, allocating time and assigning individual responsibilities</td>
<td>(d)</td>
</tr>
<tr>
<td>Identify, define and allocate the skills needed for the project, assessing current skills of team members and allocating resources for training, and learning or consultancy services as needed for the project</td>
<td>(i)</td>
</tr>
<tr>
<td>Identify and define technical resources needed for the project considering economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints</td>
<td>(c)</td>
</tr>
<tr>
<td>To compute the budget for the project, control and analyze expenditures</td>
<td>(c)</td>
</tr>
<tr>
<td>To define and apply metrics for measuring project progress, identify potential problems and actions to prevent, mitigate, compensate or correct them</td>
<td>(e)</td>
</tr>
<tr>
<td>Assess Intellectual Property potential of the project and its implications in such issues as patents, copyright, licensing, and marketing among others</td>
<td>(j)</td>
</tr>
<tr>
<td>To effectively present the project in detail and in summary, both orally and in writing to technical and non technical audiences</td>
<td>(g)</td>
</tr>
<tr>
<td>To assess the impact of the project in a global, economic, environmental, and societal context</td>
<td>(h)</td>
</tr>
<tr>
<td>To design, implement, test, and validate a system according to the definition of the problem and the project objectives, and specifications, incorporating appropriate engineering standards</td>
<td>(b)</td>
</tr>
<tr>
<td>To identify issues of the project related to the ethical and professional responsibility, analyzing and making decisions according to the corresponding codes</td>
<td>(f)</td>
</tr>
<tr>
<td>To identify, and use techniques, skills, and modern engineering tools necessary to productively collaborate and efficiently conduct the project to success</td>
<td>(k)</td>
</tr>
</tbody>
</table>

**Person(s) who prepared this description and date of preparation:** José F. Vega, Submitted by: José F. Vega August 2007, Isidoro Couvertier, Comité Timón, October 2007.
**General Information:**

- Alpha-numeric codification: ICOM 5217
- Course Title: MICROPROCESSOR INTERFACING
- Number of credits: 3
- Contact Period: 3 hours of lecture per week and 12 hours of laboratory in the semester
  - Elective in INEL, Required in ICOM

**Course Description:**

**English:** Development of micro-controller based systems for embedded applications. Interfacing to peripherals such as liquid-crystal displays (LCD), keypads, digital-to-analog and analog-to-digital converters, etc. Emphasizes hardware and software design. Requires a final project that consists in the development of a working prototype in the laboratory.

**Spanish:** Desarrollo de sistemas basados en micro-controladores para aplicaciones tipo embedded. Interconexión de periferales tales como pantallas de cristal líquido, teclados, sensores, convertidores análogo-digital, convertidores digital-análogo, etc. Énfasis en el diseño electrónico y programación. Requiere proyecto final que consiste en el desarrollo de un prototipo operacional en el laboratorio.

**Pre/Co-requisites and other requirements:**

INEL4206 Y INEL4207 or ICOM4055 and authorization of the Director of the Department.

Pre-requisite by topics:
- Logic circuit design, microprocessor systems design, A/D and D/A converters.

**Course Objectives:**

At the end of the course the students are expected to know how to specify, design, and prototype a microprocessor-based embedded system. To achieve this objective the students have to develop a semester-long project consisting of specifying, designing, and prototyping an embedded system solution to a real life problem.

**Instructional Strategies:**

- [ ] conference
- [x] discussion
- [x] computation
- [ ] laboratory
- [ ] seminar with formal presentation
- [ ] seminar without formal presentation
- [ ] workshop
- [ ] art workshop
- [ ] practice
- [ ] trip
- [ ] thesis
- [ ] special problems
- [ ] tutoring
- [ ] research
- [ ] other, please specify:

**Minimum or Required Resources Available:**

Laboratory work is considered a major part of the class, and all students are expected to participate by developing a prototype of their designs in the laboratory.

Radios, tape recorders, and other audio or video equipment are not permitted in the lab or classroom at any time.

Smoking is not permitted in any area other than those areas designated for smoking.

Laboratory Projects:

- Familiarization with programmable controllers. Demonstrations on how to use the equipment and applications. Small project in the form of assignment required.
- Familiarization with software development systems for embedded applications. Learning how to use debugging and measuring equipment.
- A final design project is required.

### Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to embedded systems design</td>
<td>3</td>
</tr>
<tr>
<td>Embedded microcontroller architecture</td>
<td>4</td>
</tr>
<tr>
<td>Bus Systems &amp; Input/Output Interfaces</td>
<td>5</td>
</tr>
<tr>
<td>Displays and Keypads</td>
<td>3</td>
</tr>
<tr>
<td>Interrupts</td>
<td>4</td>
</tr>
<tr>
<td>Timers and Applications</td>
<td>4</td>
</tr>
<tr>
<td>Analog to digital converters</td>
<td>2</td>
</tr>
</tbody>
</table>
Serial communication | 4 
| Memories and error correction | 4 
| DMA Controllers | 3 
| Design Technology in Embedded Systems | 3 
| Student Presentations | 2 
| Exams | 4 

Total hours: (equivalent to contact period) | 45

Grading System

☑ Quantifiable (letters) ☐ Not Quantifiable

Evaluation Strategies (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Percent</th>
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<tbody>
<tr>
<td>☑ Exams</td>
<td>1 20</td>
</tr>
<tr>
<td>☑ Final Exam</td>
<td>1 20</td>
</tr>
<tr>
<td>☑ Short Quizzes</td>
<td>0 0</td>
</tr>
<tr>
<td>☑ Oral Reports</td>
<td>1 10</td>
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<tr>
<td>☑ Laboratory Report</td>
<td>0 0</td>
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<tr>
<td>☑ Assignment</td>
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<td>☑ Projects</td>
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<tr>
<td>☐ Journals</td>
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</tr>
<tr>
<td>☐ Other, specify:</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL: 100%

Bibliography:


Driscoll, Coughlin, and Villanucci, “Data Acquisition and Process Control with the M68HC11”, Merrill 1994


MSP430x15x, MSP430x16x Mixed Signal Microcontroller Technical Data by Texas Instruments

SiLabs C8051F336 25 MIPS, 16 kB Flash, 10-Bit ADC, 20-pin Mixed-Signal MCU Data Manual

Microchip PIC18FXX2 High Performance, Enhanced FLASH Microcontrollers with 10-Bit A/D Data Sheet

According to Law 51

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Contribution of Course to meeting the requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
</table>

Course Outcomes
<table>
<thead>
<tr>
<th>Activity</th>
<th>Map to Program Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students conduct laboratory work to implement working prototype of project.</td>
<td>(b)</td>
</tr>
<tr>
<td>The students provide a final project of an original idea proposed by his or her group. Project implementation is a course requirement</td>
<td>(b)</td>
</tr>
<tr>
<td>Groups of two to four members work towards completion of the class project. Peer evaluation and an individual interview with the professor are required.</td>
<td>(d)</td>
</tr>
<tr>
<td>Each group must show originality in their work, the procedure to subdivide a complex problem in parts, and finally combining peer work into the final solution</td>
<td>(d)</td>
</tr>
<tr>
<td>Students will identify a problem where the skills in microprocessor interfacing could be applied</td>
<td>(e)</td>
</tr>
<tr>
<td>Their idea, along with a plausible procedure, is submitted by the working group in a proposal. The final report includes the explanation of the idea in the introduction part of the report</td>
<td>(e)</td>
</tr>
<tr>
<td>Project groups must offer an oral presentation and a written final report of their work</td>
<td>(g)</td>
</tr>
<tr>
<td>Oral presentation and working demonstration of the students work is open to the public, and therefore should be understandable for the interested parties. Mathematical derivation and technical content is allowed in oral presentations. Attendants to these sessions should at least understand why the derivation is needed although full comprehension is not expected.</td>
<td>(g)</td>
</tr>
<tr>
<td>Proposals for projects should reflect awareness of societal needs</td>
<td>(h)</td>
</tr>
<tr>
<td>Students should comment the impact to society reflected by acceptance of their design into society, impact in low skills personnel being replaced by their solution, impact to the environment, or benefits to the intended group of person</td>
<td>(h)</td>
</tr>
<tr>
<td>Student must include enough references to prove their ability to search for information. This information could be reflected in the theory part of the report, or in the finding of a technical tool or part not easily found in hardware store (as for example, an inductive sensor, or pneumatic valve)</td>
<td>(i)</td>
</tr>
<tr>
<td>Student should comment on different alternatives to solve their problem. These alternatives should include emerging technologies and their associated cost, although they might not be implemented</td>
<td>(j)</td>
</tr>
<tr>
<td>Student must be able to program a microcontroller using a development environment that includes debuggers, editing tools, compilers, among others. The microcontrollers used in class are considered state of the art</td>
<td>(k)</td>
</tr>
</tbody>
</table>

Person(s) who prepared this description and date of preparation: Manuel Jiménez. Submitted by: Manuel Jiménez, Isidoro Couvertier, Comité Timón, October 2007- Approved by: Comité Timón October, 16 2007
General Information:
Alpha-numeric codification: ICOM/INEL 5318
Course Title: Intermediate Routing, Switching, and Wide Area Networks
Number of credits: 3
Contact Period: 3 hours of lecture per week

Course Description:
English: Link state routing protocols and intermediate level concepts such as switching, wide area networks or WAN standards, virtual local area networks or VLAN, network design, and redundancy will be studied and configured. Strategies for managing and saving address space such as variable length subnet masks and network address translation will also be introduced and studied.

Spanish: Se estudiará y configurará protocolos de enrutamiento tipo estado del enlace y conceptos de nivel intermedio como conmutación, estándares de redes de área amplias o "WAN", redes de área local virtuales o "VLAN", diseño de redes y redundancia. Se presentará y estudiará además estrategias para manejar y ahorrar espacio de direcciones como submáscaras de largo variable y traducción de direcciones de red.

Pre/Co-requisites and other requirements:
Prerequisites: ICOM/INEL 4308 Networking and Routing Fundamentals or equivalent

Course Objectives:
After successfully completing this course, the student will be able to: Design, configure, and troubleshoot a local area network to satisfy the requirements of a small to medium size company making sure the design is efficient, scalable, accessible, and secure.

Instructional Strategies:
☒conference ☐discussion ☐computation ☐laboratory
☐seminar with formal presentation ☐seminar without formal presentation ☐workshop
☐art workshop ☐practice ☐trip ☐thesis ☐special problems ☐tutoring
☐research ☐other, please specify:

Minimum or Required Resources Available:
Access to a computer lab is required in order to administer the online assessments. A working computer projector and a working computer are required in the classroom. A computer projector is also required in the lab. The networking lab requires at least six (6) routers, at least three (3) switches, and at least six (6) computer workstations. The routers need a minimum of one (1) FastEthernet interface and two (2) type V.35 serial cable interfaces. The routers need the capacity to run several routing protocols such as RIP v1 and v2, EIGRP, IS-IS, BGP, and OSPF and to handle at least the 801.1q standard. The switches must be able to handle at least the 801.1q standard and have no less than 12 ThinEthnet and two (2) FastEthernet LAN interfaces.

Course time frame and thematic outline

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
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<tbody>
<tr>
<td>Classless Routing</td>
<td>2</td>
</tr>
<tr>
<td>Routing Protocols</td>
<td>3</td>
</tr>
<tr>
<td>Special Areas and Considerations</td>
<td>6</td>
</tr>
<tr>
<td>Switching Concepts and configuration</td>
<td>3</td>
</tr>
<tr>
<td>Virtual Local Area Networks</td>
<td>2</td>
</tr>
<tr>
<td>Scaling IP Addresses</td>
<td>3</td>
</tr>
<tr>
<td>WAN Technologies</td>
<td>3</td>
</tr>
<tr>
<td>WAN Design</td>
<td>2</td>
</tr>
<tr>
<td>WAN Standards</td>
<td>10</td>
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<tr>
<td>Introduction to Network Administration</td>
<td>5</td>
</tr>
<tr>
<td>Exams</td>
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<td>Total hours: (equivalent to contact period)</td>
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Grading System
☒Quantifiable (letters) ☐Not Quantifiable

Evaluation Strategies

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<th>Quantity</th>
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<tr>
<td>☐ Final Exam</td>
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<td>20</td>
</tr>
<tr>
<td>☐ Short Quizzes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 191

| Oral Reports |   |
| Monographies |   |
| Portfolio |   |
| Projects | 2 | 10 |
| Journals |   |
| Other, specify: Practical Exam | 2 | 30 |
| **TOTAL:** | 100% |

**Bibliography:**


**According to Law 51**

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

**Course Outcomes**

- Divide a major network into subnets of different sizes using VLSM. (a)
- Configure networking devices using concepts introduced or enhanced in this course. (c)
- Verify and troubleshoot routing protocols operation (e)
- Apply and troubleshoot key concepts, methods, and issues associated with routing and WANs (c)

Person (s) who prepared this description and date of preparation: Miguel Vélez, julio 07.
**General Information:**
- Alpha-numeric codification: ICOM5995
- Course Title: Special Problems
- Number of credits: 1-6
- Contact Period: 3 hours per week
- Elective in ICOM

**Course Description:**
- English: Research and special problems in Computer Engineering or related fields, open to outstanding Computer Engineering students
- Spanish: Investigaciones y problemas especiales en Ingeniería de Computadoras o áreas afines, abierto a estudiantes sobresalientes en Ingeniería de Computadoras

**Pre/Co-requisites and other requirements:**
- Consent of the Director of the Department

**Course Objectives:**
Students will work under the supervision of a faculty member to study a contemporary topic in Computer Engineering, and then define a project, conduct studies, and perform the necessary literature survey to complete a report on the project outcomes.

**Instructional Strategies:**
- conference
- discussion
- computation
- laboratory
- seminar with formal presentation
- seminar without formal presentation
- workshop
- art workshop
- practice
- trip
- thesis
- special problems
- tutoring

**Minimum or Required Resources Available:**
Students will use Departmental computer laboratories to complete course projects.

**Course time frame and thematic outline**

<table>
<thead>
<tr>
<th>Outline</th>
<th>Contact Hours</th>
</tr>
</thead>
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<tr>
<td>introduction and action plan</td>
<td>6</td>
</tr>
<tr>
<td>Topics depending on specific special problem</td>
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<tr>
<td>Oral presentation</td>
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</tr>
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**Grading System**
- Quantifiable (letters)
- Not Quantifiable

**Evaluation Strategies** (Suggested): The faculty member teaching the course will provide the student with the evaluation strategy he/she will be using throughout the semester. This will be done within the first week of classes.

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**Bibliography:**
Dependant of specific selected topic chosen by students.
According to Law 51
Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.

Contribution of Course to meeting the requirements of Criterion 5:

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**Course Outcomes**
- Identify, retrieve, and organize information related to the special problem
- Construct an appropriate hypothesis or problem statement
- Analyze, verify and validate experimental results
- Describe, select and analyze feasible alternatives to the solution of a special problem
- Write and present a demonstration or technical paper in the area of research

**Map to Program Outcomes**
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Person(s) who prepared this description and date of preparation: Wilson Rivera.
Submitted by: Manuel Rodríguez, March 2007
Course Syllabi of Supporting Departments

COURSE SYLLABUS

1. **Course Number and Title:** ECON 3021, Principles of Economics Microeconomics
   Three credit hours, Required course

2. **Catalog description:** Introduction to microeconomics emphasizing supply and demand, costs of production, and price and output determination under different market structures.

3. **Prerequisites:** None


5. **Course Learning Outcomes:** After completing the course, the student should be able to understand: how individual markets work, how firms make price and output decisions under different market conditions, the social and economic context of the national and global economy, how economics principles apply to everyday and business situations, how to employ economic principles to enhance critical-thinking skills, the ethics of academic research and policy recommendations, and should develop an interest in current economic affairs.

6. **Topics Covered:** The nature and method of economics, the economizing problem, supply and demand, the market system and the national and international economy, theory of production and costs, industrial organization, and equilibrium of the firm under different market structures.

7. **Class/Laboratory Schedule:** Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. **Course Number and Title**: ESPA 3101, Basic Course in Spanish I  
   Three credit hours, Required course

2. **Catalog description**: Practice in the critical reading of literary texts, the writing and editing of narrative texts; effective oral communication in Spanish.

3. **Prerequisites**: None

4. **Textbook(s) and/or Other Required Material**: Textbooks are at the option of each professor.

5. **Course Learning Outcomes**: After completing the course, the students will be able to identify, understand, and analyze the diverse literary genres; the basic concepts of textual and discourse structures of the literary and nonliterary texts; produce their own texts considering their communication objectives, and the readers to whom they would be directed. They will also practice strategies that will contribute towards effective communication; and also practice the interchange of ideas with a critic-constructive attitude, which will improve their use of the verbal and written Spanish.


7. **Class/Laboratory Schedule**: Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5**:

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10. **Person(s) who prepared this description and date of preparation**: 


1. **Course Number and Title:** ESPA 3102, Basic Course in Spanish II
   Three credit hours, Required course

2. **Catalog description:** Practice in the critical reading of essays, poetry, and drama; the writing and editing of expository texts; effective oral communication in Spanish

3. **Prerequisites:** ESPA 3101

4. **Textbook(s) and/or Other Required Material:** Textbooks are at the option of each professor.

5. **Course Learning Outcomes:** After completing the course, the students will be able to identify, understand, and analyze the diverse literary genres; the basic concepts of textual and discourse structures of the literary and nonliterary; the writing processes in the processing of literary and nonliterary text; and be able to produce their own texts.

6. **Topics Covered:** The exposition, essay analysis and discursive modality; the argumentation.

7. **Class/Laboratory Schedule:** Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. **Course Number and Title:** FISI 3171, Physics I  
Four credit hours, Required course

2. **Catalog description:** Principles of mechanics, waves, and thermodynamics for engineering and physical sciences

3. **Prerequisites:** MATE 3031 or MATE 3183 or MATE 3144

4. **Textbook(s) and/or Other Required Material:** Douglas C. Giancoli, *Physics for Scientists & Engineers*, Fourth Edition (2008), Addison-Wesley

5. **Course Learning Outcomes:** After completing the course, the student should be familiarized with the fundamental principles of mechanics of particles and rigid bodies, oscillatory and wave motion, and the principles of heat transfer and thermodynamics. The student should be able to apply these principles in solving problems at a level defined by the text selected for the course.


7. **Class/Laboratory Schedule:** Four hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
COURSE SYLLABUS

1. Course Number and Title: FISI 3172, Physics II.
Four credit hours, Required course

2. Catalog description: Principles of electricity, magnetism, optics, and modern physics for engineering and the physical sciences.

3. Prerequisites: FISI 3171 or FISI 3161

4. Textbook(s) and/or Other Required Material: Douglas C. Giancoli, *Physics for Scientists & Engineers*, Fourth Edition (2008), Addison-Wesley

5. Course Learning Outcomes: After completing the course, the student should be familiarized with the fundamental principles of electricity and magnetism, basic direct-current circuits, optics, and modern Physics. The student should be able to apply these principles in solving problems at a level defined by the text selected for the course.

6. Topics Covered: Electric field for point charges, Electric field for continuous charge distributions, Electric potential and potential difference, Capacitance and dielectrics, Electrostatic energy, Electrical conduction and resistance, Ohm’s law, Kirchhoff’s theorems for electric circuits, Direct current circuits, Energy and power in electric circuits, Force and torque on currents in magnetic fields, Sources of magnetic fields, Biot-Savart law, Magnetic induction. Faraday’s law, Lenz’s law, and Generators and motors.

7. Class/Laboratory Schedule: Four hours of lecture per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title:** FISI 3173, Physics Laboratory I  
   One credit hour, Required course

2. **Catalog description:** Experiments in mechanics, waves, and optics to complement the Physics I course

3. **Prerequisites:** FISI 3171 or FISI 3161

4. **Textbook(s) and/or Other Required Material:** López, Marrero y Roura, *Manual de Experimentos de Física I*, Primera Edición (2008), John Wiley & Sons

5. **Course Learning Outcomes:** The basic aims of the Laboratory are to have the student gain familiarity with a variety of instrument and to learn to make reliable measurements, represent data in useful graphic form and infer meaning from graphed data. The student should be able to make measurements of length, mass, temperature and angles using different instruments. After completing the experiments, the students should have gained a better understanding of some basic physical concepts and theories.


7. **Class/Laboratory Schedule:** A two-hour laboratory per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. **Course Number and Title:** FISI 3174, Physics Laboratory II
   One credit hour, Required course

2. **Catalog description:** Experiments in electricity, magnetism, and modern physics to complement the Physics II course

3. **Prerequisites:** FISI 3173 or FISI 3163. **Corequisite:** FISI 3172 or FISI 3162

4. **Textbook(s) and/or Other Required Material:** López, Marrero y Roura, Manual de Experimentos de Física I, Primera Edición (2008), John Wiley & Sons

5. **Course Learning Outcomes:** The basic aims of the Laboratory are to have the student gain familiarity with a variety of instruments and to learn to make reliable measurements. The students will be introduced to the oscilloscope, measured the rise time, amplitude and width of voltage pulses, AC and DC voltage. They will also have measured the resistance of a resistor and diode. After finishing all the experiments the students will have a better understanding of the behavior of resistors, capacitors, inductors and basic electric circuits. In this laboratory the students will also investigate some wave phenomena such as reflection, refraction, diffraction and polarization.


7. **Class/Laboratory Schedule:** A two-hour laboratory per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. **Course Number and Title:** GEOL 4015, Geology for Engineers  
Three credit hours, Required course

2. **Catalog description:** General principles of geology, with special emphasis on those aspects pertaining to engineering problems; study of common minerals and rocks; structural geology and geomorphology.

3. **Prerequisites:** QUIM 3001

4. **Textbook(s) and/or Other Required Material:** Edward J. Tarbuck, Frederick K. Lutgens, *Earth Science*, Eleventh Edition (2006), Prentice Hall

5. **Course Learning Outcomes:** The purpose of the course is to give civil engineering students a strong background in geology especially that which relates to civil engineering and social problems. The course seeks to provide skills in recognition of common earth materials and their engineering properties and insights into how the physical and chemical processes of the earth affect man and his civil infrastructure. By the end of this course, students will be able to recognize the geological conditions involved in civil engineering projects and the potential for these conditions to have adverse impact on the project. This will enable the student to choose the most applicable geotechnical solutions.

6. **Topics Covered:** Classification, formation and properties of earth materials (minerals, rocks, soil, water and air), Internal and external processes of the earth (tectonics and volcanism, weathering and erosion, rivers, oceans and glaciers), Geologic hazards (earthquakes, mass movements, floods, tsunamis and volcanoes)

7. **Class/Laboratory Schedule:** Two hours of lecture and one two-hour laboratory per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. **Course Number and Title:** INGE 3011, Engineering Graphics I  
Two credit hours, Required course


3. **Prerequisites:** None

4. **Textbook(s) and/or Other Required Material:** James Earle, *Graphics Technology*, Second Edition (2005), Addison-Wesley; James Earle, *Graphics & Geometry 3*, Creative Publishing. Supplies and material: Mechanical pencil .5mm, Erasers, Irregular curves, Compass, 45 and 30/60 degree Triangles, Protractors, Architect’s Scale, Civil Engineer’s Scale and Metric Scale.

5. **Course Learning Outcomes:** After completing the course, the student should be able to: Make sketches of conceptual products, Develop graphics solution to common geometrical problems, Make 2-D and 3-D Pictorial drawing whit a computer, Understand engineering drawings, Understand the engineering design process, Apply notes and dimensions, Communication of ideas,

6. **Topics Covered:**  

7. **Class/Laboratory Schedule:** One hour of lecture and two one-and one-half-hour laboratories per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. Person(s) who prepared this description and date of preparation:
1. Course Number and Title: INGE 3012, Engineering Graphics II
   Two credit hours, Required course

2. Catalog description: Underlying principles of the graphic language: fundamentals of delineation, analysis and solution of space problems, symbols and standards as applied to engineering, spatial geometry: distances between planes and lines, angles between lines and planes, rotation problems. Introduction to graphical mathematics and nomography.

3. Prerequisites: INGE 3011

4. Textbook(s) and/or Other Required Material: James Earle, Graphics Technology, Second Edition (2005), Addison-Wesley; James Earle, Graphics & Geometry 3, Creative Publishing. Supplies and material: Mechanical pencil .5mm, Erasers, Irregular curves, Compass, 45 and 30/60 degree Triangles, Protractors, Architect’s Scale, Civil Engineer’s Scale and Metric Scale.

5. Course Learning Outcomes: After completing the course the student should be able to apply the descriptive geometry basics on creative problem solution.


7. Class/Laboratory Schedule: Two two-hours of lecture drawing periods per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
1. Course Number and Title: INGE 3016, Algorithms and Computer Programming
   Three credit hours, Required course

2. Catalog description: Development of algorithms and their implementation in a structured high level language. Programming techniques applied to the solution of engineering and mathematical problems.

3. Prerequisites: MATE3031 or MATE 3144 or MATE 3183


5. Course Learning Outcomes: After completing the course, the student should be able to apply acquired computer programming skills to the solution of engineering problems. The student will be able to: Demonstrate ability to edit, compile, and run a simple computer program in C/Matlab/Visual Basic; Demonstrate ability to write a bugs-free computer program.


7. Class/Laboratory Schedule: Three hours of lecture per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
COURSE SYLLABUS

1. Course Number and Title: INGE 3017, Computed Aided Graphics
   Two credit hours, Required course

2. Catalog description: Fundamentals of computer aided graphics in engineering. Description of the equipment, use of commercial solid modeling programs, modeling of geometric figures and documentation.

3. Prerequisites: None

4. Textbook(s) and/or Other Required Material: Dr. Zhang, *Engineering Design and Pro/Engineering*, College House Enterprises, LLC.

5. Course Learning Outcomes: The course provides students the opportunity to develop the skills necessary to express engineering concepts graphically as two- or three-dimensional representations. Specifically, the student will be able to:
   - Draw 2-dimensional objects with sufficient skill and speed that the student will prefer to use a CAD program rather than draw the object using pencil, pen, and drafting board tools. Create 3-dimensional (solid-model) objects with sufficient skill and speed that the student will prefer to create the solid model first rather than draw the object in 2 dimensions. Determine the engineering characteristics of the object (having created a solid model). These characteristics include volume, surface area, centers of gravity, and moments of inertia. Create an assembly of various solid model parts. Create the documentation necessary for the backup of the electronic representation of the object. This documentation will include the hard copy of a 2-dimensional drawing showing required views of the object (top, front, side, sections, auxiliary, and isometric), notes, dimensions, tolerances, and title block. Properly dimension, annotate, and present views in a manner that is in accordance with accepted graphics practice.

6. Topics Covered: Review of computer, server, and plotter hardware basics; Review of 2D CAD techniques; Plotting procedures; Introduction to Solid Modeling: Relationship and importance of solid modeling to CAM (Computer-Aided Manufacturing), Universal coordinate system, Maneuvering objects in space, Creating solid primitives, Creating solids with extrude and revolve, Modifying solids with union and subtract, Creating assemblies with individual models; Creating of documentation.

7. Class/Laboratory Schedule: Two two-hour of lecture laboratory per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
1. Course Number and Title: INGE 3031, Engineering Mechanics Statics  
Three credit hours, Required course

2. Catalog description: Analysis of force systems; the laws of equilibrium; analysis of simple structures; distributed loads; friction; centroids and moments of inertia.

3. Prerequisites: MATE 3031 or MATE 3144 or MATE 3183


5. Course Learning Outcomes: Upon successful completion of this course the student shall be able to: Describe position, forces, and moments in terms of vector forms in two and three dimensions. Determine rectangular and nonrectangular components of a force. Determine the resultant of a system of forces. Simplify systems of forces and moments to equivalent systems. Draw complete free-body diagrams and write appropriate equilibrium equations from the free-body diagram, including the support reactions on a structure. Apply the concepts of equilibrium to evaluate forces in trusses, frames, machines, and cables. Determine the internal forces in a structure. Analyze systems that include frictional forces. Calculate centers of gravity and centroids, and moments of inertia by integration and the use of parallel axis theorem.


7. Class/Laboratory Schedule: Three hours of lecture per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title:** INGE 3032, Engineering Mechanics Dynamics. 
Three credit hours, Required course

2. **Catalog description:** Kinematics of particles and rigid bodies; relations among force, mass and acceleration; kinetics of particles and rigid bodies; work and energy; impulse and momentum.

3. **Prerequisites:** INGE 3031 and (FISI 3161 or FISI 3171)


5. **Course Learning Outcomes:** Upon successful completion of this course the student shall be able to: Determine the kinematics relationships between position, velocity, and acceleration for two-dimensional motion of systems of particles and rigid bodies. Calculate the velocity and acceleration of a particle in rectangular, polar and normal/tangential coordinate systems. Relate the velocity and acceleration of points in a rigid body using the absolute and relative motion approaches. Determine the mass moments of inertia of rigid bodies. Draw free body and kinetic diagrams for particles and rigid bodies. Apply Newton's second law in two dimensions. Analyze the two dimensional motion of particles and rigid bodies using: principle of work and energy; impulse and momentum, both linear and angular.

6. **Topics Covered:** Kinematics of Particles: Position, Velocity and Acceleration, Rectilinear Motion, Curvilinear Motion, Relative Motion; Kinematics of Rigid Bodies: Translation and Rotation, General Plane Motion; Kinetics of Particles-Newton’s Laws: Equations of Motion for a Single Particle and a System of Particles, Rectilinear Motion, Curvilinear Motion; Work and Energy Method for Particles; Impulse and Momentum for Particles; Kinetics of Rigid Bodies: Equations of Motion, Inertia Quantities, Plane Motion; Work and Energy Methods for Rigid Bodies in Plane Motion; Impulse and Momentum of Rigid Bodies.

7. **Class/Laboratory Schedule:** Three hours of lecture per week

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10. **Person(s) who prepared this description and date of preparation:**
1. Course Number and Title: INGE 3035, Engineering Mechanics
   Three credit hours, Required course

2. Catalog description: Analysis of force systems; the laws of equilibrium; friction; centroids and moments of inertia. Kinematics and dynamics of particles and rigid bodies.

3. Prerequisites: MATE 3031 or MATE 3144 or MATE 3183. Corequisite: FISI 3161 or FISI 3171


5. Course Learning Outcomes: After completing the course, the student should be able to: Describe position, forces, and moments in terms of vector forms in two and three dimensions. Determine rectangular and nonrectangular components of a force. Determine the resultant of a system of forces. Simplify systems of forces and moments to equivalent systems. Draw free body and kinetic diagrams for particles and rigid bodies. Compute support reactions on a structure. Analyze systems that include frictional forces. Calculate centers of gravity and centroids. Determine the kinematics relationships between position, velocity, and acceleration for two-dimensional motion of systems of particles and rigid bodies. Calculate the velocity and acceleration of a particle in rectangular and normal/tangential coordinate systems. Relate the velocity and acceleration of points in a rigid body using the relative motion approach. Determine the mass moments of inertia of rigid bodies. Apply Newton's second law in two dimensions. Analyze the two dimensional motion of particles and rigid bodies using the work and energy principle.

6. Topics Covered: General principles; Vector operations; Concurrent force systems; Equilibrium of particle; Equivalent force and moment systems; Distributed forces, centroids, and center of gravity; Equilibrium of rigid bodies. Kinematics of Particles; Kinetics of Particles: Newton's Laws; Equation of Motion; Kinetics of Particles: Work and Energy Methods; Kinematics of Rigid Bodies; Kinetics of Rigid Bodies: Newton's laws; Kinetics of Rigid Bodies: Work and Energy Methods.

7. Class/Laboratory Schedule: Three hours of lecture per week

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10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title:** INGE 3045, Materials Science for Electrical Engineers
Three credit hours, Required course

2. **Catalog description:** Principles that determine the properties of conductors, semiconductors, and insulators. Electromechanical properties; diffusion, electrical conduction, thermal conduction; magnetic and optical properties.

3. **Prerequisites:** QUIM 3002. **Corequisite:** FISI 3162 or FISI 3172

4. **Textbook(s) and/or Other Required Material:** Donald R. Askeland, Pradeep Phule, *The Science and Engineering of Materials*, Fifth Edition, Thomson Books

5. **Course Learning Outcomes:** After completing the course, the student should be able to: Characterize structure-property performance relationship. Identify the structure of different types of materials. Describe mechanical, thermal, electrical, and magnetic behavior of metals, polymers, and ceramics. Select materials such as conductors, semiconductors, insulators, magnetic and electro-optic materials for various electric and electronic applications.


7. **Class/Laboratory Schedule:** Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title:** INGE/INME 3809, Creative Design I  
   Three credit hours, Required course

2. **Catalog description:** Introduction to the underlying principles and methodologies of engineering graphics communications, as a tool for the solution of engineering problems: Fundamentals of graphic visualization, sketching, PC-based Computer-Aided-Design (CAD), and technical presentations. An introduction to computer-aided-design software will include principles of parametric solid modes of mechanical parts and assemblies including dimensions and tolerances. Solid modeling is the tool for visualization, and analysis of engineering problems.

3. **Prerequisites:** None


5. **Course Learning Outcomes:** After completing the course, the student should be able to: Work with engineering drawings. Be able to communicate ideas graphically. Identify the engineering design process. Develop graphics solutions through commercial software tools to engineering problems. Be proficient in using commercial software in computer-aided drafting.

6. **Topics Covered:** Introduction to engineering design, Fundamentals of 3-dimension sketching, Introduction to CAD software (2 and 3 dimensional), Creation of solid models of parts, Creation of assemblies of model parts, Creation of documentation drawings, Creation and orientation of drawing views, Fundamentals of dimensioning and tolerancing, Reading engineering drawings, Design projects, Oral defense of project to class.

7. **Class/Laboratory Schedule:** Two hours of lecture and one two-hour laboratory per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. **Course Number and Title:** INGE 4001, Engineering Materials
   Three credit hours, Required course

2. **Catalog description:** A study of the basic principles that govern the properties and behavior of engineering materials; atomic structures, interatomic forces, amorphous and crystalline structures; phase transformations; mechanical properties; the study of the capabilities and limitations of different materials; metals, polymers, ceramics and composites; introduction to corrosion.

3. **Prerequisites:** (QUIM 3002 or QUIM 3042) and (FISI 3161 or FISI 3171)

4. **Textbook(s) and/or Other Required Material:** Donald R. Askeland, Pradeep Phule, *The Science and Engineering of Materials*, Fifth Edition, Thomson Books

5. **Course Learning Outcomes:** After completing the course, the student should be able to: characterize structure-property-performance relationship, distinguish the structure of different types of materials, specify microstructure of an alloy from phase diagrams, select materials for various engineering applications, establish how failures occur in materials and how to prevent them, describe corrosion of materials and how to prevent it.


7. **Class/Laboratory Schedule:** Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. Course Number and Title: INGE 4011, Mechanics of Materials I
   Three credit hours, Required course

2. Catalog description: Stresses and strains due to axial, torsional, and bending loads; shear and moment diagrams.

3. Prerequisites: INGE 3031 and (MATE 3032 or MATE 3184)


5. Course Learning Outcomes: Upon completion of this course, the student shall be able to: Define the concepts of stress, strain due to elastic and plastic deformations. Identify the mechanical properties of Materials. Apply Hooke’s law and know its limitations. Calculate stress (normal and shear) in a structure component loaded in various ways. Analyze axially loaded members. Use stress concentration factors to find stresses in axially loaded members. Analyze deformations in structures due to thermal effects. Determine stresses and/or strains in torsional member. Write equations of shear and bending moment in terms of position and draw the corresponding diagrams for beams subjected to some combination of concentrated loads, distributed loads, and moments. Calculate normal and shearing stresses in beams. Design members using strength criteria.


7. Class/Laboratory Schedule: Three hours of lecture per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title:** INGE 4012, Mechanics of Materials II
   Three credit hours. Required course

2. **Catalog description:** Analysis of statically determinate and indeterminate beams; stresses due to combined loads; stress and strain transformation; column theory.

3. **Prerequisites:** INGE 4011 and (MATE 3063 or MATE 3185)


5. **Course Learning Outcomes:**
   Upon completion of this course, the student shall be able to: Calculate the principal stress and strains in a structure loaded in various ways. Solve problems using stress transformation and Mohr’s circle. Apply Hooke’s law for plane stress and plane strain. Calculate stresses in thin-walled spherical or cylindrical pressure vessels. Calculate the stresses produced by combined axial, bending and torsional loads. Calculate the deflections of statically determinate beams, using the elementary differential equations of the deflection curve, superposition, moment-area method, energy methods, and Castigliano’s theorem. Calculate the reactions and deflections of statically indeterminate beams, using the solution of the elementary differential equation of the deflection curve, and superposition. Apply Euler’s equation to solve buckling and stability problems for various end conditions. Analyze columns subjected to eccentric axial loads.


7. **Class/Laboratory Schedule:** Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. Course Number and Title: INGE 4015, Fluid Mechanics
   Three credit hours, Required course

2. Catalog description: Elements of mechanics of fluids and fluid statics. Development of the fundamental equations of fluid mechanics and its applications. Introduction to dimensional analysis and similitude. Motion of ideal and real fluids including internal and external viscous flows. Introduction to the use of hydraulic machinery.

3. Prerequisites: INGE 3032 and (MATE 3063 or MATE 3185)


5. Course Learning Outcomes: The Fluid Mechanics course aims at the following educational objectives: Knowledge and understanding of the definitions of the most important fluid properties in engineering applications. Develop understanding and providing analytical tools to solve problems of forces on submerged surfaces. Develop basic understanding of the fundamental equations of fluid mechanics. Apply the fundamental equations of fluid mechanics to solve fluid flow problems including: Analysis and design of simple pipe systems; Analysis of hydrodynamic forces in submerged objects; Introduction of turbomachinery in fluid systems.


7. Class/Laboratory Schedule: Three hours of lecture per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
COURSE SYLLABUS

1. **Course Number and Title:** INGE 4016, Fluid Mechanics Laboratory
   One credit hour, Required course

2. **Catalog description:** Laboratory work supplementing classroom instruction in mechanics of fluid phenomena, measuring devices and techniques, and the testing of fluid machinery.

3. **Prerequisites:** None, **Corequisite:** INGE 4015

4. **Textbook(s) and/or Other Required Material:** Walter Silva, *Fluid Mechanics Laboratory Manual*

5. **Course Learning Outcomes:** Experimentation, observation, and analysis of physical phenomena in Fluid Mechanics. Training students in measurement of the physical properties of fluids. Provide experience in collection, analysis, interpretation, and presentation of experimental data. Precision analysis and equipment limitations.

6. **Topics Covered:** Hydrostatic forces on submerged surfaces, Error analysis and uncertainty in experimental measurements, Discharge and flow velocity measurements, Friction losses in closed conduits, Boundary layer flow, Drag forces in submerged bodies, Hydraulic turbomachinery (pumps/turbines), Sharp crested weirs, Isentropic flow in nozzles, Hydraulic jump.

7. **Class/Laboratory Schedule:** One three-hour laboratory period per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. **Course Number and Title:** INGL 3101-3102, Basic Course in English
   Three credit hours per semester, Required course

2. **Catalog description:** This course is designed to meet the student's immediate needs, and to give him or her a command of the fundamental structure of the English language. The oral approach is used. Skills in reading and writing are developed. Students will be grouped according to their ability to use the language, and arrangements will be made to give additional help to those students who show poor preparation in English.

3. **Prerequisites:** Placement by examination or INGL 0066


5. **Course Learning Outcomes:** By the end of these courses, students will be able to overcome their affective barriers to successful language learning and increase their motivation to acquire English and take more responsibility for their own success in a more student-centered classroom, increase English proficiency in all language areas: listening, reading, speaking and writing; increase their awareness of and sensitivity to social and cultural information conveyed in the texts they hear or read.

6. **Topics Covered:** Readings. Verb Grammar – Affirmative, negative, interrogative sentences for: Simple Present, Present Continuous, Simple Past, Past Continuous and Future with *be going to* and *will*. Modals/Modal-like forms – Affirmative, negative, interrogative sentences for: *have to* (present, past, future), *used to*, present (modal + base) – *may, can, could, would, should, must,* and *will*. Conditional sentences – real condition with future result: *If + past, (then) future* and present imaginary condition (hypothetical or contrary to fact). Passive sentences, Modals and Adjective clauses.

7. **Class/Laboratory Schedule:** Three hours of lecture per week, supplemented by work in the language laboratory, each semester.

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. Course Number and Title: INGL 3103, Intermediate English I
   Three credit hours, Required course

2. Catalog description: Analysis of selected readings, such as essays, fiction, poetry or drama, and practice in writing compositions with attention given as needed to grammar and idiomatic expressions.

3. Prerequisites: Placement by examination

4. Textbook(s) and/or Other Required Material: Aaron, J.E. (2005). 40 Model Essays: A Portable Anthology, Bedfords/St. Martin’s; Raimes, A., Keys for Writers, Fourth Edition (2005), Houghton Mifflin, Co.; Handouts (given by the Instructor); English and/or Bilingual (English/Spanish) Dictionary.

5. Course Learning Outcomes: At the end of class discussions and the completion of various writing assignments with the effective application of the writing process, students will demonstrate that they are: Critical thinkers, Active readers, Competent writers, Effective communicators.

6. Topics Covered: Steps of the writing process, Methods of development, Research, Language use (grammar), Literary analysis.

7. Class/Laboratory Schedule: Three hours of lecture per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title:** INGL 3104, Intermediate English II
Three credit hours, Required course

2. **Catalog description:** Analysis of selected readings, such as essays, fiction, poetry or drama, and practice in writing compositions with attention given as needed to grammar and idiomatic expression.

3. **Prerequisites:** INGL 3103


5. **Course Learning Outcomes:** After completing the course, the student should be able to: Apply the various stages of the writing process to his or her written work, including pre-writing, drafting, proofreading, peer editing, and publishing. Recognize distinct genres of literature, including short stories, poetry, and plays, as well as elements that distinguish each genre or are common across them. Analyze and interpret reading selections critically for understanding and as a basis for discussion in their own writing. Narrow a topic and compose an effective thesis statement. Write effective and engaging introductory, transitional, and concluding paragraphs. Demonstrate correct usage of MLA documentation with general formatting, in-text citations, and the Works Cited page. Conduct on-line and library-based research to support their course-based writing. Produce one multimodal text drawing on Web-based and other digital technologies.

6. **Topics Covered:** Steps of the writing process, Methods of development, Research, Language use (grammar), Literary analysis.

7. **Class/Laboratory Schedule:** Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. Course Number and Title: INGL 3201-3202, English Composition and Reading
   Three credit hours per semester, Required course

2. Catalog description: Practice in writing compositions and making oral reports upon selected readings, including essays, short stories, poems, dramas and novels. Attention will be given as needed to grammar and idiomatic expressions. This course or its equivalent is a requisite for graduation.

3. Prerequisites: INGL 3102 or placement by examination


5. Course Learning Outcomes: By the end of this course sequence, students will be able to do the following composition skills: utilize one or more prewriting techniques, narrow a topic, state an author’s intended meaning and purpose; write and effective thesis statement and recognize such statements when they are present in texts they encounter; provide relevant and supporting details for all general statements in their essays; effectively organize the content of their own essays and recognize the organizational structure of essays assigned for reading (outlining and summarizing are recommended as two useful techniques for developing organizational skills); write effective introductory, developmental, and concluding paragraphs in their essays; carry out elementary tasks involving the use of the library and the internet; summarizing, paraphrasing; use of quotations, and use of the Internet.

6. Topics Covered: The writing process, Prewriting skills, Writing essays, Revision - peer response groups, Short readings, Poetry, Drama, Novels.

7. Class/Laboratory Schedule: Three hours of lecture per week each semester

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title**: INGL 3211, Advanced English I  
   Three credit hours, Required course

2. **Catalog description**: Development of reading, discussion, and writing skills through the experience, interpretation, and evaluation of short story, modern drama, poetry, and the essay. Introduction to library skills related to literary study.

3. **Prerequisites**: Placement by College Board Achievement Exam


5. **Course Learning Outcomes**: By the end of this course, students will be able to analyze, judge critically, summarize, formulate hypotheses, consider alternatives, and distinguish between feelings and reasons, develop a personal philosophy of life, one that will make them feel, not only a part of their community but also a part of the world.

6. **Topics Covered**: Reading and discussion, Writing, Research.

7. **Class/Laboratory Schedule**: Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5**:

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10. **Person(s) who prepared this description and date of preparation:**
1. Course Number and Title: INGL 3212, Advanced English II
   Three credit hours, Required course

2. Catalog description: Development of reading, discussion, and writing skills through the experience, interpretation, and evaluation of the novel, Shakespearean drama, and the complex texture of poetry. A research paper related to literary study will be required.

3. Prerequisites: INGL 3211


5. Course Learning Outcomes: By the end of this course, students will be able to analyze, judge critically, summarize, formulate hypotheses, consider alternatives, and distinguish between feelings and reasons; develop a personal philosophy of life, one that will make them feel, not only a part of their community but also a part of the world.

6. Topics Covered: Reading and discussion, Writing, Research.

7. Class/Laboratory Schedule: Three hours of lecture per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title:** MATE 3005, Pre-Calculus  
   Five credit hours, Required course

2. **Catalog description:** A preparatory course for calculus including topics in relations, functions, complex numbers, linear algebra, trigonometry and analytic geometry.

3. **Prerequisites:** None

4. **Textbook(s) and/or Other Required Material:** Larson and Hostetler, *Precalculus*, Houghton Mifflin

5. **Course Learning Outcomes:** After completing this course, the student should be able to domain algebraic procedures like exponential rules, simplification of algebraic and rational expressions; evaluate a function and obtain inverse values; identify the domain and values campus of a function; construct and interpret linear graphics and function tables; potentials, polynomials, exponentials, logarithmic, and trigonometric; identify characteristics of graphs, such as intercepts, maxima and minima, continuity and symmetry; identify the characteristics of the matrices and determinants, and use them to resolve system of equations; recognize arithmetic and geometric series; resolve logarithmic and trigonometric equations; write correctly the trigonometric form of a complex number; use the De Moivre Theorem to find the roots of a complex number; use the Binomial Theorem.

6. **Topics Covered:** Real numbers, exponentials and radicals, algebraic expressions, equations, complex numbers, inequalities, rectangular coordinates (distance, mean point, graphics and symmetry); function definition, graphic functions, quadratic functions, operations with functions, inverse functions, polynomial function, graphics of degree 2 or greater, polynomial division, zeros of a polynomial, real and complex zeros, rational functions, exponential functions, natural exponential functions, logarithmic functions, properties of a logarithm, exponential and logarithmic equations, angles, trigonometric functions and graphics of trigonometric equations, triangle rectangle applications, trigonometric identities, sum and difference formulas, formulas for double and half triangle, inverse trigonometric functions, Sine Law, Cosine Law, trigonometric form of complex numbers, De Moivre Theorem, roots of complex numbers, system of equations with two and more variables, partial fractions, determinants, infinite series, summatory notation, arithmetic and geometric series, Binomial Theorem, parabola, ellipse and hyperbola in the origin.

7. **Class/Laboratory Schedule:** Five hours of lecture per week.

8. **Contribution of Course to Meeting the Requirements of Criterion 5**

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10. **Person(s) who prepared this description and date of preparation**
COURSE SYLLABUS

1. Course Number and Title: MATE 3031. Calculus I, Four credit hours
   Four credits, Required course

2. Catalog description: Elementary differential and integral calculus of one real variable with applications

3. Prerequisites: MATE 3005 or MATE 3143 or MATE 3172 or MATE 3174

4. Textbook(s) and/or Other Required Material: James Stewart, *Calculus: Early Transcendentals*, Sixth Edition (2008), Thompson Educational

5. Course Learning Outcomes: After completing the course, the student should be able to: Understand the concept of limit of a function. Understand the concept of continuity of a function. Understand the definition of derivative, rules of derivation and applications. Analyze and describe the properties and behavior of functions. Understand the definition of integral, and its relationship to derivative through the Fundamental Theorem of Calculus. Use various methods of integration.

6. Topics Covered: Limits, continuity and derivatives of functions of one variable. Integration of functions of one variable and applications.

7. Class/Laboratory Schedule: Four hours of lecture per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

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10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title:** MATE 3032. Calculus II, Four credit hours
   Four credits, Required course

2. **Catalog description:** Integration techniques, infinite series, vectors, polar coordinates, vector functions, and quadric surfaces; applications

3. **Prerequisites:** MATE 3031 or MATE 3183 or MATE 3144

4. **Textbook(s) and/or Other Required Material:** James Stewart, *Calculus: Early Transcendentals*, Sixth Edition (2008), Thompson Educational

5. **Course Learning Outcomes:** After completing the course, the student should be able to: Apply the idea of integration in the solution of different problems. Recognize and solve separable differential equations and applications. Determine convergence of sequences and infinite series. Master the idea of vectors and their properties. Graph functions of two variables and quadratic equations. Understand vector functions, their derivatives and integrals.


7. **Class/Laboratory Schedule:** Four hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. **Course Number and Title:** MATE 3063. Calculus III, Three credit hours
   Three credits, Required course

2. **Catalog description:** Differential and integral calculus of several variables, and an introduction to differential equations with applications

3. **Prerequisites:** MATE 3032 or MATE 3184

4. **Textbook(s) and/or Other Required Material:** James Stewart, *Calculus: Early Transcendentals*, Sixth Edition (2008), Thompson Educational

5. **Course Learning Outcomes:** After completing the course, the student should be able to work with integral calculus for functions of multiple variables.

6. **Topics Covered:** Functions of several variables, their graphs, level sets. Differential calculus of functions of several variables. Optimization with and without restrictions: Lagrange multipliers. Integral calculus of functions of several variables. Line and surface integrals. Green, Stokes and Divergence theorems.

7. **Class/Laboratory Schedule:** Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. **Course Number and Title:** MATE 3171, Precalculus I  
   Three credit hours, Required course

2. **Catalog description:** Properties and operations of real numbers; equations and inequalities; Cartesian coordinates and graphs; algebraic, exponential, and logarithmic functions and their graphs; trigonometry of right triangles.

3. **Prerequisites:** Placement by examination

4. **Textbook(s) and/or Other Required Material:** Larson and Hostetler, *Precalculus*, Houghton Mifflin

5. **Course Learning Outcomes:** After completing the course, the student should be able to: Perform algebraic procedures that require manipulation of algebraic and rational expressions, as well as expressions which involve exponential and logarithmic functions. Identify the domain and range of a function. Evaluate a function and given a value in the range, obtain its pre-image. Recognize algebraically and graphically when a function is invertible, and find the inverse and its graph. Construct and interpret graphs of important functions such as: linear, quadratic, polynomial, exponential, logarithmic, etc. Identify characteristics of the graphs of functions: Intercepts, maxima and minima, symmetry, asymptotes. Interchange different representational forms of functions. Know attributes of different families of functions: Shape of graph, characteristic properties, common applications. Apply transformations to the graph of a function: Horizontal and vertical translations, reflections with respect to the axis and the origin. Perform arithmetic manipulations that require the concept of function. Compute and recognize the composition of functions.

6. **Topics Covered:** Properties of real numbers, negative numbers, fractions; sets; intervals; absolute value; distance in the numerical line. Exponents; radicals; scientific notation. Arithmetic operations with algebraic expressions; special products; factorization. Rational expressions, cancellation, arithmetic operations, rationalization. Equations, inequalities. Coordinate geometry; distance formula; mid-point; graphs; circles; symmetries. Lines, functions, graphic representation of functions. Applications of functions, transformations. Combining functions.

7. **Class/Laboratory Schedule:** Three hours of lecture per week.

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

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10. **Person(s) who prepared this description and date of preparation:**
1. Course Number and Title: MATE 3172. Precalculus II
   Three credit hours, Required course

2. Catalog description: Analytic trigonometry; complex numbers; the fundamental theorem of algebra; conic sections; systems of equations; matrices operations; sequences; and mathematical induction.

3. Prerequisites: MATE 3171 or MATE 3173

4. Textbook(s) and/or Other Required Material: Larson and Hostetler, Precalculus, Houghton Mifflin

5. Course Learning Outcomes: After completing the course, the student should be able to: Use trigonometric functions to: solve triangles, prove identities, solve equations and to represent complex numbers. Sketch and recognize the graphs of trigonometric functions. Sketch and recognize the graphs of conic sections. Solve systems of linear equations and represent them using matrices. Use sequences and series.

6. Topics Covered: Analytic Geometry; Complex number; Fundamental Theorem of Algebra; Conic sections; Systems of equations, sequences and mathematical induction.

7. Class/Laboratory Schedule: Three hours of lecture per week

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</tr>
</tbody>
</table>

10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title:** MATE 4009, Ordinary Differential Equations  
   Three credit hours, Required course

2. **Catalog description:** Ordinary differential equations with applications: basic existence theorem, linear systems, Laplace transform, series solutions, introduction to Fourier series and orthogonal functions.

3. **Prerequisites:** MATE 3063 or MATE 3185

4. **Textbook(s) and/or Other Required Material:** Morris Tenenbaum and Harry Pollard, *Ordinary Differential Equations*, Dover Publications

5. **Course Learning Outcomes:** After completing the course, the student should understand how to use differential equations as a modeling tool. The student should be able to solve ordinary differential equations.


7. **Class/Laboratory Schedule:** Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
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</tbody>
</table>

9. **Relationship of Course to Program Outcomes:**

<table>
<thead>
<tr>
<th>a</th>
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</tbody>
</table>

10. **Person(s) who prepared this description and date of preparation:**
1. **Course Number and Title:** MATE 4061, Numerical Analysis I  
   Three credit hours, Required course

2. **Catalog description:** Roots of equations, interpolation and approximation procedures, numerical integration, numerical solution of initial value problems for ordinary differential equations of first and second order, direct and iterative methods for solving systems of linear equations.

3. **Prerequisites:** (MATE 3063 or MATE 3185) and (MATE 3010 or INGE 3016 or COMP 3010)

4. **Textbook(s) and/or Other Required Material:** Richard L. Burden and J. Douglas Faires, *Numerical Analysis*, Eighth Edition (2005), Thomson Educational

5. **Course Learning Outcomes:** After completing the course, the student should be able to select and apply the most appropriate numerical solution method.


7. **Class/Laboratory Schedule:** Three hours of lecture per week

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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9. **Relationship of Course to Program Outcomes:**

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</table>

10. **Person(s) who prepared this description and date of preparation:**
COURSE SYLLABUS

1. Course Number and Title: MATE 4145, Linear Algebra and Differential Equations
Four credit hours, Required course


3. Prerequisites: MATE 3063 and either COMP 3010 or INGE 3016


5. Course Learning Outcomes: After completing the course, the student must be able to:
Use basic matrix operations (addition, multiplication, inverse, transposed, etc.) to solve engineering problems. Use linear algebra concepts (vector spaces, dimension, sets, etc.) to solve ordinary differential equations problems. Effective use of software packages to solve problems of differential equations and linear algebra. Use linear algebra methods to solve systems of differential equations. Use differentials equations to develop engineering problems models and their solutions.


7. Class/Laboratory Schedule: Three hours of lecture and one two-hour laboratory per week

8. Contribution of Course to Meeting the Requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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</table>

10. Person(s) who prepared this description and date of preparation:
COURSE SYLLABUS

1. Course Number and Title: QUIM 3131, General Chemistry I.
   Three credit hours, Required course


3. Prerequisites: None. Corequisites: QUIM 3133 and (MATE 3171 or MATE 3005 or MATE 3143).

4. Textbook(s) and/or Other Required Material: Kotz, J.C., Treichel, P.M., Weaver, G.R., Chemistry and Chemical Reactivity, Sixth Edition (2006), Thomson Learning

5. Course Learning Outcomes: After completing the course, the student should able to demonstrate an understanding of the following: The scientific method, the properties of matter, the unit systems associated with scientific measurements, the uncertainty associated with measurements. Describe the atoms, electrons, protons, neutrons, isotopes and ions. Basic concepts related to stoichiometry and chemical equations. Basic concepts related to modern theory of atomic structure.

6. Topics Covered: Introduction to Chemistry; atoms, molecules, and ions; Stoichiometry I: Equations, the mole, and chemical formulas; Stoichiometry II: Chemical Reactions in Solution; Electronics in the Atom; Periodic Trends of the Elements; The Chemical Bond; Molecular Geometry and Theories of Bonding.

7. Class/Laboratory Schedule: Three hours of lecture per week.

8. Contribution of Course to Meeting the Requirements of Criterion 5:

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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9. Relationship of Course to Program Outcomes:

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</table>

10. Person(s) who prepared this description and date of preparation:
1. **Course Number and Title:** QUIM 3132, General Chemistry II. Three credit hours, Required course

2. **Catalog description:** Introduction to thermodynamics, solutions, kinetics, chemical equilibrium, oxidation-reduction. Electrochemistry.

3. **Prerequisites:** QUIM 3001 or (QUIM 3131 and QUIM 3133). **Corequisite:** QUIM 3134

4. **Textbook(s) and/or Other Required Material:** Kotz, J.C., Treichel, P.M., Weaver, G.R., *Chemistry and Chemical Reactivity*, Sixth Edition (2006), Thomson Learning

5. **Course Learning Outcomes:** After completing the course, the student should be able to: describe the behavior of gases, identify the different intermolecular forces, describes the properties of liquids and their relations with the intermolecular forces.

6. **Topics Covered:** Gases, liquids and solids, acids, bases, salts and buffers, solutions, chemical kinetics, chemical equilibrium, and electrochemistry.

7. **Class/Laboratory Schedule:** Three hours of lecture per week.

8. **Contribution of Course to Meeting the Requirements of Criterion 5:**

<table>
<thead>
<tr>
<th>Math</th>
<th>Basic Science</th>
<th>General</th>
<th>Engineering Topic</th>
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9. **Relationship of Course to Program Outcomes:**

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10. **Person(s) who prepared this description and date of preparation:**
Appendix B – Faculty Resumes

APONTE, ERICK

Academic rank: Assistant Professor

Degrees with fields, institution, and date:

<table>
<thead>
<tr>
<th>Degree</th>
<th>Field</th>
<th>Institution</th>
<th>Date</th>
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<tbody>
<tr>
<td>BE</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico, Mayaguez, P.R.</td>
<td>94-97</td>
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<tr>
<td>MENG</td>
<td>Electric Power Eng.</td>
<td>Rensselaer Polytechnic Institute, Troy, NY</td>
<td>97-98</td>
</tr>
<tr>
<td>DENG</td>
<td>Electric Power Eng.</td>
<td>Rensselaer Polytechnic Institute, Troy, NY</td>
<td>00-05</td>
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</table>

Faculty service at UPRM:

Date of original appointment: January 1999

Dates of advancement in rank:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Instructor</td>
<td>1998-2000</td>
</tr>
<tr>
<td>Leave of Absence D.Eng</td>
<td>2000-2005</td>
</tr>
<tr>
<td>Assistant Professor</td>
<td>2006 to present</td>
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</table>

Total years of service: 2.5

Areas of professional expertise:

Distributed Generation, Islanding, DG Systems Dynamics, Optimization Techniques

Other related experience—academic or industrial:

Consulting, patents:

State(s) in which registered:

Principal publications of last five years: (FY 2002-2003-2007-2008)

Time Optimal Load Shedding for Distributed Power Systems [IEEETPRWS]. 02/2006

Grants or externally funded project active during the last five years: (FY2002-2003-2007-2008):

DOE Solar Decathlon 2007

Scientific and professional societies of which a member:

IEEE

Honors and awards:

Gates Millennium Scholarship Program [2000-2004]

Institutional and professional service in the last five years: (FY2002-2003-2007-2008)


Professional development activities in the last five years: (FY2002-2003-2007-2008)

Career Development for New Engineering Faculty [2/2007]

Professional Development Center New Faculty Orientation [8/2006]

ABET Accreditation Workshop [4/2006]
Offered Courses in the past two years (2006-2008)


ARBONA-FAZZI, JAIME A.

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

<table>
<thead>
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<th>Degree</th>
<th>Field</th>
<th>Institution</th>
<th>Date</th>
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<tr>
<td>BS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico</td>
<td>1967</td>
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<tr>
<td>MS</td>
<td>Electrical Engineering</td>
<td>Texas A. &amp; M. University</td>
<td>1969</td>
</tr>
<tr>
<td>Ph. D.</td>
<td>Electrical Engineering</td>
<td>University of Arkansas</td>
<td>1972</td>
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</table>

**Faculty service at UPRM:**

**Date of original appointment:** June 1967

**Dates of advancement in rank:**

- Instructor: 1967 to 1971
- Assistant Professor: 1971 to 1974
- Associate Professor: 1974 to 1980
- Professor: 1980 to present

**Total years of service:** 36

**Areas of professional expertise:**

- Analog and digital electronics, circuit analysis, design of electrical power systems

**Other related experience—academic or industrial:**

- Assistant Research Coordinator, College of Engineering, UPRM, 1972-73
- Consulting, patents:
  - Design of electrical systems for high-rise apartment buildings and housing developments. (1978-present)
  - Consultant to Digital Equipment Corp., training on computer mainframe related subsystems to staff engineers.

**State(s) in which registered:**

- Puerto Rico

**Principal publications of last four years:** (FY 2002-2003-2007-2008)

- None.

**Grants or externally funded project active during the last four years:** (FY 2002-2003-2007-2008)

- None.

**Scientific and professional societies of which a member:**

- PR College of Engineers and Surveyors (CIAPR)
- PR Electrical Engineers Society (SIEPR)

**Honors and awards:**

- BSEE Magna Cum Laude, UPR, 1967
- HKN, Tau Beta Pi

**Institutional and professional service in the last four years:** (FY 2002-2003-2007-2008)

- None.

**Professional development activities in the last four years:** (FY 2002-2003-2007-2008)

- None.

**Offered Courses in the past two years (2005-2008)**

- INEL 3105 Electrical Systems Analysis, INEL 4076 Fundamentals of Electronics, INEL 4201 Electronics, INEL 4202 Electronics II, INEL 5206 Digital Systems Design,

**Community service activities:** (FY 2002-2003-2007-2008)

- None
ARROYO-FIGUEROA, JAVIER A.

**Academic rank:** Associate Professor

**Degrees with fields, institution, and date:**

<table>
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<tr>
<td>BS</td>
<td>Computer Engineering</td>
<td>University of Puerto Rico, Mayagüez Campus</td>
<td>1990</td>
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<td>MS</td>
<td>Electrical Engineering</td>
<td>University of Florida</td>
<td>1992</td>
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<td>Ph. D.</td>
<td>Computer Engineering</td>
<td>University of Florida</td>
<td>1997</td>
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**Faculty service at UPRM:**

**Date of original appointment:** May 1990

**Dates of advancement in rank:**

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<tr>
<td>Instructor</td>
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<tr>
<td>Assistant Professor</td>
<td>1997 to 2001</td>
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<td>Associate Professor</td>
<td>2001 to present</td>
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<tr>
<td>Total years of service</td>
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</table>

**Areas of professional expertise:**

Distributed Systems, Databases, Software Engineering

**Other related experience—academic or industrial:**

2005-2006. Senior Member of the Technical Staff, Commoca, Inc., Mayagüez, Puerto Rico

2001-present. President, Entevia Corporation, Mayagüez, Puerto Rico

2003. Technology Director, Tecnium Products Corp., Mayagüez, Puerto Rico


2001. Panelist, Science Foundation of Ireland


**Consulting, patents:**


2004. Commoca, Inc. Consulting on application development for IP telephony

2001-2002. PRSoft, Inc. San Juan, P.R. Consulting on software development and software process improvement

1992-97. Party City of Puerto Rico, San Juan, P.R. Consulting on hardware/software acquisition.

**State(s) in which registered:**

Puerto Rico, Licence #21438 EIT

**Principal publications of last four years: (FY2002-2003-2007-2008)**


**Grants or externally funded project active during the last four years: (FY 2002-2003-2007-2008)**


**Scientific and professional societies of which a member:**

Institute of Electrical and Electronics Engineers, Member

**Honors and awards:**

None.
Institutional and professional service in the last four years: (FY 2002-2003-2007-2008)

2003. University of Puerto Rico, Mayagüez Campus. Development of GESTA (Generador de Estadísticas de Tarea Académica), a system for the generation of statistics on academic load.


Professional development activities in the last four years: (FY 2002-2003-2007-2008)

Offered Courses in the past two years (2005-2008)

- ICOM 4009 Software Engineering
- ICOM 4015 Advanced Programming


Voluntary Programmer, Development of Database for Misión Rescate, Inc. (a drug rehabilitation institution)
BEAUCHAMP, GERSON

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

<table>
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<tr>
<th>Degree</th>
<th>Field</th>
<th>Institution</th>
<th>Date</th>
</tr>
</thead>
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<tr>
<td>BS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico at Mayagüez</td>
<td>1984</td>
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<tr>
<td>MS</td>
<td>Electrical Engineering</td>
<td>Georgia Institute of Technology</td>
<td>1985</td>
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<tr>
<td>Ph. D.</td>
<td>Electrical Engineering</td>
<td>Georgia Institute of Technology</td>
<td>1990</td>
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</table>

**Faculty service at UPRM:**

- **Date of original appointment:** January 1984
- **Dates of advancement in rank:**
  - Instructor: 1984 to 1990
  - Assistant Professor: 1990 to 1993
  - Associate Professor: 1993 to 1998
  - Professor: 1998 to Present
- **Total years of service:** 29

**Areas of professional expertise:**

- Control Systems, Computer Control of Dynamical Systems

**Other related experience—academic or industrial:**

- **August 1993 – May 1994,** Special Assistant to the Engineering Dean, UPRM
- **December 1991 – July 1997,** Project Coordinator, PR-AMP Pre-College Engineering Program
- **Summer 1986,** Technical Support Engineer, Photosystems and Electronic Products Department, E.I. DuPont de Nemours and Company, Parlin, NJ
- **Summer 1985,** Technical Support Engineer, Photosystems and Electronic Products Department, E.I. DuPont de Nemours and Company, Parlin, NJ (GEM Summer Intern)
- **Summer 1984,** Technical Support Engineer, Engineering Development Laboratory, E.I. DuPont de Nemours and Company, Wilmington, DE (GEM Summer Intern)
- **Consulting, patents:** None
- **State(s) in which registered:** None

**Principal publications of last five years:** (FY 2002-2003-2007-2008)

**Grants or externally funded project active during the last five years:** (FY 2002-2003-2007-2008)

**Scientific and professional societies of which a member:**

- Institute of Electrical and Electronics Engineers (IEEE), Member
- American Society for Engineering Education (ASEE), Member
- Instrument Society of America (ISA), Member

**Honors and awards:**

- IEEE Student Chapter, UPR-RUM, Recognition Plaque for his unconditional, voluntary and committed help to IEEE Student Chapter, December 6, 2001
- Tutors and Participants of the Pre-College Engineering Program, Recognition Plaque, July 1997.
- Participants of the Pre-College Engineering Program, Recognition Plaque, July 1994, September 1993, July 1992
- Xerox Corporation and Georgia Tech Student Chapter of the Society of Hispanic Professional Engineers, 1989 Civic Contribution Award, 1989
- Sigma Xi Scientific Research Honor Society, Elected Associate Member, 1989
- National Hispanic Scholarship Fund, Fellowship, 1986
- UPR-Mayagüez, Georg Simon Ohm Prize to the Best Graduating Electrical Engineering Student, June 1984
- UPR-Mayagüez, Graduated, Magna Cum Laude, June 1984
Institutional and professional service in the last five years: (FY 2002-2003-2007-2008)

Professional development activities in the last five years: (FY 2002-2003-2007-2008)

Offered Courses in the past two years (2005-2007)

INEL 4102 Electrical Systems Analysis II, INEL 4505 Introduction to Control Systems, INEL 4998 Undergraduate Research, INEL 5505 Linear System Analysis, INEL 5508 Digital Control Systems, INEL 5995 Special Problems, INEL 6001 Feedback Control System I.

# Appendix 240

**BORGES, JOSÉ**

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

<table>
<thead>
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<th>Degree</th>
<th>Field</th>
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<th>Date</th>
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<td>BS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico at Mayagüez</td>
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<tr>
<td>MS</td>
<td>Electrical Engineering</td>
<td>Georgia Institute of Technology</td>
<td>1979</td>
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<tr>
<td>MS</td>
<td>Computer Engineering</td>
<td>Syracuse University</td>
<td>1982</td>
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<td>Ph.D.</td>
<td>Computer Science</td>
<td>University of Illinois at Urbana-Champaign</td>
<td>1990</td>
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**Faculty service at UPRM:**

**Date of original appointment:** August, 1982

**Dates of advancement in rank:**

- Assistant Professor: 1982 – 1991
- Associate Professor: 1991 – 1996
- Professor: 1996 – present

**Total years of service:** 25

**Areas of professional expertise:**

Human-Computer interaction, usability engineering, object-oriented development, medical informatics

**Other related experience—academic or industrial:**

1979 – 1982  Senior Associate Engineer, IBM Poughkeepsie NY

**Consulting, patents:**

None

**State(s) in which registered:**

None

**Principal publications of last four years: (FY 2002-2003-2007-2008)**

2. Néstor J. Rodríguez, José A. Borges, Gilberto Crespo, Carlos Pérez, Carlos Martínez, Celia R. Colón-Rivera, Aixa Ardín, Tablet PC vs. PDA: A Usability Study of Nurses’ Interaction with Two Versions of a Nursing Documentation Application. IASTED International Conference on Human Computer Interaction (IASTED-HCI 2007) (Accepted for publication).

**Grants or externally funded project active during the last four years: (FY 2002-2003-2007-2008)**

None
Scientific and professional societies of which a member:
None

Honors and awards:
None

Institutional and professional service in the last four years: (FY 2002-2003-2007-2008)
None

Professional development activities in the last four years: (FY 2002-2003-2007-2008)
Usability Engineering Tools, tutorial at CHI Conference, 2005
Software Project Management, course in Washington, DC 2004

Offered Courses in the past two years (2005-2008)
INEL 4076 Fundamentals of Electronics, ICOM 4066 Software Project Management, ICOM 4995 Engineering Practice Coop, ICOM 6089 Object Oriented Software Design, ICOM 6117 Usability Engineering, ICOM 6998 Master's Project, ICOM 6999 Master's Thesis, ICOM 6115 Microwave Active Circuits, INTD 4995 Plan Coop Int.

None
CARO MORENO, JUAN

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

<table>
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<tr>
<th>Degree</th>
<th>Field</th>
<th>Institution</th>
<th>Date</th>
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<tr>
<td>BS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico, Mayagüez</td>
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<tr>
<td>MS</td>
<td>Nuclear Engineering</td>
<td>University of Puerto Rico, Mayagüez</td>
<td>1971</td>
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**Faculty service at UPRM:**

*Date of original appointment: August 1976*

**Dates of advancement in rank:**

- Instructor: 1976 to 1979
- Assistant Professor: 1979 to 1984
- Associate Professor: 1984 to 1992
- Professor: 1992 to Present

**Total years of service:** 31

**Areas of professional expertise:**

Power Systems, Electrical Distribution Systems

**Other related experience—academic or industrial:**

- 1979-1981 Cooperative Education Program Coordinator
- 1990-1993 Associate Director Electrical and Computer Engineering
- 1993-1998, Assistant Dean of Engineering for Administrative Affairs
- 1998-2003, Associate Dean of Engineering for Administrative Affairs
- Electronic Engineer, U.S. Army, White Sands Missile Range, ASL Laboratories, New Mexico, 1971-1973
- Electric Energy Authority, Summer 1969

**Consulting, patents:**

Design of electrical systems for industrial plants and hospitals.

Power consumption studies

**State(s) in which registered:**

Puerto Rico

**Principal publications of last four years:** (FY 2002-2003-2006-2008)

None

**Grants or externally funded project active during the last four years:** (FY 2002-2003-2007-2008)

None

**Scientific and professional societies of which a member:**

IEEE, CIAPR

**Honors and awards:**

BSEE, Cum Laude 1969

MSNE, Cum Laude 1971

**Institutional and professional service in the last four years:** (FY 2002-2003-2007-2008)

Professional development activities in the last four years: (FY 2002-2003-2007-2008)

**Offered Courses**

- INEL 4086 Transformers and Electric Machinery Laboratory, INEL 4405 Electric Machines, INEL 4406 Electric Machines Laboratory

**Community service activities:** (FY 2002-2003-2007-2008)

None
CEDEÑO-MALDONADO, JOSÉ R.

Academic rank: Associate Professor

Degrees with fields, institution, and date:

- B.S. Electrical Engineering University of Puerto Rico, Mayagüez, Puerto Rico 1991
- M.S. Electrical Engineering The Ohio State University, Columbus, Ohio 1996
- Ph.D. Electrical Engineering The Ohio State University, Columbus, Ohio 2002

Faculty service at UPRM:

Date of original appointment: July 1, 2001

Dates of advancement in rank:

- Assistant Professor: July 2001 - 2005
- Associate Professor: 2005 to Present
- Total years of service: 7

Areas of professional expertise:


Other related experience—academic or industrial:

Teaching experience

- Teaching Assistant, Department of Electrical and Computer Engineering, The Ohio State University, Columbus, Ohio, January 1997 – May 2001
- Research Assistant, Department of Electrical and Computer Engineering, The Ohio State University, Columbus, Ohio, September 1994 – December 1996


Industry experience:

Electrical Engineer, Distribution Department, Planning & Research Division, Puerto Rico Electric Power Authority (PREPA), San Juan, Puerto Rico, June 1991 – August 1993.

Consulting, patents:

- Consultant – Forensic Investigator, Confidential case. Retained by the Justice Department of Puerto Rico (José F. Nazario, District Attorney, Mayagüez, Puerto Rico) to carry out a forensic investigation regarding a confidential case. September 2006 – October 2006.

**State(s) in which registered:** Puerto Rico – P.E. License 12191

**Principal publications of last five years:** (FY2002-2003 - 2007-2008)

**Book Chapters**

**Journal and Conference Papers**


**Grants or externally funded project active during the last five years: (FY2002-2003 - 2007-2008)**

Co-PI for “Intelligent Power Routers for Distributed Coordination in Electric Energy Processing Networks”, a $600k project sponsored by the National Science Foundation (NSF) and the Office for Naval Research (ONR) to develop a model for the next generation power network using a distributed concept based on scalable coordination by an Intelligent Power Router (IPR).

**Scientific and professional societies of which a member:**

Member, Institute of Electrical and Electronics Engineers (IEEE). Member, Power Engineering Society (IEEE-PES)

Member, Illuminating Engineering Society of North America (IESNA). Member, Professional College of Engineers and Land Surveyors of Puerto Rico (CIAPR). Member, Institute of Electrical Engineers of Puerto Rico (CIAPR-IIE)

**Honors and awards:**


**Institutional and professional service in the last five years: (FY2002-2003-2007-2008)**

• Director, Pre-College Engineering Program, University of Puerto Rico at Mayagüez (2002 – present)

• Faculty Advisor, Institute of Electrical and Electronics Engineers-Student Chapter, University of Puerto Rico at Mayagüez (2002-present)

• Secretary-Treasurer, Caribbean Colloquium on Power Quality (CCPQ 2003)

• Treasurer, Institute of Electrical and Electronics Engineers-Power Engineering Society Chapter, Puerto Rico West (2004–present)


• Academic Coordinator, Alliance for Graduate Education and the Professoriate Program (AGEP), Program, University of Puerto Rico at Mayagüez (2006 – present)


**Professional development activities in the last five years: (FY2002-2003-2007-2008)**

**Offered Courses in the past two years (2005-2007)**


**Community service activities: (FY 2002-2003-2007-2008)**
COLOM-USTARIZ, JOSÉ G.

Academic rank: Professor

Degrees with fields, institution, and date:

- BS Electrical Engineering University of Puerto Rico, Mayagüez Campus 1988
- MS Electrical Engineering University of Massachusetts 1991
- Ph. D. Electrical Engineering University of Pennsylvania 1998

Faculty service at UPRM:

Date of original appointment: August 1991

Dates of advancement in rank:

- Instructor: 1991 to 1994
- Assistant Professor: 1998 to 2001
- Associate Professor: 2001 to 2006
- Professor: 2006 to Present

Total years of service: 17

Areas of professional expertise:

Microwave Circuits, Microwave Systems, Computational Electromagnetics

Other related experience—academic or industrial:

- 2000-present Director Industrial Affiliates Program - RUM Mayaguez
- 1994-1998 TA and RA Penn State, State College, PA
- Summer 1993 - Development Eng. Motorola, Vega Baja PR.

Consulting, patents:

None

State(s) in which registered:

None

Principal publications of last five years: (FY 2002-2003 - 2007-2008)


Grants or externally funded project active during the last five years: (FY 2002-2003 - 2007-2008)

Collaborative Adaptive Center of Atmosphere NSF ERC Center

Scientific and professional societies of which a member:

IEEE, Tau Beta Pi
Honors and awards:
Invited to as speaker in Graduate School Experiences for the 2000 SHPE Eastern Conference
Institutional and professional service in the last five years: (FY 2002-2003 - 2007-2008)

Professional development activities in the last five years: (FY 2002-2003 - 2007-2008)

Offered courses in the past two years (2005-2008)

Science Fair Judge, UNICEF
COUVERTIER, ISIDORO

Academic rank: Professor

Degrees with fields, institution, and date:

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<tr>
<td>BS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico, Mayagüez Campus</td>
<td>1981</td>
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<tr>
<td>MS</td>
<td>Electrical Engineering</td>
<td>University of Wisconsin-Madison</td>
<td>1983</td>
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<td>Ph. D.</td>
<td>Computer Engineering</td>
<td>Louisiana State University-Baton Rouge</td>
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Faculty service at UPRM:

Date of original appointment: August 1985

Dates of advancement in rank:

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<td>Assistant Professor</td>
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<td>Associate Professor</td>
<td>1999</td>
</tr>
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<td>Professor</td>
<td>2004</td>
</tr>
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</table>

Total years of service: 21 (Five Year Leave)

Areas of professional expertise:

Computer Networking, Embedded Systems

Other related experience—academic or industrial:

Product/Design Engineer, Hewlett Packard Co. 2.5 years

Computer Center Director, UPR-Arecibo, 4 years

Computer Science Department Head, UPR-Arecibo, 1.5 years

Consulting, patents:


Consulting for Hewlett Packard – Aguadilla in 1997, C Programming

Atlantea Project UPR Central Administration – Haiti in 1998, C and C++

State(s) in which registered:

Puerto Rico

Principal publications of last five years: (FY 2002-2003-2007-2008)


Grants or externally funded project active during the last five years: (FY 2002-2003-2007-2008)

Scientific and professional societies of which a member:

Institute of Electrical and Electronics Engineers, Senior Member

Colegio de Ingenieros y Agrimensores, Member

Honors

IEEE Senior Member, Graduate Student Association Recognition, UPRM’s IEEE Student Chapter Recognition
Institutional and professional service in the last five years: (FY 2002-2003-2007-2008)

Professional development activities in the last five years: (FY 2002-2003-2007-2008)
Gerencia Académica, CCNA, CCNP

Offered Courses in the past two years (2005-2008)

CRUZ-POL, SANDRA L

**Academic Rank:** Professor

**Degrees with fields, institution, and date:**
- BS Electrical Engineering University of Puerto Rico, Mayagüez Campus 1987
- MS Electrical Engineering University of Massachusetts at Amherst 1991
- Ph. D. Electrical Engineering The Pennsylvania State University 1998

**Faculty service at UPRM:**
- **Date of original appointment:** August 1991
- **Dates of advancement in rank:**
  - Instructor: 1991 to 1998
  - Assistant Professor: 1998 to 2001
  - Associate Professor: 2001 to 2005
  - Professor: 2005 to Present
  - Total years of service: 17 (+4 on leave)

**Areas of professional expertise:**
- Microwave Remote Sensing, Atmospheric Absorption Modeling, Microwave Ocean Emissivity

**Other related experience—academic or industrial:**
- IEEE Geoscience and Remote Sensing Newsletter- Associate Editor for University Profiles
- Consulting, patents: None.

**State(s) in which registered:**
- None.

**Principal publications of last five years:**
- Cruz-Pol, S. L., José Maeso, Margarita Baquero “DSD characterization and computations of expected reflectivity using data from a Two-Dimensional Video Disdrometer deployed in a Tropical Environment”, IEEE IGARSS 05, Korea., 2005.
- Cruz-Pol, S. L., Margarita Baquero, V. Bringi and V. Chandrasekar, "Rain-Rate Estimate Algorithm Evaluation and Rainfall Characterization in Tropical Environments Using 2DVD, Rain Gauges and TRMM data”, IEEE IGARSS 05, Korea, 2005. (submitted)
Grants or externally funded project active during the last five years: (FY 2002-2003 - 2007-2008)


- Collaborative Adaptive Sensing of the Atmosphere (CASA), Source of Support: NSF, $17M (Joint), Period Covered: 09/01/03-08/31/08 University of Puerto Rico Mayagüez.

- Project/Proposal Title: Statistical techniques to improve the Hydro-Estimator rainfall algorithm during heavy storms over Puerto Rico, NOAA, $100,000 Period Covered: 2 yr Started Sept 2006,

- Project/Proposal Title: Tropical Center for Earth and Space Science Studies- Information Processing and Extraction Group (TCES/ IPEG) NASA, $4,999,513, Period Covered: July 1, 2000 to July 30, 2005 University of Puerto Rico Mayagüez


Scientific and professional societies of which a member:

Institute of Electrical and Electronics Engineers, Senior Member
IEEE Geoscience and Remote Sensing Society, member
Phi Kappa Phi, Member

Honors and awards:

May 2001 Excellence in Mentoring Award, The National GEM Consortium, San Diego CA.
December 2000, Recognition as IEEE Student Branch Advisor, IEEE Student Branch
March 1992, Recognition, Society of Women Engineers (SWE) Student Chapter

Institutional and professional service in the last five years: (FY 2002-2003 - 2007-2008)

Microrad06  Specialist Meeting on Microwave Radiometry and Remote Sensing Applications, held in San Juan, Puerto Rico, from 28 February to 03 March 2006. MicroRad’06 is sponsored by the IEEE Geoscience and Remote Sensing Society, NASA, NOAA, NCAR, URSI, UPRM, and Colorado State University. Local Arrangement Chair; Dr. Sandra Cruz-Pol, Local Arrangement Co-chair; Dr José Colom.

Professional development activities in the last five years: (FY 2002-2003 - 2007-2008)

Offered Courses in the past two years (2005-2008)

INEL 4075  Fundamentals of Electrical Engineering, INEL 4152 Electromagnetics II, INEL 4998 Undergraduate Research, INEL 5995 Special Problems, INTD 8995 Res Collaborative Prog, INEL 6069 Microwave remote Sensing, INEL 6046 Master’s Thesis, INEL 6216 Advanced Electromagnetics


Judge for several Science Fairs in local High schools
CUADROS, CARLOS

Academic rank: Assistant Professor

Degrees with fields, institution, and date:

- BS  Electrical Engineering  Pontificia Universidad Javeriana, Bogota, Colombia  1982
- MS  Electrical Engineering  Virginia Tech at Blacksburg, VA  1995
- PhD  Electrical Engineering  Virginia Tech at Blacksburg, VA  2003

Faculty service at UPRM:

Date of original appointment:  August 2004

Dates of advancement in rank:

- Assistant Professor:  2004 to present
- Total years of service:  4

Areas of professional expertise:

- Power Electronics, Bidirectional Power Conversion and Converter Modeling and Control

Other related experience—academic or industrial:

1999-2002  Design Engineer, Dynamic Structures and Materials, Franklin, TN.
1999  Instructor, Electrical Engineering Department, Virginia Tech, Blacksburg, VA. (Spring semester).
1992-1999  Graduate Research Assistant, Center for Power Electronic Systems (CPES), Virginia Tech, Blacksburg, VA.
1985-1991  Project Coordinator-Field Engineer, Lab-Volt Systems, Wall Township NJ (Based in Ecuador, South America).
1980-1985  Instructor and Research Associate, Pontificia Universidad Javeriana, Bogota, Colombia.

Consulting, patents:

State(s) in which registered:

Principal publications of last five years:  (FY 2002-2003 - 2007-2008)


Grants or externally funded project active during the last five years:  (FY 2002-2003 - 2007-2008)

Scientific and professional societies of which a member:

Honors and awards:

Institutional and professional service in the last five years:  (FY 2002-2003-2007-2008)

Professional development activities in the last five years:  (FY 2002-2003-2007-2008)

Offered Courses in the past two years

- INEL 4075 Fundamentals of Electrical Engineering
- INEL 4998 Undergraduate Research
- INEL 6046 Master Thesis
- INEL 6085 Analysis and Design of Power Semiconductor Circuits
- INEL 6995 Special Topics in Electrical Engineering
- INEL 6085, INEL 4416 Power Electronic

DIAZ CASTILLO, ANDRES J.

Academic rank: Assistant Professor

Degrees with fields, institution, and date:

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<tr>
<td>BS</td>
<td>Computer Science</td>
<td>Universidad Nacional Pedro H. Urena</td>
<td>1986</td>
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<tr>
<td>MS</td>
<td>Computer Science</td>
<td>University of Puerto Rico, Mayaguez Campus</td>
<td>1992</td>
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<td>Ph.D.</td>
<td>Computer Science</td>
<td>Michigan State University</td>
<td>2000</td>
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Faculty service at UPRM:

Date of original appointment: January 2007

Dates of advancement in rank:

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<th>Rank</th>
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<tr>
<td>Assistant Professor</td>
<td>2007</td>
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</table>

Total years of service: 1/2

Areas of professional expertise:

Electrical Engineer (Power Electronics, Automation, Embedded systems)

Other related experience—academic or industrial:

3 Years experience as Electrical Wire Manufacturing Industry Engineer
11 Years experience as Assistant Professor in Private University System

Consulting, patents:

Industrial automation consultant
Professional engineer licensed 21076

State(s) in which registered:

West area PR
Engineer Licensed for Puerto Rico State

Principal publications of last four years: (FY 2002-2003-2007-2008)

Grants or externally funded project active during the last five years: (FY 2002-2003-2006-2008)

Intelligent Exam Generator software development
(2002 Education Innovative Project)
PLC virtual Lab development
(2004 Education Innovative project)

Scientific and professional societies of which a member:

IEEE, Power Electronics Society, CIAPR

Honors and awards:

Department Distinguish Professor (UIPR Aguadilla)
Research Distinguish Professor (UIPR Aguadilla)

Institutional and professional service in the last five years: (FY 2002-2003-2007-2008)

Web Page Development seminar for faculty
Exam Generator seminar for faculty
PE review for HP Engineer
PLC, robotic an automation seminars for Industrial Technicians
Ice Maker Manufacturing Industry Automation work using PLC

Professional development activities in the last five years: (FY 2002-2003-2007-2008)

WebCT Vista Certification.
Data Mining IEEE-CIAPR seminar.

Offered Courses in the past two years (2005-2006)

INEL 4085 Machine Electric Introduction, INEL 5408 Electrical Motors Control, ICOM 5217 Microprocessor Interfacing, INEL 4998 Undergraduate Research, INEL 6046 Master’s Thesis, INEL 6066 Control of Electric Drive Systems (I)


Youth Basketball Team Coach
Appendix 254

DUCOUDRAY, GLADYS O

Academic Rank: Assistant Professor

Degrees with fields, institution, and date:

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<td>BS</td>
<td>Physics</td>
<td>University of Puerto Rico, Río Piedras</td>
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<td>MS</td>
<td>Electrical Engineering</td>
<td>Oregon Graduate Inst. of Science &amp; Tech.</td>
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<td>Ph. D.</td>
<td>Electrical Engineering</td>
<td>New Mexico State University</td>
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Faculty service at UPRM:

Date of original appointment: January, 2004

Dates of advancement in rank:

Assistant Professor: 2004 to present

Total years of service*: 3.5 years

* Calculate as of June 30, 2002

Areas of Professional Expertise:
Electronics, Analog VLSI Low Power System Design, Automated Testing Circuit Design

Other related experience—academic or industrial.

Instructor, Introductory Physics, STEP program at Turabo University, 1 year. Teaching prospective students introductory physics, 1995


Invited professor, HPA Texas Instruments, Dallas Texas, Summer 2006. Developing

State(s) in which registered
New Mexico

Principal publications of last five years: (SP 2004 --SU 2008)


Grants or externally funded project active during the last five years: (FY 2002-2003-- 2007-08)

UPRM TI Analog Program, Texas Instruments, Dallas TX, $100,000/year Aug-2006-Aug 2007.

Pending:

UPRM _TI Mixed Signal Test Program, Dallas TX, $40,000 August 2007.

Scientific and professional societies of which a member:
IEEE, Member

Honors and awards:
3rd Place IAP Poster 2006 for the Poster AD Low Power Low-Voltage Modules.

Outstanding graduating Graduate Student, New Mexico State University, Dec 2003. Recognition award given to a Ph. D. student for outstanding work on his or her field in terms of grants publications and other awards

NASA Space Grant Fellowship, NASA Space Grant Consortium Fall 2003. Fellowship of $4,000, for research on the aerospace and related fields in electronics.
NMAGEP Fellow, NMAGEP at New Mexico State University, from Jan 2002-Dec 2003. Fellowship of $4,000 yearly. For research on analog and Mixed-signal VLSI in electronics.

**Courses Offered in the last two years: (FY 2006-2008)**
INEL 4205 Logic Circuits, INEL 4207 Digital Electronics, INEL 4218 Integrated Circuit Engineering, INEL 4225 Digital Electronics Laboratory, INEL 4998 Undergraduate Research, INEL 5265 Analog Integrated Circuit Design

**Institutional and professional service in the last five years: (FY 2002-2003 -- 2007-08)**
Electronics Committee Coordinator, May 2005-Present, Responsible for reviewing courses textbooks and contents, Projection on electronics area for department, Coordination of laboratory experiences with course work, coordinate meetings between faculty members.

IAP Committee member, 1 year, Reviewing proposals submitted to the committee.

Advisor to Carlos Vega Ms Student graduated Summer 2005. Advisor to Laura Sanchez s. Students in electronics, 1st year MS student.

**Professional development activities in the last five years: (FY 2002-03 -- 2007-08)**
Seminars Attended: Situational Leadership, Moving from Conflict to Collaboration, Texas Instruments 2004,

**Community Service Activities: (FY 2002-03 -- 2007-08)**
Treasurer of Parent Association for Gymnasts at HGU (non-profit organization), Organize Fundraisers, Allocate money for events and purchase gymnastic equipment. In charge of the finances of the Association.
FIGUEROA VILLANUEVA, MIGUEL A.

**Academic rank:** Instructor

**Degrees with fields, institution, and date:**

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<th>Institution</th>
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<td>University of Puerto Rico, Mayagüez Campus</td>
<td>1999</td>
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<tr>
<td>MS</td>
<td>Electrical Engineering</td>
<td>Michigan State University</td>
<td>2001</td>
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<td>Ph.D.</td>
<td>Electrical Engineering</td>
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**Faculty service at UPRM:**

*Date of original appointment:* August 2006

**Dates of advancement in rank:**

- Instructor: 2006 to present

**Total years of service:** 1

**Areas of professional expertise:**

Pattern Recognition, Computer Vision, and Computer Graphics in general. Applications in biometrics, and biomedical signal processing and imaging are of particular interest.

**Other related experience—academic or industrial:**

<table>
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<th>Internship Duration</th>
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<tr>
<td>Summer 2002</td>
<td>IBM T.J. Watson Research Center</td>
<td>Hawthorne, NY, USA</td>
<td>Evaluation of fingerprint compression standards; and security protocol design for biometric authentication.</td>
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<tr>
<td>Summer 2000</td>
<td>IBM T.J. Watson Research Center</td>
<td>Yorktown Heights, NY, USA</td>
<td>Study and evaluation of the Core-Connect Architecture and available design tools. Designed a VHDL model for performance evaluation of System-on-a-chip (SoC).</td>
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**Consulting, patents:**

**State(s) in which registered:** Puerto Rico

**Principal publications of last five years: (FY2002-2003-2007-2008)**


**Grants or externally funded project active during the last five years: (FY2002-2003-2007-2008)**

**Scientific and professional societies of which a member:**IEEE, IEEE Computer Society.

**Honors and awards:**

- GE Faculty for the Future Program Fellowship, August 2005.
- Competitive Doctoral Enrichment Fellowship, January 2000.
Institutional and professional service in the last five years: (FY 2002-2003- 2007-2008)

Professional development activities in the last five years: (FY 2002-2003- 2007-2008)

Offered Courses in the past two years
INEL 4075 Fundamentals of Electric Circuits, INEL 5046 Pattern Recognition, INEL 3115 Introduction to Electrical Engineering, ICOM 5047 Design Project in Computer Engineering,

HUNT, SHAWN

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

- BS  Electrical Engineering  Tulane University  1986
- MS  Electrical Engineering  Michigan State University  1989
- Ph. D.  Electrical Engineering  Michigan State University  1992

**Faculty service at UPRM:**

- **Date of original appointment:** July 1992
- **Dates of advancement in rank:**
  - Assistant Professor: 1992 to 1995
  - Associate Professor: 1995 to 2000
  - Professor: 2000 to 2008
  - Total years of service: 15

**Areas of professional expertise:**

- Signal Processing, Control Theory

**Other related experience—academic or industrial:**

- Research in Hyperspectral Image processing
  - Lossless Image Compression
  - Optimal Adaptive dithering

**Consulting, patents**

- None.

**State(s) in which registered**

- None.

**Principal publications of last five years: (FY 2002-2003-2007-2008)**


- C. Benitez-Quiroz, and S. Hunt, ‘Determining the Need for Dither when Re-Quantizing a One-dimensional Signal,’ 121st AES Convention, San Francisco, October 2006.


Grants or externally funded project active during the last five years: (FY 2002-2003 - 2007-2008)

PI in "Proposal for the Communication and Signal Processing Laboratory," sponsored by Texas Instruments, December 2002, $18,875.05.


Scientific and professional societies of which a member:
Member SPIE, The International Society for Optical Engineering

Honors and awards:
None.

Institutional and professional service in the last five years: (FY 2002-2003 - 2007-2008)

Professional development activities in the last five years: (FY 2002-2003-2007-2008)

Offered Courses in the past two years (2005-2007)

Community Service Activities: (FY 2002-2003-2006-2007)

Member of the Local Spiritual Assembly of the Baha’is of Mayaguez. (2002-2003-2007-2008)
IERKIC, HENRICK M.

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

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<tr>
<td>BS</td>
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<td>Universidad Nacional de Ingeniería (Perú)</td>
<td>1972</td>
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<td>Ph. D.</td>
<td>Electrical Engineering</td>
<td>Cornell University (NY)</td>
<td>1980</td>
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</table>

**Faculty service at UPRM:**

*Date of original appointment:* June 1990

**Dates of advancement in rank:**

- Associate Professor: 1990 to 1996
- Professor: 1996 to present
- Total years of service: 17

**Areas of professional expertise:**

Communications Theory, Wireless Communications, Radars, Atmospheric Sciences

**Other related experience—academic or industrial:**

- 1991 Radio Atmospheric Science Center (Kyoto, Japan). Radar Scattering from troposphere and stratosphere.
- 1993, 1995 NASA Summer Faculty Fellow
- 2000 (Summer) IBM. Multimedia applications.

**Consulting, patent:**

None.

**State(s) in which registered:**

None.

**Principal publications of last five years: (FY 2002-2003-2007-2008):**

Grants or externally funded project active during the last five years: (FY 2002-2003-2007-2008) PI, Project Coordinator, etc.

**Institutional and professional service in the last five years: (FY 2002-2003-2007-2008)**

Point of contact: Global Wireless Educational Consortium (GWEC).

**Professional development activities in the last five years: (FY 2002-2003-2007-2008)**

- AFRL/ASEE Summer Faculty Fellow, Summer 2006. Hanscom Air Force Base.
- Gravity Waves and Turbulence.
- 1 week summer courses at MIT: Data and Models (2003)
- 1 week summer course at UC Berkeley: SDH/ATM and IP/MPLS Networks (2002)

**Offered Courses in the past two years (2005-2007)**


**Community service activities: (FY 2002-2003-2007-2008)**

Visits to the National Astronomy and Ionosphere Center (The Arecibo Observatory)
IRIZARRY-MILÁN, SAMUEL R.

**Academic Rank:** Professor

**Degrees with fields, institution, and date:**

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<tr>
<td>BS</td>
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<td>University of Puerto Rico, Mayagüez Campus</td>
<td>1961</td>
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<td>MS</td>
<td>Electrical Engineering</td>
<td>University of Michigan</td>
<td>1964</td>
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<td>Ph. D.</td>
<td>Nuclear Engineering</td>
<td>University of Michigan</td>
<td>1974</td>
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**Faculty service at UPRM:**

**Date of original appointment:** August 1971

**Dates of advancement in rank:**

- Instructor: 1971 to 1974
- Assistant Professor: 1974 to 1977
- Associate Professor: 1977 to 1983
- Professor: 1983 to Present
- Total years of service: 36

**Areas of professional expertise:**

Electromagnetic Theory

**Other related experience—academic or industrial:**

- Electrical Engineer; Puerto Rico Electrical Power Authority, 1961-63
- Research Assistant; University of Michigan, 1966-71
- Chairman; Physics Dept; UPRM, 1981
- Associate Chairman; Electrical and Computer Eng. Dept, UPRM, 1982-89
- Chairman; ECE Dept., UPRM, 1990-98

**Consulting, patents:**

Member; Research Advisory Committee; Center for Energy and Environment Research, UPRM, 1978-81

**State(s) in which registered:**

Puerto Rico

**Principal publications of last four years: (FY 2002-2003 - 2007-2008)**

None.

**Grants or externally funded project active during the last four years: (FY 2002-2003 - 2007-2008)**

None

**Scientific and professional societies of which a member:**

Institute of Electrical and Electronics Engineers, Life Member
Colegio de Ingenieros y Agrimensores

**Honors and awards:**

None.

**Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)**

None

**Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)**

None.

**Offered Courses in the past two years (2005-2007)**

- INEL 4075 Fundamentals of Electrical Engineering, INEL 4151 Electromagnetics I,
- INEL 3105 Electrical Systems Analysis I

**Community service activities: (FY 2002-2003 - 2007-2008)**

None.
IRIZARRY-RIVERA, AGUSTÍN A.

**Academic Rank:** Professor

**Degrees with fields, institutions, and dates:**

- BS Electrical Engineering, University of Puerto Rico, Mayagüez 1988
- MS Electrical Engineering, University of Michigan, Ann Arbor 1990
- Ph. D. Electrical Engineering, Iowa State University, Ames 1996

**Faculty service at UPRM:**

- **Date of original appointment:** January 1997
- **Dates of advancement in rank:**
  - Assistant Professor: 1997 to 2001
  - Associate Professor: 2001 to 2005
  - Professor: 2005 to Present
- **Total years of service:** 10

**Areas of professional Expertise:**

- Electric Power Systems Dynamics and Operation
- Renewable Energy Sources

**Other related experience—academic or industrial.**

- (8/06 – present) President, Electrical and Computer Engineering Department Personnel Committee
- (8/06 – present) President, ADHOC Committee to Evaluate Proposals for a New UPRM Class Schedule
- (8/05 – 8/06) Elected Academic Senator for the College of Engineering – University of Puerto Rico, Mayagüez, Puerto Rico.
  - Duties included: Coordinator of the ADHOC Committee to Design Instruments to Evaluate the Chancellors’ Performance, Coordinator of the ADHOC Committee to Evaluate Proposed Academic Work Schedules for the Mayagüez Campus, Member of the Courses Committee.

**EXPERT WITNESS**


**Consulting, patents**

- (06/04 – present) Consultant and Partner of ecoEnergy a private corporation with the objective of
  - building the first commercial electric power plant of Puerto Rico using eolic energy.
- (4/01 – 07/02) Consultant – Wind Energy Consulting Services for the Puerto Rico Energy Affairs Administration. Provided technical advice in the area of wind energy and electric power systems technology.
  - (01/03) Consultant – Engineering evaluation of electrical installation at a private residence in Mayagüez, Puerto Rico. Identified electrical design deficiencies and failures to comply with the National Electric Code.

**State(s) in which registered**

- **Puerto Rico**

**Principal publications of last four years: (FY 2002-2003 – 2007-2008)**

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Grants or externally funded project active during the last four years: (FY 2002-2003-2007-2008)

-Colegio San Ignacio - Ejemplo de Sostenibilidad (2007) A $73,332 project to match the energy needs of Colegio San Ignacio with its available renewable energy sources. Demonstration projects with a strong educational component will be proposed to the School to be designed, installed and operated on the Scholl Campus with the participation of the School Faculty and students. The philosophy behind the program will be one of sustainable development.

-Programa Panamericano de Capacitación en Ingeniería de Potencia Eléctrica (2006) A $97,370 educational project to deliver a Web-broadcast master program in electric power engineering to engineers in the Dominican Republic. Courses in this program will respond to the reality and necessities of the Dominican Republic electric power industry. The philosophy of the program will be one of sustainable development.

-Caguas Sustainable Energy Showcase, Phase I (2006) A $90,055 project sponsored by the Municipality of Caguas, Puerto Rico to assess the current electric energy consumption profile, by sector: residential, commercial, industrial and governmental, of Caguas and to propose achievable goals (percentages of demand), by sector, to be -satisfied using renewable energy sources.

-Failure Probabilities for Risk-Based Maintenance and Parameter Estimation of Synchronous Machines (2003) A $99,444 project sponsored by the National Science Foundation (NSF) to estimate parameters and failure probabilities for synchronous generators. The proposed method improves estimates of synchronous machine parameters from on-line terminal voltage and current measurements to monitor field and stator winding deterioration over time. The main outcomes of this work are the application of useful alternate robust estimation techniques and the identification of failure modes for risk-based maintenance of generators.

-Intelligent Power Routers for Distributed Coordination in Electric Energy Processing Networks (2002) A $499,849 project sponsored by the National Science Foundation (NSF) and the Office for Naval Research (ONR) to develop a model for the next generation power network using a distributed concept based on scalable coordination by an Intelligent Power Router (IPR). Our goal is to show that by distributing network intelligence and control functions using the IPR, we will be capable of achieving improved survivability, security, reliability, and re-configurability. Our approach builds on our knowledge from power engineering, systems, control, distributed computing, and computer networks.

-Puerto Rico Wind Resource Assessment - Phase I: Partnership formation and prospective site identification (2002) A $32,465 project sponsored by the Puerto Rico Energy Affairs Administration to increase the knowledge of wind resources in Puerto Rico. We will assess wind velocity probabilities at sites that may be used to install wind farms. The criteria to select the prospective sites shall not be convenience of data gathering, such as existing towers or existing wind recording stations, but land availability for establishment of a wind farm, road access, available electric grid connections, zoning regulations and indicators of potential wind resource such as existing wind data, topography, wind-deformed vegetation or eolian landforms.

Scientific and professional societies of which a member:

- Registered Professional Electrical Engineer in Puerto Rico (6/91) and Member of the “Colegio de Ingenieros y Agrimensores de Puerto Rico”
- Member Institute of Electrical and Electronic Engineers (IEEE) - Power Engineering Society and Faculty Advisor of
UPRM’s PES Student Chapter
- Member American Society of Engineering Educators (ASEE)
- Member Tau Beta Pi, National Engineering Honor Society and Principal Faculty Advisor of Puerto Rico’s Tau Beta Pi
  Alpha Chapter

Honors and awards:
- Recipient “Ingeniero Electricista Distinguido 2005” (Distinguished Electrical Engineer 2005) from the Electrical
  Engineering Institute of the Puerto Rico Professional Engineers Society (Instituto de Ingenieros Electricistas del Colegio de
  Ingenieros y Agrimensores de Puerto Rico) - In recognition of services rendered to the profession and outstanding
  professional achievements in the field of electrical engineering.
- Recipient “2004 Professional Progress in Engineering Award” (PPEA) from Iowa State University
- Professional Progress in Engineering Award - Established in 1988 In recognition of outstanding professional progress and
  personal development in a field of engineering specialization as evidenced by significant contributions to the theory and
  practice of engineering, distinguished service rendered to the profession, appropriate community service, and/or
  achievement in a leadership position. There shall also be evidence of recognition through citations and acceptance of
  achievements by colleagues, and of the promise of continued progress and development.
- Recipient “2003-2004 Electrical and Computer Engineering Outstanding Faculty Award” from the School of Engineering,
  Mayagüez, Puerto Rico
- Magna Cum Laude – BSEE, University of Puerto Rico, 1988

Institutional and professional service in the last four years: (FY 2002-2003-2007-2008)
- (8/06 – present) President, Electrical and Computer Engineering Department Personnel Committee
- (8/06 – present) President, ADHOC Committee to Evaluate Proposals for a New UPRM Class Schedule
- (8/05 – 8/06) Elected Academic Senator for the College of Engineering – University of Puerto Rico, Mayagüez, Puerto Rico.
- Instructor of Continuous Education Courses at the Puerto Rico Engineers and Surveyors Association
  (CIAPR, from the Spanish “Colegio de Ingenieros y Agrimensores de Puerto Rico”)
- Member of the AD HOC Committee to Evaluate the Technical Administration of the Puerto Rico Electric System
  Department of Education and University of Puerto Rico Mayagüez (UPRM) to professionally
  advance Mathematics and Science school teachers of 7th, 8th and 9th grade in three Educational Districts; Mayagüez, Moca
  and San Sebastian. The primary goal of the project is to improve knowledge and practice of Mathematics
  and Science teachers thru summer and weekend long internships at the UPRM taking courses that will focus on content (Math,
  Physics, Chemistry, Geology, Basic Engineering, and Information Technology) rather than teaching methods.

Professional development activities in the last four years: (FY 2002-2003-2007-2008)

Offered Courses in the past two years (2005-2007)
INEL 3105 Electrical Systems Analysis I, INEL 4048 Electrical Engineering Practice, INEL 4103 Electrical Systems
Analysis, INEL 4407 Electrical Systems Design, INEL 4415 Power System Analysis, INEL 5495 Design Power System,
INEL 6046 Master Thesis, INEL 6025 Advanced Energy conversion, INEL 6027 Dynamics and Control of Integrated power
systems, INEL 6995 Special Topics in Electrical Engineering.

None
Appendix

JIMÉNEZ-CEDEÑO, MANUEL A.

**Academic rank:** Associate Professor

**Degrees with fields, institution, and date:**

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<th>Field</th>
<th>Institution</th>
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<td>BS</td>
<td>Electrical Engineering</td>
<td>Universidad Autónoma de Santo Domingo</td>
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<td>MS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico at Mayagüez</td>
<td>1991</td>
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<td>Ph. D.</td>
<td>Electrical Engineering</td>
<td>Michigan State University</td>
<td>1999</td>
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</table>

**Faculty service at UPRM:**

- **Date of original appointment:** August 1991
- **Dates of advancement in rank:**
  - Instructor: 1991 to 1994
  - Assistant Professor: 1999 to 2002
  - Associate Professor: 2002 to present
- **Total years of service:** 16

- *On study leave from July 1994 to June 1999*

**Areas of professional expertise:**

CAD Techniques for Digital VLSI Layout, Digital Systems Design, Microprocessors/Embedded Systems

**Other related experience—academic or industrial:**

- APEC University: Invited Professor, Summer 2003. Engineering and Technology School, Santo Domingo, Dominican Republic. Taught graduate-level course in Digital Microelectronics and IC Design.
- Texas Instruments Inc. Wireless CAPCOM Division, Dallas, Texas, Visiting Professor, Summer 2000. Collaborator in the design team of a variable output band-gap voltage reference bank IC.
- Texas Instruments Inc. Power Management Products Division, Dallas, Texas, Visiting Professor, Summer 1999

**Consulting, patents:** None

**State(s) in which registered**

Professional License, Dominican Republic

Engineer in Training, Michigan

Principal publications of last five years: (FY2002-2003-2007-2008)


Grants or externally funded project active during the last five years: (FY 2002-2003 -2007-2008)

1. Title: “2007 Continuation of the TI Analog, Digital and Mixed-signal Electronics Program at UPRM”
   Researchers: Rogelio Palomera (PI), Manuel Jiménez (Co-PI), and Gladys O. Ducoudray (Co-PI) Sponsor: Texas Instruments
   Funding: $129,119 Period: January-December 2007

2. Title: “Study of System-level Design Methodologies for Implementing SAR Support Algorithms”
   Researchers: Manuel Jiménez (PI), Domingo Rodríguez (Co-PI), Nayda Santiago (Co-PI), and Ana Nieves (Collaborator)
   Sponsor: Lockheed Martin Corporation
   Funding: $260,000 Period: January-December 2007

3. Title: “ATE/TPS 44 Voltage Regulator THT to SMT Redesign and Prototyping”
   Researchers: Pedro Resto (PI), Manuel Jiménez (Co-PI)
   Sponsor: Intuitive Research and Technology Corporation
   Funding: $36,000 Period: January-October 2006

4. Title: “Integrated Methodology for IPEM Gate Driver Layout Improvement – 2007 Continuation”
   Researchers: Manuel Jiménez (PI)
   Sponsor: Center for Power Electronic Systems (CPES)
   Funding: $30,000 Period: August 2006 – July 2007

5. Title: “2006 Continuation of the TI Analog, Digital and Mixed-signal Electronics Program at UPRM”
   Researchers: Rogelio Palomera (PI), Manuel Jiménez (Co-PI), Gladys O. Ducoudray, and Manuel Toledo (Co-PI)
   Sponsor: Texas Instruments
   Funding: $116,000 Period: January-December 2006

6. Title: “Integrated Methodology for IPEM Gate Driver Layout Improvement – 2006 Continuation”
   Researchers: Manuel Jiménez (PI)
   Sponsor: Center for Power Electronic Systems (CPES)
   Funding: $40,000 Period: August 2005 – July 2006

7. Title: “Study of Controller Architectures and GLP Regulations for the Smart Drug Delivery Platform”
   Researchers: Manuel Jiménez (PI), and Gladys Omaya Ducoudray (Co-PI)
   Sponsor: Hewlett-Packard Corporation
   Funding: $5,600.00 Period: Summer 2005

8. Title: “2005 Continuation of the TI Analog, Digital and Mixed-signal Electronics Program at UPRM”
   Researchers: Rogelio Palomera (PI), Manuel Jiménez (Co-PI), and Manuel Toledo (Co-PI)
   Sponsor: Texas Instruments
   Funding: $120,000 Period: January-December 2005

9. Title: “Hardware and Software Tools to Support Embedded/DSP Systems Education at UPRM”
   Researchers: Rogelio Palomera (PI), Manuel Jiménez (Co-PI), Domingo Rodríguez (Co-PI), M. Toledo (Co-PI)
   Sponsor: Texas Instruments
   Funding: $10,000.00 Period: January-August 2005

10. Title: “Integrated Methodology for IPEM Gate Driver Layout Improvement”
    Researchers: Manuel Jiménez (PI), and Miguel Vélez-Reyes (Co-PI)
    Sponsor: Center for Power Electronic Systems (CPES)
    Funding: $45,000.00 Period: August 2004 – July 2005

11. Title: “2004 Continuation of the TI Analog, Digital, and Mixed-signal Electronics Program at the UPRM”
    Researchers: Rogelio Palomera (PI), Manuel Jiménez (Co-PI), Manuel Toledo Quiñones (Co-PI).
    Sponsor: Texas Instruments
    Funding: $110,000.00 Period: January 2004 – December 2004

12. Title: “Integrated Modeling and Design of Integrated Power Electronic Modules (IPEMs)”
    Researchers: Miguel Vélez-Reyes, Jorge González (Co-PI), Manuel Jiménez (Co-PI).
    Sponsor: Center for Power Electronic Systems (CPES)
    Funding: $141,567.00 Period: August 2003 – July 2004

13. Title: “2003 Continuation of the TI Analog, Digital, and Mixed-signal Electronics Program at the UPRM”
    Researchers: Rogelio Palomera (PI), Manuel Jiménez (Co-PI), Manuel Toledo Quiñones (Co-PI).
    Sponsor: Texas Instruments
    Funding: $110,000.00 Period: January 2003 – December 2003

14. Title: “Continuation of the TI Analog, Digital, and Mixed-signal Electronics Program at the UPRM”
    Researchers: Rogelio Palomera (PI), Manuel Jiménez (Co-PI), Manuel Toledo Quiñones (Co-PI).
    Sponsor: Texas Instruments
    Funding: $114,027.00 Period: January 2002 – December 2002

    Researchers: Agustín Rullán (PI), Manuel Jiménez (Co-PI), and Miguel Vélez (Co-PI)
    Sponsor: Center for Power Electronic Systems (CPES)
    Funding: $57,926.00 Period: July 2001 – June 2002

16. Title: “Extension of the Integrated Circuits Design Laboratory to Include Testing Facilities”
    Researchers: Manuel Jiménez (PI) and Rogelio Palomera (Co-PI)
    Sponsor: Texas Instruments
    Funding: $203,200.00 Period: January 2001 – June 2002

17. Title: “Development of a Rapid Systems Prototyping Laboratory”
    Researchers: Domingo Rodríguez (PI), Manuel Jiménez (Co-PI), and Ramón Vásquez (Co-PI)
    Sponsors: PRECISE Project, Xilinx Corp., and Texas Instruments
    Funding: $171,750.00 (Equipment and software donations)
    Period: August 2000 – June 2002

18. Title: “Establishment of an Analog Integrated Circuit Design Emphasis Area in the UPRM”
    Researchers: Manuel Jiménez (PI) and Rogelio Palomera (Co-PI)
    Sponsor: Texas Instruments
    Funding: $313,573.00 Period: August 1999 – June 2002

Scientific and professional societies of which a member:

- Institute of Electrical and Electronics Engineers IEEE, (Member)
- American Society of Engineering Education ASEE (Member)

Honors and awards:

- General Co-Chair 49th IEEE International Midwest Symposium on Circuits and Systems, Aug. 6-9, San Juan PR
Member Steering Committee for the “Midwest Symposium on Circuits and Systems” (Spring 2001 – to present)
Panelist for the National Science Foundation since 2003
National Science Foundation Fellowship for Minorities and Women (1994-1998)

GTE Corporation Fellowship Award (Spring 1996)

Institutional and professional service in the last five years: (FY2002-2003-2007-2008)

- ECE-CSE Transition Committee – ECE Department (2006 – to present)
- Research Committee – Engineering College (2004 – to present)
- Electronics Committee Member – ECE Department (2004 – to present)
- ICOM Steering Committee Member – ECE Department (2003 – to present)
- Planning Committee – ECE Department (1999 – to present)
- Graduate Committee Member -- ECE Department (1999 - 2005)
- Electronics Committee Coordinator – ECE Department (1999 - 2004)
- ABET INEL Committee Member – ECE Department (1999 - 2004)
- Curricular Revision Committee Member – ECE Department (1999 - 2004)
- Computational Resources – ECE Department (1999 - 2004)

Professional development activities in the last five years: (FY 2002-2003-2007-2008)

1. Title: “High Performance Embedded Computing Workshop (HPEC 2006)” Sponsor: MIT Lincoln Laboratory
   Date: September 19-21, 2006 (24 hours)
2. Title: “Organizational Savvy” Sponsor: Texas Instruments & Center for Professional Enhancement UPRM
   Date: October 12, 2006 (7 hours)
3. Title: “The Four Disciplines of Execution” Sponsor: Texas Instruments & Center for Professional Enhancement
   UPRM Date: August 31, 2006 (7 hours)
4. Title: “Group Decision Making and Problem Solving” Sponsor: Texas Instruments & Center for Professional
   Enhancement UPRM Date: May 9, 2006 (7 hours)
5. Title: “Emotional Intelligence” Sponsor: Texas Instruments & Center for Professional Enhancement UPRM Date:
   April 6, 2006 (7 hours)
6. Title: “Understanding Ethics in the Context of Engineering as a Global Profession” Sponsor: System for the
   Evaluation of Education Office and the College of Engineering, UPRM Date: April 5, 2005 (2 hours)
7. Title: “Crucial Conversations” Sponsor: Texas Instruments & Center for Professional Enhancement UPRM
   Date: November 18, 2005 (7 hours)
8. Title: “Win-Win Negotiations” Sponsor: Texas Instruments & Center for Professional Enhancement UPRM
   Date: September 23, 2005 (7 hours)
9. Title: “Orientación para Profesores de Nueva Contratación en el Recinto” Sponsor: Center for Professional
   Enhancement UPRM Date: August 3 to 5, 2005 (21 hours)
10. Title: “Design of On-line Courses Using WebCT” Sponsor: Instituto para el Desarrollo de la Enseñanza y el
    Aprendizaje en Linea (IDEAL) Date: Mayo 5, 2005 (6 hours)
11. Title: “Exercising Influence” Sponsor: Texas Instruments & Center for Professional Enhancement UPRM
    Date: April 1, 2005 (6 hours)
12. Title: “Developing High Performance Teams” Sponsor: Texas Instruments & Center for Professional Enhancement
    UPRM Date: November 11, 2004
13. Title: “Situational Leadership” Sponsor: Texas Instruments & Center for Professional Enhancement UPRM
    Date: September 9, 2004
14. Title: “Moving from conflict to collaboration” Sponsor: Texas Instruments & Center for Professional Enhancement
    UPRM Date: April 23, 2004
15. Title: “Working With Global Cultures” Sponsor: Texas Instruments & Center for Professional Enhancement UPRM
    Date: November 5, 2003
16. Title: “Presentation Skills” Sponsor: Texas Instruments & Center for Professional Enhancement UPRM
    Date: May 1, 2003
17. Title: “Time Management Workshop” Sponsor: Texas Instruments & Center for Professional Enhancement UPRM
    Date: March 20, 2003
18. Title: “Ultra Low-power Microcontrollers” Sponsor: Texas Instruments, UPRM
    Date: August 27 – 28, 2002 (20 Hours)

Offered Courses in the past two years (2005-2008)

CIIC 9995 Doctoral Dissertation, CHC 8997 Special Topics in CISE, INEL 4207 Digital Electronics, ICOM 5217/INEL 4217
Microprocessor Interfacing, INEL 4998 Undergraduate Research, ICOM 4998 Undergraduate Research, ICOM
5217 Microprocessor, ICOM 5995 Special Problems, INEL 6079 Advanced IC Design Techniques, INEL 6045 Engineering
Project, INEL 6046 Master Thesis, INEL 6080 VLSI Systems Design, INEL 4206 Microprocessors, INEL 4102 Electrical
Systems Analysis II, INEL-4076 Fundamentals of Electronics

- Organization of Workshop “Organizational Savvy” Sponsored by Texas Instruments (October 12, 2006)
- Organization of Workshop “The Four Disciplines of Execution” Sponsored by Texas Instruments (August 31, 2006)
- Organization of Workshop “Group Decision Making and Problem Solving” Sponsored by Texas Instruments (May 9, 2006)
- Organization of Workshop “Problem Solving” Sponsored by Texas Instruments (May 9, 2006)
- Organization of Workshop “Emotional Intelligence” Sponsored by Texas Instruments (April 6, 2006)
- Organization of Workshop “Tools and Toys for an Introductory DSP Experience” offered to High School Students in Pre-engineering Camp, Sponsored by Texas Instruments (Summer 2005)
- Organization of Workshop “A hands-on Experience in DSP” offered to non-EE majors, Sponsored by Texas Instruments (Spring 2005)
- Organization of Workshop “Crucial Conversations” Sponsored by Texas Instruments (November 18, 2005)
- Organization of Workshop “Win-Win Negotiations” Sponsored by Texas Instruments (September 23, 2005)
- Organization of Workshop “Zodiak: The Game of Business Finance and Strategy” Sponsored by Texas Instruments (May 1, 2005)
- Organization of Workshop “Exercising Influence” Sponsored by Texas Instruments (April 1, 2005)
- Organization of Workshop “Developing High Performance Teams” Sponsored by Texas Instruments (November 11, 2004)
- Organization of Workshop “Situational Leadership” Sponsored by Texas Instruments (September 9, 2004)
- Organization of Workshop “Finance for Non-finance Managers” Sponsored by Texas Instruments (May 2004)
- Organization of Workshop “Moving from conflict to collaboration” Sponsored by Texas Instruments (April 23, 2004)
- Organization of Workshop “Working With Global Cultures” Sponsored by Texas Instruments (Nov. 5, 2003)
- Organization of Workshop “Presentation Skills” Sponsored by Texas Instruments (May 1, 2003)
JUAN-GARCÍA, EDUARDO J.

Academic rank: Associate Professor

Degrees with fields, institution, and date:

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<td>BS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico, Mayagüez Campus</td>
<td>1997</td>
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<td>Ph. D.</td>
<td>Electrical Engineering</td>
<td>Purdue University</td>
<td>2001</td>
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Faculty service at UPRM:
Date of original appointment: July 2001

Dates of advancement in rank:
- Assistant Professor: 2001 to 2004
- Associate Professor: 2004 to Present
- Total years of service: 6

Areas of professional expertise:
Control Systems, Biomedical Instrumentation

Other related experience—academic or industrial:
2/05-present Co-Founder and Scientific Advisor, SonarMed, Inc., IN, USA
Summer 1997: Process Control Engineer (Intern), Design and documentation of instrumentation systems. Union Carbide Corporation, Charleston, WV

Consulting, patents:

State(s) in which registered:
Puerto Rico

Principal publications of last five years: (FY2002-2003-2007-2008)


Grants or externally funded project active during the last five years: (FY 2002-2003-2007-2008)

Acoustical Guidance of Liquid-Filled Catheters. Funded by NIH-MBRS Program; $111,361. 5/01/03-4/30/07
Non-Invasive Stress Level Assessment Using a Hydrogel-Based Biosensor. Funded by Tropical Center for Earth and Space Studies (TCESS-NASA); $60,000, 10/02-10/03.

Biomedical Research and Education Experiences (BReEd) at UPRM. Funded by NSF; $99,653, 9/03-8/04.
Development of Technologies for the Manufacture of Cardiac Pacing and Defibrillation Leads: Phase I. Funded by Medtronic, Inc. $45,863, 8/03-12/03.

Development of Technologies for the Manufacture of Cardiac Pacing and Defibrillation Leads: Phase II. Funded by Medtronic, Inc. $65,363, 1/04-9/04.

Scientific and professional societies of which a member:
Institute of Electrical and Electronics Engineers (IEEE)
IEEE Engineering in Medicine and Biology Society
Honors and awards:
Geddes-Laufman-Greatbach Outstanding Graduate Student Award, Department of Biomedical Engineering, Purdue University, 1999
SLOAN Fellowship, 1997-1998
GEM Fellowship, 1997-1998

Institutional and professional service in the last five years: (FY 2002-2003-2007-2008)

- Coordinator, Control Systems Area Committee 2002-2007
- Member, Departmental Planning Committee 2002-2007
- Member, Graduate Committee 2001-present

Professional development activities in the last five years: (FY 2002-2003-2007-2008)

Offered Courses in the past two years (2005-2008)

None.
LLORÉNS-ORTIZ, BALDOMERO

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

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<td>BS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico, Mayagüez</td>
<td>1974</td>
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<tr>
<td>MS</td>
<td>Electrical Engineering and Computer Science</td>
<td>Massachusetts Institute of Technology</td>
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<td>EE</td>
<td>Electrical Engineering and Computer Science</td>
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**Faculty service at UPRM:**

**Date of original appointment:** 1979

**Dates of advancement in rank:**

- Assistant Professor: 1979 to 1984
- Associate Professor: 1984 to 1991
- Professor: 1991 to present

**Total years of service:** 28

**Areas of professional expertise:**

Control Systems, Power Systems

**Other related experience—academic or industrial:**

- 1976–1979 Electrical Engineer, MIT Lincoln Laboratories
- 1980-Development of the course and laboratory facilities real time process control
- 1990-1991 Acting Dean of Administration U.P.R. –Mayagüez Campus
- 2000-2001 ECE Department Chairman U.P.R. –Mayagüez Campus

**Consulting, patents:**

Consulting process automation using programmable controllers –Different dates during the 90’s.

Consulting on automation using programmable controllers.

**State(s) in which registered:**

Puerto Rico

**Principal publications of last five years:** (FY2002-2003- 2007-2008)

**Grants or externally funded project active during the last five years:** (FY 2002-2003- 2007-2008)

**Scientific and professional societies of which a member:**

Colegio de Ingenieros y Agrimensores de Puerto Rico

**Honors and awards:**

None

**Institutional and professional service in the last five years:** (FY 2002-2003- 2007-2008)

**Professional development activities in the last five years:** (FY2002-2003- 2007-2008)

**Offered Courses in the past two years (2005-2008)**

- INEL 3105 Electrical Systems Analysis I
- INEL 4048 Electrical Engineering Practice
- INEL 4075 Fundamentals of Electrical Engineering
- INEL 4102 Electrical Systems Analysis II
- INEL 4505 Introduction to Control Systems
- INEL 5205 Instrumentation
- INEL 6046 Mather’s Thesis..INEL 4201Electronics I

**Community service activities:** (FY2002-2003- 2007-2008)
LU, KEJIE

Academic rank: Assistant Professor

Degrees with fields, institution, and date:

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<td>Electrical Engineering</td>
<td>The University of Texas at Dallas</td>
<td>2003</td>
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Faculty service at UPRM:

Date of original appointment: July 2005

Dates of advancement in rank:

Assistant Professor: 2005 to present

Total years of service: 2

Areas of professional expertise:

Computer and communications networks: architecture and protocol design, performance evaluation, network security

Wireless communications: space-time coding, channel capacity

Other related experience—academic or industrial:

4 years experience in research and development in telecommunications industry

1.5 years experience conducting research as a postdoc research associate

Consulting, patents:

N/A

State(s) in which registered:

N/A

Principal publications of last four years: (FY 2002-2003 - 2007-2007)

JOURNAL ARTICLES (PUBLISHED OR ACCEPTED)


CONFERENCE PAPERS

7. Kejie Lu and Yi Qian, "On The Performance Of A Distributed Key Management Scheme In Heterogeneous Wireless Sensor Networks", in Proc. of IEEE MILCOM, Oct. 2006, Washington DC, USA.


Scientific and professional societies of which a member:
- Member of IEEE
- Member of IEEE Communications Society

Honors and awards:

Institutional and professional service in the last four years: (FY 2002-2003-2007-2008)

SERVICE

University, School and Department Committees
- UPRM ECE Department, Graduate Committee (2006-current)
- UPRM ECE Department, ICOM Software Committee (2005-current)
- UPRM ECE Department, Communications and Signal Processing Committee (2005-current)

Conference Program Committees
- Special Session Chair, IASTED PDCS 2007
- Technical Program Committee Member, Chinacom 2007
- Technical Program Committee Member, AccessNets 2007
- Publicity co-chair, Valuetools 2006
- Publicity vice chair, SPECTS 2005
- Publicity chair, BroadWISE 2004
- Publicity chair, GridNets 2004
- Technical Program Committee Member, BroadWise’2004, 2004

Reviews of Journal Articles, Conference Papers, and Book Proposals
- Reviewer of Journals:
  1. IEEE Transaction on Communication
  2. IEEE Journal on Selected Areas in Communications (JSAC)
3. IEEE Transaction on Vehicular Technology
4. IEEE Transaction on Wireless Communications
5. IEEE Communications Magazine
6. IEEE Communication Letter
7. IEEE Signal Processing Letter
8. SPIE / Kluwer Optical Networks Magazine
9. Elsevier Computer Networks
10. Elsevier Theoretical Computer Science A
11. Elsevier Optics Communications
12. Wiley Wireless Communications and Mobile Computing (WCMC)
13. The International Journal of Management Science (OMEGA)

- Reviewer of Conferences:
  6. IEEE ICCCN (2001)

**Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)**

* Taken various short courses and training.

**Offered Courses in the past two years**


**Community service activities: (FY 2002-2003 - 2007-2008)**
MANIAN, VYDIA

Academic rank: Assistant Professor

Degrees with fields, institution, and date:

<table>
<thead>
<tr>
<th>Degree</th>
<th>Field</th>
<th>Institution</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>Electrical Engineering</td>
<td>A. C. College of Eng. Tech., Karaikudi, India</td>
<td>1990</td>
</tr>
<tr>
<td>MS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico, Mayaguez</td>
<td>1995</td>
</tr>
<tr>
<td>Ph. D.</td>
<td>CISE</td>
<td>University of Puerto Rico, Mayagüez</td>
<td>2004</td>
</tr>
</tbody>
</table>

Faculty service at UPRM:
Date of original appointment: August 2006

Dates of advancement in rank:
Assistant Professor: 2006 to present

Total years of service: 1

Areas of professional expertise:
Image processing, computer vision, remote sensing and computational algorithm analysis

Other related experience—academic or industrial:
Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV.
Visiting Scholar
Jan 2004-Dec 2004

Consulting, patents:

State(s) in which registered:

Principal publications of last four years: (FY 2002-2003 - 2007-2008)

Journal Publications


Conference Publications


**Grants or externally funded project active during the last five years: (FY 2002-2003 - 2007-2008)**

DoD grant W911NF-06-1-0008 Velez-Reyes (PI) 09/2005-09/2008
Improving algorithms for target detection in hyperspectral infrared imagery.
Role: Co-Investigator

NGA grant HM1582-06-1-2042 Velez-Reyes (PI) 09/2006-09/2008
A geometric approach for the analysis of hyperspectral imagery
Role: Co-Investigator

**Scientific and professional societies of which a member:**

IEEE
SPIE Society for Optical Engineering

**Honors and awards:**

**Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)**

**Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)**

**Offered Courses in the past two years**


**Community service activities: (FY 2002-2003 - 2007-2008)**
MONROY, HÉCTOR

Academic rank: Professor

Degrees with fields, institution, and date:

- BS Electrical Engineering National University of Colombia 1965
- MS Electrical Engineering Ohio State University 1971
- Other Florida State University (Educational Technology), University of Colorado (Radars), Penn State University (PhD studies, not finished)

Faculty service at UPRM:

Date of original appointment: July 1986

Dates of advancement in rank:

- Associate Professor: 1986 to 1991
- Professor: 1991 to present
- Total years of service: 21

Areas of professional expertise:

Communications Systems Design, Radars
Radio Links Planning, Antenna design, Full Correlation Analysis applied to radar systems

Other related experience—academic or industrial:

1966-1969, 1972-1984 Faculty member of National University of Colombia

Consulting, patents:

1981-1985 Consultant, National Telecommunications Company of Colombia

State(s) in which registered:

Colombia

Principal publications of last five years: (FY 2002-2003-2007-2008)


Grants or externally funded project active during the last five years: (FY 2002-2003-2007-2008)

-PI Multi-function Radar, 2006-2009, NSF Univ. of Oklahoma

Scientific and professional societies of which a member:

Institute of Electrical and Electronics Engineers, Senior Member

Honors and awards:

Institutional and professional service in the last five years: (FY 2002-2003-2007-2008)

Member Academic Senate, UPRM 2003-2007

Professional development activities in the last five years: (FY 2002-2003-2007-2008)
Offered Courses in the past two years:


 глубина информации о MOURA DOS SANTOS, ANDRE LUIZ

**Academic rank:** Associate Professor

**Degrees with fields, institution, and date:**

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<tr>
<th>Degree</th>
<th>Year</th>
<th>University</th>
<th>Field</th>
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<tr>
<td>PhD</td>
<td>2000</td>
<td>University of California at Santa Barbara</td>
<td>Computer Science</td>
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<td>MSc</td>
<td>1994</td>
<td>University of Washington</td>
<td>Atmospheric Science</td>
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<tr>
<td>BSc</td>
<td>1988</td>
<td>Instituto Tecnológico de Aeronáutica</td>
<td>Electronics Engineering</td>
</tr>
</tbody>
</table>

**Faculty service at UPRM:**

*Date of original appointment:* August 2006

**Dates of advancement in rank:**

- Associate Professor: 2006 to present
- Total years of service: 1

**Areas of professional expertise:**

- Homeland Security
- Security of Biomedical Data
- Electronic Voting
- Software Engineering Techniques for writing secure code
- Security of large scale distributed systems using tamper resistant devices
- Security of embedded devices

**Consulting, patents:**

- **Consulting:**
  - 2004- Wargo & French LLP. Analysis and expert opinions on computer logs.
  - 1992- ... Fujitec Corporation. Analysis and design of security mechanisms for their transportation system, using tamper resistant devices (smart cards).
  - 1999-2001 ACCCard. Analysis of existing security and design of digital security mechanisms to be used for online access and Automatic Teller Machines (ATM) for this credit and debit card operator.
  - 1998-1999 Bank Bradesco. Penetration Testing and security analysis of this multinational bank that has over 15 million clients.
  - 1996-1996 EIT. Design of the digital security mechanisms for a system used for traffic speed monitoring.

- **Patents**
  - Leakage-Proof Program Partitioning
  - Patent Pending in US, Germany, France, Japan and China.
  - Inventors: Tao Zhang, Santosh Pande, André L. M. Dos Santos, Franz Joseph Bruecklmayr
  - Filed: June 4th, 2003.

**State(s) in which registered:**

N/A.

**Principal publications of last four years:** *(FY 2002-2003 - 2007-2008)*

Appendix


Grants of externally funded project active during the last four years: (FY 2002-2003 – 2007-2008)


Scientific and professional societies of which a member:
Sociedade Brasileira de Computação

Honors and awards:
Denial of Service Attacks: Taxonomy and Protections
Raytheon Faculty Fellowship
Georgia Tech
December 2000

Netscape Bug Bounty Award
Netscape Corporation
October 1997

Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)

Distinguished Lectures

Seminar Presentations (Invited Papers and Talks at Meetings and Symposia)


Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)

Developed the course “Information Security Laboratory”, Developed the course “Applied Cryptography.”

Revised the course “Foundations of Computing”

Offered Courses in the past two years


Current collaboration with the SANS Institute on designing the Secure Programming Skills Assessment test.

Current collaboration with the SANS Institute on forming a consortium of schools that share techniques for effective education in Secure Programming.

International Observer of the 2006 Venezuelan presidential elections.
NAVARRO, JOSÉ

Academic rank: Instructor

Degrees with fields, institution, and date:

- BS Computer Engineering UPR (Mayagüez) Jun/1987
- MS Electrical Engineering UPR (Mayagüez) Jun/1991
- ME Computer Engineering UPR (Mayagüez) Dec/2000
- Other

Faculty service at UPRM:
Date of original appointment: August 2006

Dates of advancement in rank:

Instructor 2000 to present
Assistant Professor:

Total years of service: 7

Areas of professional expertise:
Digital Systems, Microprocessors, Computer Architecture, Software Development

Other related experience—academic or industrial:

Interamerican University of Puerto Rico, Aguadilla, Puerto Rico. 1989 to present
Computer Sciences & Electronic Engineering Technology Professor

Super B&M Supermarkets
Aguadilla, P.R. Jan 1991 - Jun 1993
Computer Systems Consultant

Sensomatic Electronics Corp.
San Antonio, P.R. Jan/1992 – May/1993
QCA Department Software Engineer (Consultant)

Consulting, patents:

State(s) in which registered:

Principal publications of last five years: (FY2002-2003-2007-2008)


Grants or externally funded project active during the last five years: (FY 2002-2003-2007-2008)

Scientific and professional societies of which a member:

Honors and awards:


Institutional and professional service in the last five years: (FY 2002-2003-2007-2008)

Electronics Committee

Professional development activities in the last five years: (FY 2002-2003-2007-2008)


Quality on Distant Education, UIPR (Aguadilla), Jan. 16/2007

Blogs Applications for Teaching) UPR (Mayagüez), Nov 2 – 21/2006


Online Course Development with WebCT, (Online Course), UPR (Mayaguez), Mar. 20 – Apr. 11/2005.

Offered Courses in the past two years

(UPR Mayagüez) INEL 4205 Logic Circuits, INEL 4206 Microprocessors, ICOM 4215 Computer Architecture and Organization

(IUPR Aguadilla) Calculus I, Logic Circuits, Structured Programming, Object Oriented Programming, Software Engineering, Computer Graphics,


Keep a weblog mostly oriented to help faculty, mainly non computer experts, using computer applications related to teaching-learning process. The weblog also includes other articles related to the teaching-learning process. Dimensión 360 (url: http://josenavarro.wordpress.com)

Judge at the Math Fair, 2002
NOACK, THOMAS

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

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**Faculty service at UPRM:**

- **Date of original appointment:** August 1982
- **Dates of advancement in rank:**

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<td>Professor</td>
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<td>Total years of service:</td>
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**Areas of professional expertise:**

- Operating systems, computer networks, operating system and network security

**Other related experience—academic or industrial:**

- Member of Technical Staff, AT&T Bell Laboratories, Liberty Corner, NJ, Summer 1988
- Consultant, contractor software development, Loveland, Colorado, 1981 to 1982
- Development Engineer, Hewlett-Packard Corporation, 1975 to 1981
- Elected Council Member, City of Loveland, Colorado, 1978 to 1982
- Assistant and Associate Professor, Department of Electrical Engineering, University of Missouri, Rolla, Mo., 1965 to 1975
- Member of Technical Staff, Bell Telephone Laboratories, North Andover, MA, Summer 1968
- Instructor, Department of Electrical Engineering, Iowa State University, 1956 to 1963
- Ensign and Lt. (j.g.), Shipboard Communications Officer, U.S. Navy, 1957 to 1959.

**Consulting, patents:**

- Medical laboratory software (1985-2001)

**State(s) in which registered:**

- Puerto Rico, Colorado, original registration obtained in Missouri

**Principal publications of last four years:** (FY2002-2003-2007-2008)

**Grants or externally funded project active during the last four years:** (FY 2002-2003-2007-2008)

**Scientific and professional societies of which a member:**

- Institute of Electrical and Electronics Engineers, (Life Senior Member)
- Colegio de Ingenieros y Agrimensores
- Association for Computing Machinery, Member

**Honors and awards:**

- Sigma Xi, Eta Kappa Nu, Collins Radio Graduate Assistantship, Iowa State College, 1956 to 1957

**Institutional and professional service in the last four years:** (FY 2002-2003-2007-2008)

**Professional development activities in the last four years:** (FY 2002-2003-2007-2008)

**Offered Courses in the past two years (2005-2007)**

- ICOM 4215 Computer Architecture and Organization
- ICOM 5007 Operating Systems Programming
- ICOM 5017 Network Security and Adm.
- ICOM 5018 Crypto and Net Security
- INEL 4206 Microprocessors
- INEL 4307 Communication between computers
- ICOM 4998 Undergraduate Research

**Community service activities:** (FY 2002-2003-2007-2008)
O’NEILL-CARRILLO, EFRAÍN

Academic rank: Professor

Degrees with fields, institution, and date:

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<tr>
<td>BS</td>
<td>Electrical</td>
<td>University of Puerto Rico, Mayagüez Campus</td>
<td>1994</td>
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<td>MS</td>
<td>Electrical</td>
<td>Purdue University</td>
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<td>Ph. D.</td>
<td>Electrical</td>
<td>Arizona State University</td>
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Faculty service at UPRM:

Date of original appointment: July 1999

Dates of advancement in rank:

- Assistant Professor: 1999 to 2002
- Associate Professor: 2002 to 2004
- Professor: 2004 to present

Total years of service: 9

Areas of Professional Expertise:

Power quality, power distribution systems, engineering education, energy policy, power electronics, load modeling, and social implications of technology

Other related experience—academic or industrial.

1/1996-5/1999 Arizona State University, Department of Electrical Engineering, Research Associate


Consulting, patents: None

State(s) in which registered: Puerto Rico

Principal publications of last four years: (FY 2002-2003- 2007-2008 )

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Grants or externally funded project active during the last four years: (FY 2002-2003- 2007-2008 )


Scientific and professional societies of which a member:
- Colegio de Ingenieros y Agrimensores de Puerto Rico (CIAPR), Society of Professional Engineers and Land Surveyors
- IEEE (Institute of Electrical & Electronics Engineers)
- IEEE Power Engineering Society
- IEEE Power Electronics Society
- IEEE Industrial Electronics Society
- IEEE Education Society
- IEEE Society of Social Implications of Technology
- American Society for Engineering Education (ASEE)
- Tau Beta Pi, National Engineering Honor Society

Honors and awards:
2005 Walter Fee Outstanding Young Engineer Award, IEEE Power Engineering Society Senior Member, IEEE, May 2005.
2004-2005 Outstanding Professor of Electrical and Computer Engineering Award, UPRM Early Promotion to Full Professor for Exceptional Merit, UPRM, November 2004
2003 Electrical Engineer of the Year, PR Society of Professional Engineers and Land Surveyors
2001-2002 Outstanding Professor of Electrical and Computer Engineering Award, UPRM

Institutional and professional service in the last four years: (FY 2002-2003-2007-2008)
- Member of the CIAPR Committee to Evaluate Renewable Energy in Puerto Rico and implementation strategies. Since June 2007.
- Member of the Round Table of Scientists on the Effects of Climate Change in Puerto Rico, May 2007.
- Editor-in-Chief/President of the Board, Dimension, Professional Magazine of the CIAPR (PR Society of Professional Engineers and Land Surveyors), since 2006.
- Coordinator for Social, Ethical and Global Issues in Engineering, UPRM, since 2006.
- PR-LSAMP Engineering Mentoring Coordinator, UPRM, since 2006.
- Chair of the IEEE Western PR Joint Chapter of the Education Society/SSIT, 2006-Present.
- Organizer of the IEEE Western PR Joint Chapter of the Education Society/Society for Social Implications oTechnology (SSIT), 2006.
- IEEE EAC Program Evaluator, since 2006.
- Engineering Representative to the UPRM Institutional Review Board (IRB), since 2006.
- Adjunct Professor, Center for Professional Ethics, UPRM, since 2005.
- Judge, Ethics Bowl, UPRM, April 2005.
- Member of the Committee to Evaluate the Technical Administration of the Puerto Rico Electric System by the Puerto Rico Electric Power Authority during the Tropical Storm (TS) Jeanne. The official inquiry by the CIAPR about what caused a general electric blackout in the Island of Puerto Rico during the TS of September 15, 2004. Responsibilities included: analysis of technical evidence, as submitted by PREPA, of the power system state and behavior as TS Jeanne crossed over Puerto Rico, the formulation of an hypothesis to explain such behavior, and to judge the decisions made on the administration of the power system during the storm. September 2004 – April 2005.
- Chair of the IEEE Western PR Power Engineering Society Chapter, 2004–Present.
President of the Industry-Academe Committee of the PR Institute of Electrical Engineers, 2004-Present.
Creator and President of the Executive Committee of the First Industry-University Symposium on Electrical Engineering (IUSEE 2003), November 2003.
Creator and General Chair, NSF Caribbean Colloquium on Power Quality, June 24-27, 2003, Dorado, PR.
Adjunct Professor, Institute for Communities’ Development, UPRM, since 2002.
Secretary-Treasurer, IEEE/PELS 7th Workshop on Computers in Power Electronics (COMPEL), Mayagüez, PR, June 2002.
President of the Education Committee of the PR-DOE’s One Million Solar Roof Initiative (2001).
Reviewer for the IEEE Transactions on Education.
Reviewer of NSF proposals in Education and Engineering.
Organizer, leader and presenter of continuing education conferences, short course and seminars for the IEEE, PES and the Colegio de Ingenieros y Agrimensores de Puerto Rico (CIAPR - PR Society of Professional Engineers and Land Surveyors). Since 2002, the continuing education activities organized by Dr. O’Neill have reached over 700 practicing engineers in Puerto Rico. Some of those activities were: Introduction to Power Quality, Distributed Generation, Power Quality Issues of Alternate Energy Sources, Introduction to Power Electronics, Grounding Systems.
Author and Contributor for Tecnomundo, official publication of the CIAPR.
Presenter for UPRM’s Pre-College Engineering Program (Since 2002)
Session Chair for conferences such as ASEE/IEEE Frontiers in Education (FIE) and IEEE/PES North American Power Symposium (NAPS)
Presenter during UPRM Open-House activities on the Atmospheric Phenomena Laboratory (1999-2002) and energy conversion laboratory.

**Professional development activities in the last four years: (FY 2002-2003- 2007-2008 )**

What Program Evaluators Know & Faculty Members Need to Know, by Ted Bickart, April 2006
EPRI’s Power Quality Seminar, San Juan, PR, February 2005.
Energy Sources, CIAPR-IIE, May 2004
Grounding Short Course, CIAPR-IIE, December 2003
Joint PR/VI Wind Workshop, DOE, September 2003
Efficiency in Energy Systems, CIAPR-IIE, May 2003
Advanced Course in Electric Power Engineering, Fall 2001 & Spring 2002

**Puerto Rico Electric Power Authority, Santurce, P.R.**

**Offered courses in the past two years (2005-2007)**

INEL 5495 Design Projects in Power Systems, INEL 5995 Special Problems, INEL 6096 Power Quality, INEL 6046 Master Thesis, INEL 6045 Master Project, INEL 6995 Special Topics in Electrical Engineering

**Community service activities: (FY 2002-2003- 2007-2008 )**
ORAMA-EXCLUSA, LIONEL R.

Academic rank: Professor

Degrees with fields, institution, and date:
- BS Electrical Engineering, Polytechnic University of Puerto Rico November 1992
- ME Electrical Power Engineering, Rensselaer Polytechnic Institute May 1994
- DEng Electrical Power Engineering, Rensselaer Polytechnic Institute October 1997

Faculty service at UPRM:
Date of original appointment: Assistant Professor, January 1998

Dates of advancement in rank:
- Associate Professor: July/2001 to June/2006
- Professor: July/2006 to present
- Total years of service: 10 years

Areas of professional expertise:

Other related experience—academic or industrial:
- Practice in design, consulting and expert witness as a Licensed Professional Engineer since 1999.

Consulting, patents:
- Jennings Tech, San Jose, California
- Advance Alternate Concepts-Tren Urbano, San Juan, Puerto Rico

State(s) in which registered:
- Commonwealth of Puerto Rico

Principal publications of last five years: (FY 2002-2003-2007-2008)

Grants or externally funded project active during the last five years: (FY 2002-2003 - 2007-2008)
- Collaborative Adaptive Sensing of the Atmosphere (CASA). With Dr. Sandra Cruz Pol, Dr. Jose Colóm, Dr. Rafael Rodriguez Solís and Dr. Walter Díaz, supported by the National Science Foundation (NSF)-Engineering Research Centers (ERC) Program, Fall 2003-present.
- Student Developed DCAS Radar Network for NASA Satellites Validation. Supported by the National Aeronautics and Space Administration (NASA)-IDEAS-ER Program, May 2005-April 2006.
- Strengthening Diversity Collaboration Through a Student Led System Test Bed on the Island of Puerto Rico ERC for (CASA. With Dr. Sandra Cruz Pol, Dr. Jose Colóm, Dr. Rafael Rodriguez Solís and Dr. Walter Díaz, supported National Science Foundation (NSF)-Supplement 2005.
- Acquisition of Instrumentation for the Electric Energy Processing Systems Laboratory at UPRM. With Dr. Efraín O’neill and Dr. Miguel Vélez, supported by the National Science Foundation (NSF)-Major Research Instrumentation (MRI) Program, Spring 2002-Fall 2004.

Scientific and professional societies of which a member:
- Institute of Electrical and Electronic Engineers (IEEE)-Power & Energy Society (IEEE-PES)
- Colegio de Ingenieros y Agrimensores de Puerto Rico (CIAPR)-Instituto de Ingenieros Electricistas (IIE)

Honors and awards:
Reserve Officers Association Award, AFROTC national decoration, May 1987.

Institutional and professional service in the last five years: (FY 2002-2003 - 2007-2008)

Special Assistant to the Chancellor for Research Affairs, University of Puerto Rico, Mayagüez, October 2001 to October 2003.
Director, Title V Project, $2,118,696 Grant from the U.S. Department of Education, University of Puerto Rico, Mayagüez, October 2001 to October 2003.
Coordinator, Industrial Affiliates Program (IAP), January 2007 to present.
Coordinator, Power & Energy Committee, January 2007 to present.

Professional development activities in the last five years: (FY 2002-2003 - 2007-2008)

- De acuerdo con la Energía Sostenible y Ahora ¿Cómo llegar allí?, Colegio de Ingenieros y Agrimensores de Puerto Rico (CIAPR), Mayagüez, mayo 2007.
- Financiamiento de Proyectos de Eficiencia Energética, Oficina de Asuntos de Energía, marzo de 2004.
- Ethics Across the Currículo Workshop, SEED, Oficina del Decano de Ingeniería, diciembre de 2003.
- Diseño de Sistemas de Puesta a Tierra, Colegio de Ingenieros y Agrimensores de Puerto Rico, mayo de 2003.

Offered Courses in the past two years

- Consulting Board Member for Licensing of the Electrical Engineering Program at the Interamerican University Puerto Rico, February 2004 to present.
- Member CIAPR: Committee to Investigate Palo Seco Steam Plant (PSSP) Fires, CIAPR, January to May 2006.
ORTIZ, JORGE L.

Academic rank: Professor

Degrees with fields, institution, and date:

- BS Electrical Engineering University of Puerto Rico-Mayaguez 1976
- MS Electrical Engineering University of Puerto Rico-Mayaguez 1978
- Ph. D. Electrical Engineering University of Houston 1984

Faculty service at UPRM:

Date of original appointment: August 1978

Dates of advancement in rank:

- Instructor: 1978 to 1984
- Assistant Professor: 1984 to 1987
- Associate Professor: 1987 to 1992
- Professor: 1992 to Present

Total years of service: 25

Areas of professional expertise:

Artificial Intelligence, Artificial Neural Networks, Natural Language Processing, Microprocessors, Digital Logic Systems

Other related experience—academic or industrial:

Interim Chairman of the Electrical and Computer Engineering Department 2004

Associate Dean of Engineering - Academic Affairs - August 1992-November 1993

Assistant Dean of Engineering - Academic Affairs - October 1989-August 1992

Acting Assistant Dean of Engineering - Academic Affairs - January 1989-October 1989

Associate Director - Administrative Affairs - Spring 1987 - Fall 1988

Acting Associate Director of the Electrical and Computer Engineering Department, Spring 1986


Appointments in the 2000 NAVY ASEE Summer Faculty Program in the Naval Air Warfare Center, Patuxent River, MD.. Research work in neural networks

Appointment the 1988 NAVY/ASEE Summer Faculty Fellowship Program in the Naval Surface Warfare Center, Dahlgren, Virginia. Research work was in Fault-Tolerant Processors

Appointment in the "1987 NASA/ASEE Summer Faculty Fellowship Program" in Johnson Space Center, Houston, Texas. Research work was in Fault-Tolerant Processors using INMOS Transputers.

Appointment in the "1986 NASA/ASEE Summer Faculty Fellowship Program" in the National Space Technology Laboratories in the Area of Remote Sensing.

Consulting, patents:

Hewlett-Packard Caribbean 2001

State(s) in which registered:

Puerto Rico

Principal publications of last five years: (FY 2002-2003-2007-2008)


- J.L. Ortiz, R. Pineiro, “EVELOUTIONARY LEARNING ALGORITHM FOR MORPHOLOGICAL PERCEPTRONS.” The Third IASTED International Conference on Artificial Intelligence and Applications (AIAC03),September 8-10, 2003, Benalmádena, Spain.


- J. Ortiz, C. Ocasio, “Analog Hardware Model for Morphological Neural Networks.” IASTED International Conference in Neural Networks and Computational Intelligence (NCI 2003), Cancun, Mexico. May 2003.


Grants or externally funded project active during the last five years: (FY 2002-2003-2007-2008)

Institutional and professional service in the last five years: (FY 2002-2003-2007-2008)

Professional development activities in the last five years: (FY 2002-2003-2007-2008)

Offered courses in the past two years (2005-2007)
ICOM 5995 Special Problems, INEL 4205 Logic Circuits, INEL 4206 Microprocessors, ICOM 6999 Master Thesis, ICOM 6015 Artificial Neural Network

ORTIZ FRANCESCHI, LUIS E.

Academic rank: Assistant Professor

Degrees with fields, institution, and date:

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<th>Degree</th>
<th>Field</th>
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<tr>
<td>BS</td>
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<td>MS</td>
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<td>Brown University</td>
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Faculty service at UPRM:

Date of original appointment: January 2007

Dates of advancement in rank:

Assistant Professor: 2007

Total years of service: 1

Areas of professional expertise:

Artificial intelligence and machine learning, computational game theory and economics, computational game theory and economics, computational biology, graphical models, computational probability and statistics, computational finance

Other related experience—academic or industrial:

Research Experience
Assistant Professor: Affiliated to Program for Research in Computing and Information Sciences and Engineering (PRECISE), Department of Electrical and Computer Engineering, University of Puerto Rico at Mayagüez, 2/2007-Present.
Working on computational game theory, artificial intelligence and machine learning applied to the study of complex systems.

Working on computational game theory and machine learning applied to computational biology.

Worked on computational game theory, economics and finance.

Worked on the system design, development and implementation of the Penn Exchange Server (PXS), and electronic crossing network (ECN) simulator. Also worked on the data analysis on intra-an inter-university competitions’ results.

Worked on a system for name disambiguation. Also worked on computational learning theory.

Conducted research on modeling faults in real-world electricity grid networks.

Teaching experience

Lectured on boosting.

Guest Lecturer: 6.972 Game Theory and Mechanism Design (graduate course), Department of Electrical Engineering and Computer Science, Massachusetts, Institute of Technology, Spring 2005 (instructor: Prof. Asuan Ozdaglar).
Lectured on computing Nash equilibria in games.

Guest Lecturer: Joint course CIS 620 and Wharton OPIM 952 Computational Game Theory, University of Pennsylvania, Spring 2003 (instructor: Prof. Michael Kearns). Lectured on game-theoretic graphical models (graphical games)


Held Q&A and tutorial sessions on the usage of the Penn Exchange Server (PXS), strategy implementation and project competitions on occasion during weekly meetings with project participants (approximately 30 Penn students plus faculty and students from other institutions including U. Texas, CMU, Columbia and Rutgers). Supervised project staff members working on system implementation. Advised project participants on strategy design and development. Assisted during intra- and inter–university competitions.

Course Assistant: Department of Computer Science, Brown University, Spring 2001 (instructor: Prof. Thomas L. Dean).
Lectured on EM, learning Bayesian networks and ensemble methods for graduate-level machine learning course. Assisted during lectures and homework development. Helped students with homework.
Mentor: NSF Integrative Graduate Education and Research Training (IGERT) Program, Brown University, Summer 2000-Spring 2001 (advisor: Prof. Steven Sloman, Department of Cognitive and Linguistic Sciences).
Mentored undergraduate student in cognitive science toward honor thesis.

Consulting, patents:

State(s) in which registered:

Principal publications of last four years: (FY 2002-2003-2007-2008)

Publications

Ph.D. Thesis

Referred Journals

Referred Conferences

Technical Reports


Working Papers


Grants or externally funded project active during the last four years: (FY 2002-2003- 2007-2008)

Scientific and professional societies of which a member:

Honors and awards:


Institutional and professional service in the last four years: (FY 2002-2003- 2007-2008)

Professional development activities in the last four years: (FY 2002-2003- 2007-2008)

Offered Courses in the past two years


None
ORTIZ-RIVERA, EDUARDO I.

Academic rank: Assistant Professor

Degrees with fields, institution, and date:

- BS Electrical Engineering, University of Puerto Rico, Mayagüez Campus, 05/2000
- MS Electrical Engineering, Michigan State University, 05/2002
- Ph.D. Electrical Engineering, Michigan State University, 05/2006 (Advisor Fang Z. Peng)

Faculty service at UPRM:

Date of original appointment: August 2006

Dates of advancement in rank:

- Assistant Professor: 2006 to present
- Total years of service: 1

Areas of professional expertise:

Renewable Energy, Algorithms for Maximum Power Control, Resonators, Nonlinear Control, Power Electronics, Electric Drives

Other related experience—academic or industrial:

- 2006 – : Assistant Professor, Electrical and Computer Engineering, UPRM
- Summer 2002 : Research Assistant, Fermi National Accelerator Laboratory, Batavia, IL
- Summer 2001 : Research Assistant, Fermi National Accelerator Laboratory, Batavia, IL
- 1999 : Project Manager Assistant, Transmission Lines Division, Lord Electric Company, Rio Piedras, PR
- 1998 – 1999 : Research Assistant, Tren Urbano, ATI, San Juan, PR

Consulting, patents:

State(s) in which registered:

Principal publications of last five years: (FY 2002-2003-2007-2007)


Grants or externally funded project active during the last five years: (FY 2002-2003-2007-2008)

1. Mathematical modeling of the Z-Source converter (2004), Chinese Academy of Science Institute of Automation, sponsored by the National Science Foundation, Beijing, China (EAPSI Program).

Scientific and professional societies of which a member:

Institute of Electrical and Electronics Engineers
American Institute of Aeronautics and Astronautics
Honors and awards:

- Graduate Assistance In Areas Of National Need Fellow (GAANN) Fellow, 2004
- Alfred P. Sloan Ph.D. Fellow, 2001
- National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM) Fellow, 2002
- Puerto Rico Industrial Development Company (PRIDCO) Fellow, 2000
- MSU Competitive Doctoral Fellow, 2000
- Hispanic Scholarship Fund Fellow, 2000
- Puerto Rico Manufacturers Association Fellow, 2000

Institutional and professional service in the last five years: (FY 2002-2003-2007-2008)

- Reviewer for the IEEE Transactions in Power Electronics.
- Reviewer for the IASTED Transactions in Power Quality.
- Reviewer for several IEEE Conference

Professional development activities in the last five years: (FY 2002-2003-2007-2008)

Seminars related to solar energy

Offered Courses in the past two years

INEL 6000 Nonlinear Control, INEL 4505 Introduction to control systems, INEL 4998 Undergraduate Research, INEL 5995 Special Problems, ICOM 4998 Undergraduate Research, ICOM 5995 Special Problems, INEL 4102 Electrical Systems Analysis II, INEL 6046 Master’s Thesis.


- Motivational speaker for high school students in low-income communities at Barranquitas, PR.
- Volunteer (consultant services) for the Helechal Arriba Community, Barranquitas, PR.
PALOMERA GARCÍA, ROGELIO

Academic rank: Professor

Degrees with fields, institution, and date:

BS Electronics and Communications Engineering University of Guadalajara, México 1971
MS Electrical Engineering University of Electrocommunications, Japan 1975
Ph.D. Docteur es Sciences Tecniques Swiss Federal Institute of Technology 1979

Faculty service at UPRM:
Date of original appointment: 1985

Dates of advancement in rank:

Instructor:
Assistant Professor: 1985 to 1986
Associate Professor: 1986 to 1992
Professor: 1992 to present
Total years of service: 22

Areas of professional expertise:
Integrated Circuits, Circuit Theory, Fuzzy Logic, Neural Networks, Linear algebra, Graph Theory

Other related experience—academic or industrial:
June 1975 -June 1979, Research assistant, Department of Electricity, Swiss Federal Institute of Technology, Lausanne, Switzerland.
November 1979 -August 1985, Titled Full time Scientific Researcher, Centro de Investigación Científica y de Estudios Superiores de Ensenada, Ensenada, Baja California, Mexico
Invited Professor, San Diego State University, Department of Electrical Engineering, Fall 1984
Invited Summer Faculty Internship, OakRidge National Laboratory, Oak Ridge, TN, Summer: 1990, 1991
1992-1993, Researcher, Department of Electricity, Swiss Federal Institute of Technology, Lausanne, Switzerland
Summer Internship: Texas Instruments, Dallas. Summer 2000, 2001

Consulting, patents:
Consulting:
Novatek, Puerto Rico, 1994
AMI Microsensor, 2002

State(s) or Countries in which registered:
Mexico

Principal publications of last five years: (FY 2002-2003- 2007-2008 )

Grants or externally funded project active during the last five years: (FY 2002-2003- 2007-2008 )

Scientific and professional societies of which a member:
Member of the IEEE: (Circuits and Systems, Education, Fuzzy Systems, Social Implications of Technology, Professional Communication societies)
Chairman of the IEEE Circuits and Systems - Signal Processing Chapter of Western Puerto Rico Section
Member of the Institute of Electronics, Information and Communication Engineers, Japan.

Honors and awards:
Scholarship from the Japan Ministry of Education 1972-1975
National Institute of Scientific Researchers, Mexico, National Researcher Category II, 1985-1988
Institutional and professional service in the last five years: (FY 2002-2003- 2007-2008 )

Professional development activities in the last five years: (FY 2002-2003- 2007-2008 )
Offered courses in the past two years (2005-2007)

PARSIANI, HAMED

Academic rank: Professor

Degrees with fields, institution, and date:

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<tr>
<th>Degree</th>
<th>Field</th>
<th>Institution</th>
<th>Date</th>
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<tbody>
<tr>
<td>BS</td>
<td>Mathematics</td>
<td>Oregon State University</td>
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<tr>
<td>BS</td>
<td>Electrical Engineering</td>
<td>Oregon State University</td>
<td>1971</td>
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<tr>
<td>MEE</td>
<td>Electrical Engineering</td>
<td>Texas A&amp;M University</td>
<td>1973</td>
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<td>Ph. D.</td>
<td>Electrical Engineering</td>
<td>Texas A&amp;M University</td>
<td>1979</td>
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</table>

Faculty service at UPRM:

Date of original appointment: August 1986

Dates of advancement in rank:

- Assistant Professor: 1986 to 1988
- Associate Professor: 1988 to 1993
- Professor: 1993 to present

Total years of service: 21

Areas of professional expertise:

Image Processing, Remote Sensing, LIDAR, Communications, Microprocessors

Other related experience—academic or industrial.

Chair & Coordinator of NOAA-CREST Symposium at Mayaguez, PR, Feb. 23-25, 2006

- Presenting the group research at yearly technical session of NOAA-CREST advisory Board Meetings 2003 to present.
- Organizing and sending UPRM-NOAA-CREST students with oral and poster session presentations once or twice a year to a NOAA conference or symposium, from 2003 to present.

Consulting, patents: None

State(s) in which registered: None

Principal publications of last five years: (FY2002-2003-2007-2008)

- Pedro Rodriguez, Hamed Parsiani, “Moisture Determination Based on Ground Penetrating Radar Measurements” CRC’2004 Proceedings, April 2, 2004, Mayaguez, P.R.


Grants or externally funded project active during the last five years: (FY2002-2003-2007-2008)

- UPRM-Deputy-PI of “Center of Remote Sensing & Technology”, CREST-NOAA research grant for $2,500,000 per year for 2006-2011.

- PI of “soil moisture algorithm development using Radar”, GSSI Inc. grant 2006-2007, $36,000.00

- UPRM-Deputy-PI of “Center of Remote Sensing & Technology”, CREST-NOAA research grant for $2,500,000 per year for 2001-2006.

- Co-PI of “Tropical Center for Earth and Space Studies”, NASA-URC II, Goddard Flight Center, NASA grant for $4,999,513.00, with UPR matching fund for $2,450,000.00, 2000-2005.

Scientific and professional societies of which a member:

Institute of Electrical and Electronics Engineers, (Member)

Honors and awards:

- Permanent member of the Eta Kappa Nu Honor Society, granted by Texas A&M University

- Institutional and professional service in the last four years: (FY2002-2003-2006-2007)

- Communication & Digital Signal Processing committee member FY 2002 to present.


- Professional development activities in the last four years: (FY2002-2003-2006-2007)

- Chair & Coordinator of NOAA-CREST Symposium at Mayaguez, PR, Feb. 23-25, 2006

- Lidar system development, short seminars at CUNY-NY Lidar Lab., NY 2005 & 2006

- Visit to Arecibo Observatory Lidar lab with research students, March 22, 2005

- Certification of Completion of Hyperspectral Imaging & Data Analysis at Univ. of Colorado Center for the study of earth from Space June, 2003.

Offered Courses in the past two years (2005-2007)

INEL 4205 Logic Circuits, INEL 4301 Communications Theory I, INEL 6046 Master Thesis, INEL 6045 Engineering Project, INEL 5327 Image Processing, INEL 5307 Optical Communications, INEL 4301 Communication Theory
- International delegate for the election of the Universal House of Justice, the supreme institution of the Baha’is of the world (2003)
- Chairman (2002-2005) & vice-chairman (2006-2007) of the Local Spiritual Assembly of the Baha’is of Mayaguez
RAMIREZ, ALBERTO

**Academic rank:** Associate Professor

**Degrees with fields, institution, and date:**

<table>
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<th>Degree</th>
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<th>Institution</th>
<th>Date</th>
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<tr>
<td>BS</td>
<td>Electromechanical Engineer</td>
<td>UNC</td>
<td>1968</td>
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<td>PhD</td>
<td>Electrical Engineering</td>
<td>University of Texas at Arlington</td>
<td>2002</td>
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**Faculty service at UPRM:**

*Date of original appointment: Jan 2003*

**Dates of advancement in rank:**

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<th>Rank</th>
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<tr>
<td>Associate Professor</td>
<td>2003 to present</td>
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<td>Total years of service</td>
<td>4</td>
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**Areas of professional expertise:**

Energy System Economics, Planning, Operation and Organization; Congestion Management; Ancillary Services, Rational Use of Energy

**Other related experience—academic or industrial:**

- General Electric (USA) 5 years
- Hidronor Utility (Argentina), 14 years
- Energy Policy Institute (Argentina) 5 years

**Patents:** US Utility Invention Patent # 5262677

**Consulting:** Montreal/S Engineering (Canada) 4 years

**State(s) in which registered:**

**Principal publications of last four years: (FY 2002-2003-2007-2008)**


**Grants or externally funded project active during the last four years: (FY 2002-2003-2007-2008)**

NSF EPNESS/IPR Project IAP “Corona Loss Engineering-Economic Assessment to the Electric Power System”
UPRM ‘Proyecto Especial para el Establecimiento de un Programa de Capacitación Avanzada en Ingeniería de Potencia para las Américas (Programa Panamericano de Capacitación en Ingeniería de Potencia Eléctrica)’

**Scientific and professional societies of which a member:** IEEE Power Engineering Society; IEEE Power Education Society; IEEE PR West Chapter; the New York Academy of Science

**Honors and awards:** IEEE Senior Member

**Institutional and professional service in the last four years: (FY 2002-2003-2007-2008)**

**Professional development activities in the last four years: (FY 2002-2003-2007-2008)**

**Offered Courses in the past two years**


RIVERA-CARTAGENA, JOSÉ A.

Academic rank: Professor.

Degrees with fields, institution, and date:

<table>
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<th>Date</th>
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<tr>
<td>BS</td>
<td>Electrical</td>
<td>Engineering, University of Puerto Rico,</td>
<td>1971</td>
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<td>Engineering</td>
<td>Mayagüez Campus</td>
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<tr>
<td>MS</td>
<td>Electrical</td>
<td>Engineering, University of Puerto Rico,</td>
<td>1975</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td>Mayagüez Campus</td>
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<tr>
<td>MS</td>
<td>Electrical</td>
<td>Engineering, The City University of New</td>
<td>1992</td>
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<td>Engineering</td>
<td>York, New York</td>
<td></td>
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<tr>
<td>Ph. D.</td>
<td>Electrical</td>
<td>Engineering, The City University of New</td>
<td>1992</td>
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<tr>
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<td>Engineering</td>
<td>York, New York</td>
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</table>

Faculty service at UPRM:

Date of original appointment: August 1976.

Dates of advancement in rank:

Instructor: 1973 to 1978
Assistant Professor: 1978 to 1991
Associate Professor: 1992 to 1998
Professor: 1998 to Present
Total years of service: 28

Areas of professional expertise:


Other related experience—academic or industrial.

2000 – Interim Chairman of the ECE Dept., University of Puerto Rico, Mayagüez.
Summer 1971 – Instructor of Mathematics, Puerto Rico Department of Public Works.
Active member of the accreditation committee for engineering related programs - Board of Higher Education of Puerto Rico (2000 to present).

State(s) in which registered:

Puerto Rico.

Principal publications of last four years: (FY 2002-2003 - 2007-2008):

None.

Grants or externally funded project active during the last four years: (FY 2002-2003 - 2007-2008)

None.

Scientific and professional societies of which a member:

Institute of Electrical and Electronics Engineers, Member.

Tau Beta Pi, Member.

Honors and awards:

President’s Dissertation Year Fellowship - CUNY Graduate School (1991-92).

Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)

Technical paper evaluator.

Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)

None.

Offered Courses in the past two years (2005-2007)


Tutoring High School Students for College Board Examination.
RIVERA-GALLEGO, WILSON

Academic rank: Associate Professor

Degrees with fields, institution, and date:

<table>
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<td>BS</td>
<td>Mathematics</td>
<td>Universidad del Valle</td>
<td>1989</td>
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<td>MS</td>
<td>Computational Mathematics</td>
<td>University of Puerto Rico</td>
<td>1994</td>
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<td>Ph. D.</td>
<td>Computational Engineering</td>
<td>Mississippi State University</td>
<td>2000</td>
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</table>

Faculty service at UPRM:

Date of original appointment: July 2000

Dates of advancement in rank:

- Assistant Professor: 2000 to 2004
- Associate Professor: 2004 to Present
- Total years of service: 7

Areas of professional expertise:
High Performance Computing, Parallel and Distributed Computing, Information Technology

Other related experience—academic or industrial.

None

Consulting, patents

None

State in which registered

None

Principal publications of last four years: (FY 2002-2003 - 2007-2008)


Grants or externally funded project active during the last four years: (FY 2002-2003 - 2007-2008)

1. Co-PI, “An Infrastructure for Wide-Area Large Scale Automated Information Processing” National Science Foundation (NSF), 10/15/04-10/14/09, $1,499,012
3. PI, “Digital Publishing Research Program” Hewlett-Packard 03/01/04-02/28/05, $450,000
4. PI,” Enhancing High Performance Computing Research and Education at UPRM” Hewlett-Packard 06/01/03-07/01/04, $151,872 (+ $126,000 fondos de pareo HP-Puerto Rico)

Scientific and professional societies of which a member:

Association for Computing Machinery - ACM

Honors and awards:

Distinguished Professor 2005-2006; Electrical and Computer Engineering Department

Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)

1. Member INEL/ICOM Graduate Committee, 2000-2003
2. Member CISE Graduate Committee, 2001-2004
3. Member ICOMSW committee, 2000-Present
4. Member Faculty Computational Resources committee, 2000-2003

Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)

1. HP University Relations Latin America Grid & Utility Computing Workshop - San Juan, Puerto Rico, May 22 - 23, 2006
2. Emerging computing trends: utility computing and digital publishing Workshop – Santiago, Chile, August 20-26, 2006
5. IBM Faculty Workshop, December 8-11, 2003
6. Presentation skills, Texas Instrument, April 30, 2003
8. EOT-PACI/AN-MSI High Performance Computer Clusters Workshop National Center for Supercomputing Applications, Champaign, IL, May 6-7, 2002

Offered Courses in the past two years (2005-2007)


1. Director, Parallel and Distributed Computing Laboratory at UPRM.
2. Executive Director, Institute for Computing and Informatics Studies at UPRM
5. Voting member of the Gelato Strategy Council
RIVERA-VEGA, PEDRO I.

Academic rank: Professor

Degrees with fields, institution, and date:

- BS Mathematics University of Puerto Rico, Río Piedras 1977
- MS Applied Mathematics University of Puerto Rico, Río Piedras 1980
- Ph. D. Computer Sciences University of Florida 1990

Faculty service at UPR:

Date of original appointment: August 2001 (since August 1984 at UPR – Río Piedras)

Dates of advancement in rank:

- Instructor: 1983 to 1990
- Assistant Professor: 1990 to 1994
- Associate Professor: 1994 to 1999
- Professor: 1999 to Present

Total years of service: 21

Areas of professional expertise:

Algorithms, Data Structures, and Databases

Consulting, patents:


State(s) in which registered:

None

Principal publications of last four years: (FY 2002-2003-2007-2008):


Grants or externally funded project active during the last four years: (FY 2002-2003-2007-2008)


Scientific and professional societies of which a member:

Association for Computer Machinery (ACM)

Honors and awards:

NSF Graduate Fellowship, 1978-1980. While being a graduate student at the Department of Mathematics at UPR.

NASA Graduate Fellowship, 1988-1989. As a PhD student at the University of Florida, Gainesville.

Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)

Faculty advisor of the Local Engineering and Sciences ACM Student Chapter in UPR-Mayaguez.
Reviewer for various technical journals and conferences, including: CRC UPR-RUM, and The IASTED International Conference in Information and Knowledge Sharing, and in Databases.

Member of the IASTED Technical Committee on Information and Knowledge Sharing. Reviewer in different grant programs:

NSF - CISE NSF – SBIR


Faculty advisor for several undergraduate students sponsored by the following projects or grants: IAP at UPR-Mayaguez, PR-LSAMP, E-Government Project, and InduSoft Project.

Evaluator appointed by the Board of Higher Education in Puerto Rico to evaluate a graduate program in e-commerce at the Interamerican University of Puerto Rico, Bayamón.
Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)
Global Entrepreneurship: Strategy and Execution, Grupo Guayacán, Ritz Carlton Hotel, Casino and Spa, Carolina, PR, October 31\textsuperscript{st}, 2007.
Puerto Rico Venture Forum and Enterprize Competition, Ritz Carlton Hotel, Casino and Spa, Carolina, PR, November 13, 2006.

Offered Courses in the past two years (2005-2008)

Vice-president of Board of Residents at Condominium Los Almendros, Rincón, PR.
RODRÍGUEZ, DOMINGO

Academic rank: Professor

Degrees with fields, institution, and date:

- BS  Electrical Engineering  City College of New York  1979
- MS  Electrical Engineering  Union College  1981
- Ph. D.  Electrical Engineering  City University of New York  1988

Faculty service at UPRM:

Date of original appointment: July 1988

Dates of advancement in rank:

- Assistant Professor:  1988 to 1991
- Associate Professor:  1991 to 1996
- Professor:  1996 to Present
- Total years of service:  19

Areas of professional expertise:

- Digital Signal Processing, Communications.

Other related experience—academic or industrial:

- Jun/85 - Jul/88  Research Assistant, Center for Large Scale Computation, Grad. Center CUNY, NY.
- Sep/84 - Jun/85  Lecturer, New York Inst. of Technology, Comp. Science Dept., Long Island, NY.
- Jun/82 - Sep/84  Senior DPBX Systems Engineer, CONTEL – MCI, Long Island, New York.
- Jun/79 - Jun/82  Communications Engineer, General Electric Res. and Dev. Center, Schenectady, NY.

Consulting, patents:

None

State(s) in which registered:

None

Principal publications of last five years:  (FY 2002-2003-2007-2008)

Significant Publications


Other Significant Publications

Grants or externally funded project active during the last five years: (FY 2002-2003 - 2007-2008)

Scientific and professional societies of which a member:

Institute of Electrical and Electronics Engineers, (Member)
International Society of Optical Engineering (SPIE)

Honors and awards:

None

Institutional and professional service in the last five years: (FY 2002-2003 - 2007-2008)

Professional development activities in the last five years: (FY 2002-2003-2007-2008)

1. Director of the UPRM-ECE Institute for Computing and Informatics Studies, at the R&D Center.
2. Collaborated in the development and the establishment of the PhD in Computing and Information Sciences and Engineering at UPRM.

Offered courses in the past two years (2005-2008)


None.
Appendix 315

RODRÍGUEZ, NÉSTOR J.

Academic rank: Professor

Degrees with fields, institution, and date:

<table>
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<tr>
<th>Degree</th>
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<td>BS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico</td>
<td>1978</td>
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<td>MS</td>
<td>Electrical Engineering</td>
<td>Ohio State University</td>
<td>1981</td>
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<tr>
<td>Ph.D.</td>
<td>Electrical Engineering</td>
<td>University of Wisconsin Madison</td>
<td>1988</td>
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Faculty service at UPRM:

Date of original appointment: July 1981

Dates of advancement in rank:

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<th>Rank</th>
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<td>Instructor</td>
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<td>Assistant Professor</td>
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<td>Associate Professor</td>
<td>1991 to 1996</td>
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<td>Professor</td>
<td>1996</td>
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<td>Total years of service</td>
<td>16</td>
</tr>
</tbody>
</table>

Areas of professional expertise:

Human computer interaction, usability engineering, computer architecture

Other related experience—academic or industrial:

Design Engineer at Phillips Puerto Rico Core (June 78 to August 79)

Consulting, patents:

None

State(s) in which registered:

None

Principal publications of last four years: (FY 2002-2003 - 2007-2008)


Grants or externally funded project active during the last four years: (FY 2002-2003 - 2007-2008)

CoPI, “Computing Alliance for Hispanic-Serving Institutions” National Science Foundation, $2,000,000, March 1, 2006 – February 28, 2009
Co-PI, “An Infrastructure for Wide-Area Large Scale Automated Information Processing”, National Science Foundation, $1,000,000, September 2004-August 2009


Scientific and professional societies of which a member:
Institute of Electrical and Electronics Engineers, (IEEE), Member
Association of Computer Machinery (ACM), Member
American Medical Informatics Association, Member

Honors and awards:
None.

Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)
None.

Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)

Workshops:
2. Project Management: Implementing Systems on Time and Within Budget (AMIA 2005, October 23, 2005)

Offered courses in the past two years (2005-2008)
INEL 4998 Undergraduate Research, INEL 6046 Master’s Thesis, INEL 6068 ICOM 6095 Human-Computer Interaction, ICOM 6998 Master’s Project, ICOM 6999 Master Thesis, ICOM 4215 Computer Architecture and Organization, INEL 6009 Computer System Architecture, ICOM 4152 Electromagnetics I,

None.
RODRÍGUEZ-MARTÍNEZ, MANUEL

**Academic rank:** Associate Professor

**Degrees with fields, institution, and date:**

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<th>Field</th>
<th>Institution</th>
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<tr>
<td>BS</td>
<td>Mathematics</td>
<td>University of Puerto Rico, Rio Piedras</td>
<td>1994</td>
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<tr>
<td>MS</td>
<td>Computer Science</td>
<td>University of Maryland, College Park</td>
<td>1996</td>
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<td>Ph. D.</td>
<td>Computer Science</td>
<td>University of Maryland, College Park</td>
<td>2001</td>
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**Faculty service at UPRM:**

**Date of original appointment:** July 2001 (Month, Year)

**Dates of advancement in rank:**

- Assistant Professor: 2001 to 2005
- Associate Professor: 2005 to Present
- Total years of service: 6

**Areas of professional expertise:**

Database Management Systems, Computer Networks

**Other related experience—academic or industrial:**

- None

**Consulting, patents:**


**State(s) in which registered:**

- None

**Principal publications of last five years: (FY 2002-2003 - 2006-2008)**


**Grants or externally funded project active during the last five years: (FY 2002-2003- 2007-2008)**

PI for IBM SUR Grant, IBM, $100K, 2005-2006

Scientific and professional societies of which a member:
Association for Computer Machinery (ACM)
Special Interest Group on the Management of Data (SIGMOD)

Honors and awards:
2005 NSF CAREER AWARD for project “CARREER: NetTraveler – A Database Middleware System for Ubiquitous Data Access on Wide-Area Networks”.

Institutional and professional service in the last five years: (FY 2002-2003 - 2007-2008)

1. Member of the ICOM Computing Systems Committee
2. Member of the INEL/ICOM Graduate Committee
3. Member of the CISE Ph.D. Graduate Committee
4. Member of the Campus Senate Computing Ad Hoc Committee
5. Coordinator for the CISE Ph.D. Program
6. Member of NSF Panel on Cyber Infrastructure
7. Member of NSF Panel on IT SBIR Proposals
8. Member of NSF Panel on Minority Infrastructure and Instrumentation Proposals
9. Member of the Ad Hoc Committee for the Puerto Rico Higher Education Board regarding the IT B.S. degree of the National College of Business and Technology.

Professional development activities in the last five years: (FY 2002-2003 - 2007-2008)

Puerto Rico Venture Forum and Enterprize Competition, Ritz Carlton Hotel, Casino and Spa, Carolina, PR, November 13, 2006.

Offered courses in the past two years (2005-2007)

Palo Seco Sports Club, Board of Directors for the Caboquero Condominium
RODRÍGUEZ-SOLÍS, RAFAEL A.

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

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**Faculty service at UPRM:**

**Date of original appointment:** January 1998

**Dates of advancement in rank:**

- Assistant Professor: 1998 to 2001
- Associate Professor: 2001 to 2006
- Professor: 2006 to Present

**Total years of service:** 10

**Areas of professional expertise:**

- Microwaves, Antennas

**Other related experience—academic or industrial:**

- Visiting Scientist, 06/99 to 08/99, BBN Technologies, Cambridge, MA.
- Instructor, 06/97 to 08/97, The Pennsylvania State University, University Park.
- Engineering Technical Associate, 08/96 to 08/97, BBN Systems and Technologies, Cambridge, MA.
- Summer Intern, 05/96 to 08/96, BBN Corporation, Cambridge, MA.
- Summer Staff, 06/95 to 08/95, MIT Lincoln Laboratory, Lexington, MA.
- Graduate Assistant, 08/91 to 08/93, University of Florida, Gainesville.
- Engineer I, 05/90 to 08/91, Telefónica Larga Distancia, San Juan, Puerto Rico.

**Consulting, patents:**

- Independent Consultant, 08/97 to 12/97, REMCOM, Inc., University Park, PA.

**State(s) in which registered:**

- P.R. Inactive license.

**Principal publications of last five years: (FY 2002-2003 - 2007-2008)**


Grants or externally funded project active during the last five years: (FY 2002-2003 - 2007-2008)

Center for Collaborative and Adaptive Sensing of the Atmosphere, NSF, Researcher
Gordon Center for Subsurface Sensing and Imaging Systems, NSF, UPRM Education Coordinator
Detection, Fate, Transport, and Remediation of Chlorinated Solvents in Low-Permeability Porous Media, DoE, Co-PI
CAREER: Wideband Slot-like Antennas and Enhancement of Electromagnetic Education at UPRM, NSF, PI
Tropical Center for Earth and Space Studies, NASA, Researcher
Partnership for Space Science Education and Research, NASA, Co-PI

Scientific and professional societies of which a member:
IEEE Antennas and Propagation Society (Member)
IEEE Microwave Theory and Technique Society (Member)
IEEE Geosciences and Remote Sensing Society (Member)
IEEE Education Society, Western PR Section Chapter (Treasurer)

Honors and awards:

Outstanding Electrical Engineering Professor 2000-2001

Institutional and professional service in the last five years: (FY 2002-2003 - 2007-2008)
IEEE Education Society, Western PR Section Chapter (Treasurer)
IEEE Communications Society UPRM Student Chapter Advisor
Reviewer for IEEE Transactions on Antennas an Propagation Special Issue on Multifunction Antennas and Antenna Systems, Feb. 2006
Panelist for the NSF-SBIR Program in 2003, 2005 and 2007
Panelist for the NSF Graduate Research Fellowship Program in 2005
Coordinator for the ECE Applied Electromagnetics Area, 2000-present
ECE Graduate Committee, 2001-present
School of Engineering Graduate Committee, 2001-2006
UPRM Graduate Council, 2006-present

Professional development activities in the last five years: (FY 2002-2003 - 2007-2008)

Introduction to Networking and Wireless Networks, CASA ERC, Mayagüez, PR, Jan. 2006

Practical Design of Microstrip Arrays and Reflectarrays, 2003 IEEE Antennas and Propagation International Symposium, Columbus, OH.

Offered courses in the past two years (2005-2007)


ROSADO ROMÁN, JOSÉ

**Academic Rank:** Associate Professor

**Degrees with fields, institution, and date:**

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**Faculty service at UPRM:**

- **Date of original appointment:** August 1999
- **Dates of advancement in rank:**
  - Assistant Professor: 1999 to 2004
  - Associate Professor: 2004 to Present
  - **Total years of service:** 8

**Areas of professional expertise:**

- Electromagnetics, Electro-physics, Space Plasma Physics

**Other related experience—academic or industrial.**

- **Industrial:** Worked for 1 year as radar technician 1991 at Cornell University after completing Master of Eng. EE.
- **Academic:** Worked for 1 year as assistant professor of Physics at the Physics Department, UPRM. 1999-2000.
- **Academic:** Worked for 1 summer as Visiting Scientist at the Arecibo Observatory, Arecibo, PR. Summer 2003.

**Consulting, patents:**

None.

**State(s) in which registered:**

- Puerto Rico (EIT).

**Principal publications of last five years: (FY 2002-2003 - 2007-2008)**


**Grants or externally funded projects active during the last five years: (FY 2002-2003 - 2007-2008)**

- NASA Grant, $750k, Partnership for Space Science and Education and Research (PaSSER), 2004 – 2006. Started as Co-I and worked as PI during last two years after original PI retired.
- NOAA Grant, $1.2M, NOAA – CREST Project, 2007-2012, Co-I.
  - NSF funded, Horizontal structure of Sporadic-E revisited using dual beam., Arecibo Observatory Project, August 2002. Observing time for 4 nights (48 hours) sponsored by NSF.

**Institutional and professional service in the last five years: (FY 2002-2003 - 2007-2008)**

- Coordinator, Basic Courses committee, 2002-2004.
- Member, Applied Electromagnetics Area Committee, 2002-2008.
- Member, Advising Committee of the ECE Dept, 2002-2003.
- Member, Engineering Faculty Rules Committee, 2004-2006.
- Member, IAP Committee, 2006-2008.
- Member, UPRM Academic Senate, 2007-2008.

**Professional development activities in the last five years: (FY 2002-2003 - 2007-2008)**

- Attended IEEE-ABET Progam Evaluator training conference as observer, April 2005, Broomfield, CO.

**Offered courses in the past two years (2005-2007)**

- ICOM 4998 Undergraduate Research
- INEL 4102 Electrical Systems Analysis II, INEL 6216 Advanced Electromagnetics
- INEL 5995 Special Problems, INEL 5029 Telecommunications Elective
- INEL 4151 Electromagnetics I, INEL 4102 Electrical Systems Analysis II, INEL 4048 Electrical Engineering Practice
- INEL 3105 Electrical Systems Analysis I, INEL 4998 Undergraduate Research
SANTIAGO-SANTIAGO, NAYDA G.

**Academic rank:** Assistant Professor

**Degrees with fields, institution, and date:**

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<td>Electrical Engineering</td>
<td>Michigan State University</td>
<td>2003</td>
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**Faculty service at UPRM:**

Date of original appointment: August 1990

**Dates of advancement in rank:**

- Instructor: 1990 to 1994
- Assistant Professor: 2000 to 2003
- Total years of service: 11

**Areas of professional expertise:**

- Performance Evaluation Methods, HPC systems, and Parallel Processing
- Other related experience—academic or industrial:
  - August 1997 to 2000 – Research Assistant, Department of Electrical and Computer Engineering, Michigan State University, East Lansing, MI
  - June 1996 to August 1996 – Summer Intern, Cornell Theory Center, Ithaca, NY
  - August 1995 to May 1996 – Teaching Assistant, Michigan State University, East Lansing, MI
  - August 1990 to June 1994 – Instructor, University of Puerto Rico, Mayagüez, PR
  - September 1989 to May 1990 – Research Assistant, Cornell University, Ithaca, NY
  - August 1988 to May 1989 – Digital Electronics Laboratory Instructor, University of Puerto Rico, Mayagüez, PR
  - 1988 Summer – Research Assistant, Texas A&M University, College Station, TX

**Consulting, patents:**

None.

**State(s) in which registered:**

Puerto Rico

**Principal publications of last five years: (FY 2002-2003- 2007-2008)**


- Morales, Javier; Medero, Nelson; Santiago, Nayda G.; Sosa, Julio; Hardware implementation of image space reconstruction algorithm using FPGAs, *Proceedings of the 2006 49th Midwest Symposium on Circuits and Systems*, v 1, MWSCAS'06, Aug 6- 9, 2006, San Juan, PR, p 433-436.

Grants or externally funded project active during the last five years: (FY 2002-2003-2007-2008)
-PI, Integrating Software and Hardware Components of WIMS testbeds – Wireless Integrated Microsystems Engineering Research Center (WIMS-ERC), PI: Kensall Wise, University of Michigan, Ann Arbor, Integrate diverse components developed by different research groups, Sept 07 – Ago 08, $64,994.00, NSF Award 5986866, ENGINEERING RESEARCH CENTERS NSF Program, EEC Division of Engineering Education and Centers, ENG Directorate for Engineering.
-CoPI, BPC: Paving the Road to Professorship for Female Students, Aid female students to obtain PhD degrees, Feb 08 – Ene 2011, $428,162.00, NSF Broadening Participation in Computing.
-CoPI, Establishment of a Computational Infrastructure for Research Hardware and Electronics Design Challenges at the UPRM – IBM Sur Grant, Performance Evaluation of Advanced Computational Structures, Abr 07 – Mar 08, $389,147.00, IBM Sur Grant.
-CoPI, Study of System Level Design Methodologies for Implementing SAR Support Algorithms – Lockheed Martin, Study of performance metrics and evaluation on FPGA and DSP platforms, Dic 06 – Nov 07, $259,988.00, Lockheed Martin Corp.
-PI, Analyzing the Effect of Algorithmic Decisions on Power Consumption – WIMS, Study of the effect of code transformations on power consumption in embedded systems, Sept 06 – Aug 07, $64,994.00, NSF ERC Program.
-Collaborator, Computing Alliance for Hispanic Serving Institutions – NSF, A cargo de la intervención sobre investigación subgraduada en colaboración con UTEP, Mar 06 – Feb 09, $2,848,716.00, NSF Broadening Participation in Computing.
-PI, Code Development for the Neural Prosthesis and EMT testbeds for WIMS ERC – WIMS, , Code for cochlear implant and micro gas chromatograph with low power constraints, Sept 05 – Aug 06, $65,000.00, NSF Engineering Research Centers Program.
-PI, Porting Benchmarks and Environmental Monitoring Testbed Application Coding for the WIMS micontroller – WIMS, Develop code for EMT testbed, Sept 04 – Aug 05, $39,740.00, NSF Engineering Research Center Program.
-CoPI, Research Program on Digital Publishing – HP, Dependability Analysis using Petri Nets, Mar 04 – Feb 05, $442,467.00, Hewlett Packard
-PI, Evaluation of the WIMS microcontroller and floating point support – WIMS – PI, Evaluate floating point support of the WIMS MC, Feb 04 – Aug 04, $20,108.00, NSF Engineering Research Center Program.
-Collaborator, An infrastructure for Wide area large scale automate information processing (Walsaip), PI: Domingo Rodriguez, Award Number 0424546, Terrain Visualization Tool: VTE, Feb 04 – Present, $1,499,012.00, NSF CISE Minority Institution Infrastructure (MII) Program, Division of Computer and Network Systems.

Scientific and professional societies of which a member:
Institute of Electrical and Electronic Engineers -- member.
Colegio de Ingenieros y Agrimensores de Puerto Rico -- member
Association for Computing Machinery -- member.
Honors and awards:
Distinguished Engineer CIAPR 2008
NSF Dean's Distinguished Fellowship for Minorities and Women (1994-1998)
University Graduate Fellowship (UGF) (Fall 1997, Fall 1995)
GTE Corporation Fellowship Award (Spring 1996)
Georg Simon Ohm Award (Best EE Student in Class 1988-89 at University of PR, Mayaguez)
NASA Graduate Student Researcher Fellowship (1989-1990)
USAA Scholastic All-American Award

National Collegiate Engineering Award

Honor Student (University of PR Dean’s List)

The National Dean’s List

NACME Fellowship (1984-1989)

Institutional and professional service in the last five years: (FY 2002-2003 - 2007-2008)

- Reviewer for Data & Knowledge Engineering (DKE) Journal, Peter Chen, Editor-in-Chief, Feb 07.
- Served in NSF Cyberinfrastructure Panel – June 2007
- Served in NSF MRI Panel – April 2007
- IEEE Computer Society Undergraduate Teaching Award Chair (National IEEE), 2007 Year.

Professional development activities in the last five years: (FY 2002-2003 - 2007-2008)

- Project Management Overview, UPR Mayaguez, CEP, 9 Sept 03
- Electrónica de Potencia, CIAPR, CIAPR, 22 Dec 04
- Exercising Influence, UPR Mayaguez, CEP, 1 Apr 05
- Orientación a profesores de nueva contratación, UPR Mayaguez, CEP, 3-5 Autg 05
- Emotional Intelligence, UPR Mayaguez, CEP, 6 Apr 06
- Group Decision Making, UPR Mayaguez, CEP, 9 May 06
- Four disciplines of execution, UPR Mayaguez, CEP, 31 Aug 06
- Integrating Mentoring into Undergraduate Research Experience, UPR Mayaguez, CEP, 21 Sept 06
- Time Management, UPR Mayaguez, CEP, 6 Sept 07
- CID 101: Budget Preparation, UPR Mayaguez, CEP, 18 Sept 07
- Entrepreneurship for Educators, Babson y Guayacán, Grupo Guayacán, 8-11 Jan 08

Offered Courses in the past two years (2005-2007)

- INEL 3105, Analisis de circuitos I, F05, F07, 3 credits
- INEL 4075, Fundamentos de Ing Electrica, F03, S04, F04, F06, 3 credits
- INEL 4215, Arquitectura de Compt y Organiz., F03, S03, F04, S05, 3 credits
- ICOM 5047, Diseño en Ing de Computadoras, S06, F06, S07, S08, 5 credits
- INEL 6046, Tesis de Maestría Ing Eléctrica, De F06 to S07., 3 y 1 credits
- INEL/ICOM 4998, Investigación Subgraduada, Todos los semestres, 3 credits
- INEL 6067, Procesamiento distribuído y arq de computadoras avanzado, S05, 3 credits
- ICOM 6115, Tópicos Especiales: Evaluación y medidas de sistemas de computación, F06, 3 credits
- ICOM 6999, Tesis de Maestra Ing Computadoras, F06, S07, F07, 3 y 1 credits
- INTD 3995, Experiencias en desarrollo de las comunidades, S06, 1 credits
- INEL 4998 Undergraduate Research


SEGUEL, JAIME

Academic rank: Professor

Degrees with fields, institution, and date:

- BS Mathematics, Catholic University of Valparaiso, Chile, 1979
- MS Applied Mathematics, University of Santiago, Chile, 1982
- Ph. D. Computational Mathematics, City University of New York, 1987

Faculty service at UPRM:

Date of original appointment: January 1988

Dates of advancement in rank:

- Instructor: 1988 to 1989
- Assistant Professor: 1989 to 1993
- Associate Professor: 1993 to 1997
- Professor: 1997 to Present

Total years of service: 19

Areas of professional expertise:

- Theory of Computation, Algorithms, Bioinformatics

Other related experience—academic or industrial:

- Associate Dean of Academic Affairs
- Director of Graduate Studies
- Coordinator, Doctoral Program in CISE
- Consulting, patents:
  - None

State(s) in which registered:

None

Principal publications of last four years: (FY 2002-2003 - 2007-2008)


Grants or externally funded project active during the last four years: (FY 2002-2003 - 2007-2008)

- Principal Investigator in “Assisting Bioinformatics Efforts at Minority Schools”, NIH-MARC grant PAR-03-026, started FY 2005
- Co-Principal Investigator in “Wide-area Large-scale Automated Information Processing”, NSF-MII grant No. 0424546, started FY 2004
- Co-Principal Investigator in “A Program for Research in Computing and Information Sciences and Engineering (PRECISE)”, NSF-CISE, started on FY 1999 – ended FY 2004

Scientific and professional societies of which a member:

- Society for Industrial and Applied Mathematics (SIAM)

Honors and awards:

None

Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)

- Member of a Consulting Board of the Council of Higher Education of Puerto Rico

Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)

None
Offered Courses in the past two years (2005-2007)


None
SEPULVEDA, NELSON

Academic rank: Assistant Professor

Degrees with fields, institution, and date:

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Faculty service at UPRM:

Date of original appointment: January 2006

Dates of advancement in rank:

Assistant Professor: 2006 to present

Total years of service: 1

Areas of professional expertise:

Other related experience—academic or industrial:

05/2006 – 08/2006 Visiting Faculty Researcher, Air Force Research Laboratories (SND), Wright Patterson Air Force Base, Dayton OH

05/2005 – 12/2005 Sandia National Laboratories MESA Fellow, Sandia National Laboratories

01/2001 - 05/2005 Teaching Assistant, Department of Electrical and Computer Engineering, University of Puerto Rico, Mayagüez Campus

08/2000 - 12/2000 Lab Instructor, Department of Electrical and Computer Engineering, University of Puerto Rico at Mayaguez

05/2000 - 08/2000 Summer Intern, College of Computing, Atlanta, GA, Georgia Institute of Technology

Consulting, patents:

State(s) in which registered:

Principal publications of last four years: (FY 2002-2003- 2007-2008)


Grants or externally funded project active during the last four years: (FY 2002-2003 - 2007-2008)

1. Project/Proposal Title: Characterization of high-Q nano-electro-mechanical resonators Total Award Amount: $ 83,903 Total Award Period Covered: 07/2006 – 05/2007

2. Project/Proposal Title: Simulation of polycrystalline materials used for micro-electro-mechanical devices Total Award Amount: $ 10,000 Total Award Period Covered: 11/06-12/07

Scientific and professional societies of which a member:

- Member of the Institute of Electrical and Electronic Engineers (IEEE).

Honors and awards:

- Gates Millenium Scholar (1999-2005)
- Sandia National Laboratories MESA Fellow
- Elected 4 times in a row as student leader in the NSF/WIMS ERC center at Michigan State University
• NSF-EPSCoR Faculty Start-Up Award (2006)
• Honor Student
• The National Dean's List

**Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)**

1. NSF Panelist of CAREER proposals, Division of Electrical, Communications and Cyber Systems, 2006

**Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)**

1. “Polycrystalline Diamond Mechanical Resonators with submicrometer and nanometer dimensions” Presentation at Material Research Society Meeting Spring 2006, San Francisco, CA
2. “Polycrystalline Diamond (Poly-C) MEMS Resonators” Seminar at University of Michigan, invited by the NSF-WIMS ERC on January 28th, 2005

**Offered Courses in the past two years**

- INEL 4202 Electronics II, INEL 4998 Undergraduate Research, INEL 5209 Solid State Electronics, INEL 6046 Master’s Thesis, INEL 6995 Special Topics in Electrical Engineering (I, II), INEL 4076 Fundamentals of Electronics, INEL 4151 Electromagnetics I

**Community service activities: (FY 2002-2003- 2007-2008)**
SERRANO, GUILLERMO

**Academic rank:** Assistant Professor

**Degrees with fields, institution, and date:**

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**Faculty service at UPRM:**

- **Date of original appointment:** July 2007
- **Dates of advancement in rank:**
  - Assistant Professor: 2007 to present
  - Total years of service: 1

**Areas of professional expertise:**

- Analog and mixed-signal circuit design
- Sub-threshold circuit design
- Floating-gate transistors

**Other related experience— academic or industrial:**

- Consulting, patents:

**State(s) in which registered:**

**Principal publications of last four years:** (FY 2002-2003 - 2007-2008)


**Grants or externally funded project active during the last four years:** (FY 2002-2003 - 2007-2008)

**Scientific and professional societies of which a member:**

- IEEE Member

**Honors and awards:**

- Best Student Paper Award at the 2005 IEEE Custom Integrated Circuits Conference
- Presidential Fellowship at Georgia Institute of Technology
Institutional and professional service in the last four years:  (FY 2002-2003 - 2007-2008)

Professional development activities in the last four years:  (FY 2002-2003 - 2007-2008)
   Reviewer – Journal of Solid State Circuits (JSSC)
   Reviewer – International Symposium on Circuits and Systems (ISCAS)

Offered Courses in the past two years:
   INEL 4202 – Electronics II
   INEL 4205 – Logic Circuits
   INEL 4998 – Undergraduate research

Community service activities:  (FY 2002-2003- 2006-2007)
SURIS, JUAN

**Academic rank:** Assistant Professor

**Degrees with fields, institution, and date:**

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<td>MS</td>
<td>Statistics</td>
<td>University of Chicago</td>
<td>12/99</td>
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<td>PhD</td>
<td>Computer Engineering</td>
<td>Virginia Polytechnic Institute and State University</td>
<td>12/07</td>
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**Faculty service at UPRM:**

*Date of original appointment:* January 2008

**Dates of advancement in rank:**

- Assistant Professor: 2008 to present
- Total years of service: 1

**Areas of professional expertise:**

Wireless Networking

**Other related experience—academic or industrial:**

- Prudential Financial, Quantitative Financial Analyst (8/99-02/01)
- Motorola Inc., Software Engineer (7/96-8/97)

**Consulting, patents:**

**State(s) in which registered:**

**Principal publications of last four years: (FY 2002-2003 - 2007-2008)**


**Grants or externally funded project active during the last four years: (FY 2002-2003 - 2007-2008)**

None

**Scientific and professional societies of which a member:**

- IEEE
- IEEE Computer Society
- CIAPR (Colegio de Ingenieros y Agrimensores de Puerto Rico)

**Honors and awards:**

- Bradley Fellowship (Virginia Tech)
- NSF Graduate Minority Research Fellowship
- Walter P. Murphy Fellowship (Northwestern University)

**Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)**

**Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)**

- Offered Courses in the past two years
  - Foundations of Computing
  - Data Structures in Java

**Community service activities: (FY 2002-2003 - 2007-2008)**
TOLEDO-QUIÑONES, MANUEL

**Academic Rank:** Associate Professor

**Degrees with fields, institution, and date:**

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<td>University of Massachusetts</td>
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<td>Electrical Engineering</td>
<td>Boston University</td>
<td>1995</td>
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**Faculty service at UPRM:**

**Date of original appointment:** July 1998

**Dates of advancement in rank:**

- Assistant Professor: 1998 to 2002
- Associate Professor: 2002 to present
- Total years of service: 9

**Areas of professional expertise:**

Instrumentation, Embedded Systems, Machine Vision

**Other related experience-academic or industrial:**

1997-1998 Assistant Professor, Interamerican University, Math. and Physical Sciences Dept., San Germán, P.R.
1989-1995 Research Fellow, Boston University, Boston, MA
1987-1989 Engineer, Radiation Monitoring Devices, Watertown, MA
1986 - Professor, National University of Engineering, Electrical Eng. Dept., Managua, Nicaragua
1984-1986 Instructor, Women’s Technical Institute, Boston, Mass.
1979-1983 Project Engineer, P.R. Telephone Company, San Juan, Puerto Rico

**Consulting, patents**


**State(s) in which registered**

None

**Principal publications of last four years:** (FY 2002-2003 - 2007-2008)

8. Manuel Toledo-Quinones; Manuel Jiménez; Rogelio Palomera, Industry Sponsored Practical Undergraduate Learning: Two Case Studies from the University of Puerto Rico, International Conference on Engineering Education and Research, Olomouc, Czech Republic, 2004
9. Jhon Arvey Henao-Sepulveda, Manuel Toledo-Quinones, José G. Colom-Ustáriz and Rafael Medina; Recycling Graduate Coursework to Introduce Freshmen to Engineering Fields, International Conference on Engineering Education and Research, Olomouc, Czech Republic, 2004

Grants or externally funded project active during the last four years: (FY 2002-2003 - 2007-2008)


Scientific and professional societies of which a member:

Institute of Electrical and Electronics Engineers, Member

Honors and awards:

None.

Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)

Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)

Offered Courses in the past two years (2005-2007)


None.
TORRES-MUÑIZ, RAÚL E., P.E.

Academic Rank: Professor

Degrees with fields, institution, and date:

<table>
<thead>
<tr>
<th>Degree</th>
<th>Field</th>
<th>Institution</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>Electrical Engineering</td>
<td>University of Puerto Rico at Mayaguez</td>
<td>1991</td>
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<tr>
<td>MS</td>
<td>Electrical Engineering</td>
<td>University of Virginia</td>
<td>1994</td>
</tr>
<tr>
<td>Ph. D.</td>
<td>Electrical Engineering</td>
<td>University of Virginia</td>
<td>1998</td>
</tr>
</tbody>
</table>

Faculty service at UPRM:

Date of original appointment: July 1998

Dates of advancement in rank:

- Assistant Professor: 1998 to 2002
- Associate Professor: 2002 to 2007
- Professor: 2007 to present

Total years of service: 8

Areas of professional expertise:

Neural Networks, Robotics, Intelligent Systems, Computer Vision, and Manufacturing

Other related experience—academic or industrial:

Honeywell Inc., MN Home and Building Control Division: New Product Development--design aid for damper actuators: Designing tests for new prototypes to ensure they meet their specifications, Summers of 1993 and 1992

Puerto Rico Electric Power Authority, Mayagüez Regional Office: Software development and computerize records. Introducing computer technology to personnel. Summer 1991

Consulting, patents


State(s) in which registered:

Puerto Rico

Principal publications of last four years: (FY 2002-2003 - 2007-2008)


Grants or externally funded project active during the last four years: (FY 2002-2003 - 2007-2008)

- “Medical Devices Research Group (MDRG).” A group of professors from the College of Engineering at UPRM, each having an area of expertise related to the medical devices and biomedical engineering field. The mission of MDRG is to assist medical device companies located in Puerto Rico solve research and development problems related to manufacturing processes or to the development of new products and technologies.

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Sponsor</th>
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<tbody>
<tr>
<td>Development of Technologies for the Manufacture of Cardiac Pacing and Defibrillation Leads, August 2003-December 2003</td>
<td>Medtronic - Villalba</td>
</tr>
<tr>
<td>Development of Technologies for the Manufacture of Cardiac Pacing and Defibrillation Leads: Phase II, January 2004 - August 2004</td>
<td>Medtronic - Villalba</td>
</tr>
</tbody>
</table>
• “Center for Subsurface Sensing and Imaging Systems (CenSSIS).” Participant in the developing of a robust algorithm for objects segmentation and classification. The development focus is in the identification of coral reefs. This research is sponsored by a NSF grant.

• “Robotic Soccer.” Multidisciplinary research to design a team of five robots that play autonomously controlled by a main computer. A vision system is used to identify the field, ball, foe robots and our own robots using color segmentation. Position and velocities calculated from the vision system are passed to an AI strategy module that plans the game moves. Finally the our own designed robots read a wireless signal and execute the commands. F-180 rules of the RoboCup organization are followed.

• Industrial Affiliates Program 2006: “Plantain Processing Automation.” A project of peeling plantain automatically for a agriculture production site in Puerto Rico.

• Industrial Affiliates Program 2003 - 2004: “Assistance Technology for Handicap and Impaired People.” The Program of Technological Assistance of Puerto Rico asked for the design of several devices to aid impaired and handicap people. Among these devices are a low cost robotic arm (below $400) to be attached to wheelchair and mobile vehicles to guide blind people.

Scientific and professional societies of which a member:

Institute of Electrical and Electronics Engineers, Senior Member
IEEE Robotics and Automation Society
Colegio de Ingenieros de Puerto Rico

Honors and awards:
None

Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)

• The 49th IEEE Midwest Symposium on Circuits and Systems (MWSCAS 2006)
  o Volunteer as Track Chairperson and Review Committee Member for the Control Systems, Mechatronics & Robotics Track.
  o Volunteer as Session Chairperson for Neural Networks & Fuzzy Systems and Image Processing II Sessions.

Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)

• Ethics in the Engineering and Surveying Field in Puerto Rico, Seminar sponsored by CIAPR, November 2007
• ABET Accreditation Workshop, Sponsor: System for the Evaluation of Education Office at UPRM, April 2006
• Orientation on Institutionalizing Assessment in the Administrative / Service Units, Sponsor: UPRM, April 2006
• Organizational Savvy and Ethical Lobbying, Sponsor: Texas Instrument, October 2006
• Intellectual Property at the University of Puerto Rico and the Law of Ethics, Sponsor: Center for Professional Enhancement at UPRM, May 2006
• Assessment 101, Sponsor: Center for Professional Enhancement at UPRM, March 2006
• Building Surveys, Sponsor: Center for Professional Enhancement at UPRM, September 2005
• Design of WEB based courses using WEBCT, Sponsor: “Instituto para el Desarrollo de la Enseñanza y el Aprendizaje en Línea (IDEAL)” at UPRM, May 2004

Offered Courses in the past two years (2005-2007)

ICOM 4998 Undergraduate Research, INEL 4048 Electrical Engineering Practice, INEL 4505 Introduction to Control Systems, INEL 4998 Undergraduate Research, INEL 5516 Automation and Robotics, INEL 6088 Computer Vision, INEL 6059 Intelligent System & Control , INEL 6046 Master Thesis, INEL 5516 Automation an Robotics, INEL 4998 Undergraduate Research, INEL 4205 Switching, INEL 3105 Circuits Analysis I, INEL 6045 Engineering Project I, II


Church Choir Director: Parroquia El Buen Pastor de Mayaguez
President of Paseo del Valle Corporation: Residence Community
VÁSQUEZ-ESPINOZA, RAMÓN E.

Academic rank: Professor

Degrees with fields, institution, and date:

- BS Electrical Engineering University of Puerto Rico, Mayagüez 1974
- MS Electrical Engineering University of Puerto Rico, Mayagüez 1979
- Ph. D. Electrical Engineering Louisiana State University 1984

Faculty service at UPRM:

Date of original appointment: August 1975

Dates of advancement in rank:

- Instructor: 1975 to 1984
- Assistant Professor: 1984 to 1987
- Associate Professor: 1987 to 1992
- Professor: 1992 to Present

Total years of service: 31

Areas of professional expertise:

Remote Sensing, Computer Vision, Geographic Information Systems, Image Processing, Artificial Intelligence

Other related experience—academic or industrial:

Feb., 2000-present Dean, College of Engineering, University of Puerto Rico at Mayagüez

June, 1999 to Jan. 2000 Director, Center for Research and Development, UPRM

June 1998 to June 1999 Associate Dean of Academic Affairs, College of Engineering, UPRM

Mar. 1990 to June, 1998 Associate Director, Dept. of Electrical and Computer Engineering, UPRM

1994 to 1998 Director, Center for Computing Research and Development, Dept. of Electrical and Computer Engineering, (CECORD) UPRM

1989 to 1998 Director, Laboratory of Remote Sensing and Image Processing (LARSIP), Department of Electrical and Computer Engineering, UPRM

Consulting, patents: None

State(s) in which registered: None

Principal publications of last five years: (FY 2002-03 -- 2007-08):

* - “Continuous Improvement Educational Initiative: A Campus-Wide Assessment Effort”, by A.D. Sharma and R. Vásquez, World Congress on Engineering & Technology Education - WCETE 2004 in Santos, Brazil, March 14-17, 2004; and also at the ASEE Annual Meeting in Salt Lake City, Utah, June 22-24, 2004.

Grants or externally funded project active during the last five years: (FY 2002-03-- 2007-08)
- “Center of Remote Sensing & Technology”, CREST-NOAA, $2,500,000/5 year, 2006-2011-Deputy-PI
- “Statistical Techniques to Improve the Hydro-Estimater Rainfall Algorithm During Heavy Storms over Puerto Rico” Funded by NOAA/NWS, $100,000, September 2006 to July 2008-Collaborator for Remote Sensing
- “Soil Moisture Estimation and Validation a Hydro-Estimater” Funded by NOAA-CREST, $270,000, August 2003 to July 2006, PI
- “National Aeronautic Space Administration: Experiments Program to Stimulate Competitive Research” NASA-EPSCOR, 1,125,000/ 5 year, 2002-2007-Co-PI
- “Center of Remote Sensing & Technology”, CREST-NOAA, $2,500,000/5 year, 2001-2006-Deputy PI
- “Tropical Center for Earth and Space Studies”, NASA-URC II, Goddard Flight Center, NASA, $4,999,513.00, UPR matching fund for $2,450,000, 2000-2005-Co-PI
- “PaSCOR-NASA” grant, $3,163,167.00, UPR matching fund for $299,918, 1999-2004-Research collaborator
- “Partnership for Spatial Computational Research” (PaSCoR), NASA (PAIR), $2,301,289, June 1998 to May 2003 – PI

Scientific and professional societies of which a member:
IEEE, ASEE, SPIE, ASPRS, PRS, ADMI, and ACM.

Honors and awards:
(1) Centennial Certificate, The American Society for Engineering Education, Best of Session Award for the Plenary Session on COASTAL MAPPING AND CHARTING entitled: “An Integrated Mapping and Databank System for Coastal Changes”; (2) Tau Beta Pi; (3) Eta Kappa Nu: (4) Who is Who Among Students in American Universities; (5) Sigma XI.

Institutional and professional service in the last five years: (FY 2002-03 -- 2007-08)
- Chair, Co-Chair and/or committee member of numerous conferences such as ISWPC 2007, ICEE 2006, LACCEI 2006, MWSCAS 2006, ITHET 2005, ADMI 2005, and others
- Member of several departmental, faculty and institutional committees

Professional development activities in the last five years: (FY 2002-03 -- 2007-08)
- 7mo Taller de Gerencia Académica, March 2007
- 6to Taller de Gerencia Académica, September 2006
- Propiedad Intelectual en UPR y Ley de Ética, May 2006
- 5to Taller de Gerencia Académica, April 2006
- “Orientation in Institutionalizing Assessment in the Administrative Service Units”, March 2006


Community service activities: (FY 2002-2003-- 2007-08)
None
VEGA-RIVEROS, J. FERNANDO

Academic rank: Professor

Degrees with fields, institution, and date:

<table>
<thead>
<tr>
<th>Degree</th>
<th>Field</th>
<th>Institution</th>
<th>Date</th>
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</thead>
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<tr>
<td>BS</td>
<td>Electrical Engineering</td>
<td>University Javeriana</td>
<td>1979</td>
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<tr>
<td>MS</td>
<td>Electrical Engineering</td>
<td>Syracuse University</td>
<td>1983</td>
</tr>
<tr>
<td>Ph. D.</td>
<td>Electrical Engineering</td>
<td>Syracuse University</td>
<td>1989</td>
</tr>
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</table>

Faculty service at UPRM:

Date of original appointment: July 2001

Dates of advancement in rank:

<table>
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<th>Rank</th>
<th>Period</th>
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<tr>
<td>Associate Professor</td>
<td>2001 to 2006</td>
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<tr>
<td>Professor</td>
<td>2006 to Present</td>
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<tr>
<td>Total years of service:</td>
<td>5.5</td>
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Areas of professional expertise:

Artificial Intelligence, knowledge-based systems

Other related experience—academic or industrial:

Communications Engineer; Communications Division; Avianca Airlines; Planning; design and support of communication systems. July 1979, December 1980. Colombia.

Communications Projects Coordinator; Communications Division; Avianca Airlines; coordination and management of communication projects. January 1981, July 1982. Colombia.

Postdoctoral Research Associate; Institute for Energy Research at Syracuse University; research on Artificial Intelligence Applications for Energy Management Systems. June 1989, June 1990. USA.

Professor; Department of Electronics Engineering; Javeriana University; October 1990, June 2001. Colombia.

Chairman Electronics Engineering Department; Javeriana University; May 1999, June 2001. Colombia.

Consulting, patents:

None

State(s) in which registered:

None

Principal publications of last five years: (FY 2002-2003 - 2007-2008)


**Grants or externally funded project active during the last five years: (FY 2002-2003 - 2007-2008)**


**Scientific and professional societies of which a member:**

**Institute of Electrical and Electronics Engineers, (Member)**

**Honors and awards:**

“Mención de Honor” from Vicerrectoría Académica (Mention of Honor, Academic Vicerrector), Pontificia Universidad Javeriana (Javeriana University). Awarded for the research project “Tecnologías de Información y Educación” (Education and Information Technologies), Oct 8 1999.

Diamond Award; 2nd Asia-Pacific Forum on Engineering and Technology Education. To the best Forum Paper. Sydney, Australia, July 4-7 1999.


Fellow; Parallel Architectures Center at Syracuse University, June-Aug 1987.

**Institutional and professional service in the last five years: (FY 2002-2003 - 2007-2008)**


**Professional development activities in the last five years: (FY 2002-2003 - 2007-2008)**

Founding member and UPRM representative in Digital Publishing University Research Community (Chameleon Federation), led by HP Labs.

**Offered courses in the past two years (2005-2008)**


**Community service activities: (FY 2002-2003 - 2007-2008)**

- President of Parents and Teachers Association, Immaculate Conception Academy – Elementary School level, Mayagüez, FY 2004-05
- Vicepresident of Parents and Teachers Association, Immaculate Conception Academy – High School level, Mayagüez, FY 2005-06.
VÉLEZ-REYES, MIGUEL

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

- BS  Electrical Engineering  University of Puerto Rico – Mayagüez  1985
- MS  Electrical Engineering  Massachusetts Institute of Technology  1988
- Ph. D.  Electrical Engineering  Massachusetts Institute of Technology  1992

**Faculty service at UPRM:**

**Date of original appointment:** July 1992

**Dates of advancement in rank:**

- Assistant Professor:  1992-1995
- Associate Professor:  1995-2000
- Professor:  2000 - current
- Total years of service:  16

**Areas of professional expertise:**

Information extraction problems that arise in minimally or non intrusive sensing and imaging of dynamic systems and its application to problems in control, estimation, and identification of energy processing, environmental, and biological systems.

**Other related experience—academic or industrial:**

- **Summer Faculty Fellow.** United States Air Force Research Laboratories, Hanscom Air Force Base, Boston, MA, Summer 2002. Analysis of hyperspectral imagery. Sponsored by the AFRL/SFFP Program.
- **NASA Faculty Fellow.** NASA Goddard Space Flight Center, Greenbelt, MD, Summer 1997. Research in remote sensing data assimilation and information content in high spectral resolution radiometers. Sponsored by NASA-ASEE Summer Faculty Fellowship Program.
- **Summer Faculty Fellow.** United States Air Force Phillips Laboratory, Hanscom Air Force Base, Boston, MA, Summer 1996. Research in algorithms for atmospheric retrieval problems from microwave radiometry using regularization methods.
- **Director.** Institute of Integrative Systems and Engineering (IRISE). 2007-present.
- **Director.** Tropical Center for Earth and Space Study (TCESS). This is a NASA University Research Center. 2004-2006.
- **Associate Director.** Center for Subsurface Sensing and Imaging Systems (CenSSIS). This is a NSF Engineering Research Center lead byNortheastern University. Associate Director, Multispectral Discrimination thrust leader, and UPRM Campus Coordinator. 2003-present.
- **Campus Coordinator and Education Director.** Center for Power Electronic Systems (CPES). CPES is a NSF Engineering Research Center lead by Virginia Polytechnic Institute. UPRM campus coordinator (since 1998) and the center wide education program director (from August 2000 to August 2001).

**Consulting, patents:**

- Preparation of the Puerto Rico Professional Engineer Exam for Electrical Engineering for “Junta Examinadora de Ingenieros, Arquitectos, y Agrimensores” P.R. State Department, March 1997.

**State(s) in which registered:**

Puerto Rico

**Principal publications of last five years: (FY 2002-2008)**

**Journal**


Conferences


Books and Book Chapters


Grants or externally funded project active during the last five years: (FY 2002-2008)
- Collaborator in Intelligent Diagnostic for Aging Civil Infrastructure, NSF IGERT, (PI Sara Wadia-Fasceiti NEU, and Co-PI Ingrid Padilla, UPRM)/$ 600,000, September 1, 2007 to August 31, 2008.
- Co-PI in Failure Probabilities for Risk-Based Maintenance and Parameter Estimation of Synchronous Machines, National Science Foundation Industry University Cooperative Research Centers, $99,444.
- Co-PI in Acquisition of Instrumentation for the Electric Energy Processing Systems Laboratory at UPRM, (Dr. Efrain O’Neill, PI) National Science Foundation Major Research Instrumentation Program, January 1, 2002 to December 2003, $180,000.
- Co-PI in Center for Subsurface Sensing and Imaging Systems. A consortium between Northeastern University (lead institution), Boston University, Rensselear Politecnic Institute, and the University of Puerto Rico Mayagüez Campus. NSF Engineering Research Centers Program. August 2000 to July 2005. UPRM Component $3.75M
- UPRM Project Director in Center for Power Electronic Systems. A consortium between Virginia Institute of Technology and State University (Lead Institution), University of Wisconsin, Renselear Politecnic Institute, North Carolina A&T, and the University of Puerto Rico Mayagüez Campus. NSF Engineering Research Centers Program. August 1998 to July 2003. UPRM Component $1.0M
- Project Director (August 2003-September 2006), Tropical Center for Earth and Space Studies and PI for the Information Processing and Extraction Group, NASA University Research Centers Program, October 2000 to September 2006. $8.3M.

Scientific and professional societies of which a member:
 IEEE - Institute of Electrical and Electronics Engineers, (Senior Member)
 CIAPR - Colegio de Ingenieros y Agrimensores de Puerto Rico
 ASEE - American Society for Engineering Education
 SPIE – The International Society for Optical Engineering
 SIAM- Society for Industrial and Applied Mathematics
 Remote Sensing and Photogrammetry Society

Honors and awards:
Inducted to the Academy of Arts and Sciences of Puerto Rico, November 2005.
Presidential Early Career Award for Scientists and Engineers for “Contributions to engineering education and research on power systems applicable to large systems that transfer power among multiple suppliers in the electric power industry.” The presidential honor is the highest bestowed by the U.S. government on outstanding young scientists and engineers who are in the early stages of their independent research careers. Given in November 3, 1997.
Senior Member of the Institute of Electrical and Electronics Engineers, May 2000.
1999 Walter Fee Outstanding Young Engineer Award, IEEE Power Engineering Society.
1997-98 Distinguished Professor, Department of Electrical and Computer Engineering, UPR Mayagüez.
1998 Distinguished Professor, of the Puerto Rico Professional Engineers and Land Surveyors Association Mayagüez Chapter.  
NASA Summer Faculty Fellowship, June to August 1997.  
Air Force Office of Scientific Research Summer Research Faculty Fellowship, June to August 1996.  
Institutional and professional service in the last five years: (FY 2002-2008)  
Electrical Engineering Program Evaluator, ABET, Selected as an IEEE Program Evaluator for by the IEEE Educational Activities Board. 2002-present.  
Member, Board of Directors, UPRM Research and Development Center, 2003-present.  
Member, UPRM Graduate Council, 2000-2005.  
Graduate Program Coordinator and President of the UPRM ECE Graduate Committee, 1994-2006, 2007-present  
Co-Chair, Power Systems and Power Electronics Track, 2006 IEEE Midwest Symposium on Circuits and Systems, San Juan PR.  
Program Committee Member, SPIE Conference on Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery, 2004-present.  
Chairman, 2002 IEEE Workshop on Computers in Power Electronics  
Associate Editor, IEEE Transactions on Power Electronics Special Issue on Digital Control, 2002  
Region 9 Representative, IEEE Power Electronics Society Administrative Committee. 2000-2003  
Member, IEEE Power Electronics Society Committee on Modeling and Simulation.  
Program Committee Member, IASTED Intelligent Systems and Control Conference.  
Reviewer for  
IEEE Transactions on Power Systems  
IEEE Transactions on Geoscience and Remote Sensing  
IEEE Transactions on Control Technology  
Served in several National Science Foundation Proposal Review Panels  
Offered Courses in the past two years (2006-2008)  
Community service activities: (FY 2002-2008)  
Appendix 347

VÉLEZ-RIVERA, BIENVENIDO

Academic rank: Associate Professor

Degrees with fields, institution, and date:

- BA Computer Science, Cornell University, 1986
- MS Computer Science, University of California Berkeley, 1988
- Ph. D. Computer Science, Massachusetts Institute of Technology, 1999

Faculty service at UPRM:

- Date of original appointment: January 2000
- Dates of advancement in rank:
  - Assistant Professor: January 2000 - 2005
  - Associate Professor: 2005 to Present
  - Total years of service: 7

Areas of professional expertise:

- Software Quality Assurance, Information Retrieval

Other related experience—academic or industrial:

- Assistant Professor. University of Puerto Rico – Río Piedras, Department of Mathematics and Computer Science, August 1999 – December 1999
- Teaching Assistant. Massachusetts Institute of Technology – Laboratory for Computer Science, CS 6.821 – Graduate Course on Programming Languages Taught by Professor David K. Gifford, Fall 95
- Teaching Assistant, Massachusetts Institute of Technology – Laboratory for Computer Science. CS 6.001 Structure and Interpretation of Computer Programs, Taught by Professor Gerald J. Sussman. Spring 95
- Instructor of Computer Science, University Puerto Rico – Río Piedras, Department of Mathematics and Computer Science, Fall 89 - Summer 93

Other related experience—academic or industrial:

- Colegio de Abogados de PR, Development of membership information system. 1993.
- CEO and Founder of Phidelix Technologies Corporation (www.phidelix.com)
- Consulting, patents

State(s) in which registered:

Principal publications of last five years: (FY 2002-2003-2007-2008):


Grants or externally funded project active during the last five years: (FY 2002-2003-2007-2008)

- Digital Government Project (PI:NSF:750K)
- Indusoft Center of Excellence in Industrial Software Development (PI:PRIDCO:1.4M)
Assisting Bio-Informatics Efforts at Minority Institutions (CoPI:NIH:500K)

Scientific and professional societies of which a member:
Association for Computing Machinery (ACM)
IEEE-Computer Society – UPRM Chapter Faculty Advisor

Honors and awards:
MIT Special Minority Award (1993)
Cornell University Computer Science Distinction in all Subjects (1986)
Ford Foundation Doctoral Fellowship Award (1986-1988)

Professional development activities in the last five years: (FY 2002-2003-2007-2008)
  MIT Entrepreneurship Development Program
  Workshop: Development of Outcomes-based Courses
  Workshop: Systems Security
  Workshop: IBM Websphere Studio
  Workshop: WebCT
  Workshop: How to Create and Grow your Technology Business
  MIT Entrepreneurship Development Program

Offered Courses in the past two years (2006-2008)

Condominio Playa Buyé Residents Association – President
Colegio San Agustin Parents Teachers Association – Vice President
VENKATESAN, KRISHNASWAMI

**Academic rank:** Professor

**Degrees with fields, institution, and date:**

<table>
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<th>Degree</th>
<th>Field</th>
<th>Institution</th>
<th>Date</th>
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<tbody>
<tr>
<td>BS</td>
<td>Electrical Engineering</td>
<td>University of Jabalpur, India</td>
<td>1962</td>
</tr>
<tr>
<td>MS</td>
<td>Electrical Engineering</td>
<td>University of Roorkee, now Indian Institute of Technology (IIT-Roorkee)</td>
<td>1966</td>
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<tr>
<td>Ph.D.</td>
<td>Electrical Engineering</td>
<td>University of Roorkee, (IIT-Roorkee), India</td>
<td>1974</td>
</tr>
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</table>

**Faculty service at UPRM:**

Date of original appointment: January 1983

Dates of advancement in rank:

- Associate Professor: 1983 to 1987
- Professor: 1987 onwards
- Total years of service: 25 years

**Areas of professional expertise:**

Electrical Machines, Power Electronics, and Electrical Drives

**Other related experience—academic or industrial.**

1962 – 1963 Bhilai Steel Project, Bhilai, India, Engineer,

1963 – 1966 Govt of India, Senior Fellowship under Tech Teacher Training Program

1966 – 1973 University of Roorkee, Roorkee, India, -- Lecturer in Electrical Engineering

1973 – 1980 University of Roorkee, Roorkee, India -- Reader in Electrical Engineering,

1980 – 1983 Concordia University, Montreal, Canada -- Post Doctoral Research Associate,

**Consulting, patents**


**State(s) in which registered**

Puerto Rico

**Principal publications of last five years:** (FY 2002-2003 - 2007-2008)

1. L.Arnedo and K. Venkatesan, 'P-Spice modeling of an induction motor drive system for high frequency studies', (Conference record) IEEE conference on computer applications in Power Electronics, June 2002


Grants or externally funded project active during the last four years: (FY 2002-2003 - 2007-2007)

**Scientific and professional societies of which a member:**

Institute of Electrical and Electronics Engineers, Senior Member

Colegio de Ingenieros y Agrimensores, Member

**Honors and awards:**

May 1988, Distinguished Professor Award, Faculty of Eng, UPR, Mayaguez

Aug 1994, Who is Who among America's Teachers

Dec 1978. Khosla Research Award, Univ of Roorkee, India
Nov 1978. Paper prize award, Institution of Engineers (India) for a paper published in Journal of Instn of Engrs (India), Elect Div.

Jan 1980 Paper prize award from Institution of Engineers (India) for a paper published in Journal of Instn of Engrs (India), Elect Div.

Institutional and professional service in the last four years: (FY 2002-2003 - 2007-2008)

Supervision and development of Power Electronics Laboratory at this institution

Professional development activities in the last four years: (FY 2002-2003 - 2007-2008)

Offered Courses in the past two years (2005-2008)

- INEL 4405 Electrical Machines
- INEL 6995 Independent Studies in electrical Engineering
- INEL 6046 Master Thesis
- INEL 5496 Design Power Electronic systems
- INEL 4416 Power Electronic
- INEL 5408 Electrical Motors Control
- INEL 4416 Power Electronic
- INEL 6046 Master Thesis
- INEL 4085 Fundamentals of Transformers and Electric Machinery
- INEL 4102 Electrical Systems Analysis II


None
### Appendix C - Laboratory Equipment

#### Table C-1: Basic Analog and Digital Electronics Laboratories (S-104A and S-104B)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
<th>Model</th>
<th>Quantity</th>
</tr>
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<tbody>
<tr>
<td>Oscilloscopes</td>
<td>2-Channel, 100 MHz, 1GSa/s Oscilloscope</td>
<td>Agilent</td>
<td>24</td>
</tr>
<tr>
<td>DC power supplies</td>
<td>Triple output: 0- +25V, 0-1A; 0- -25V, 0-1A; 0 - 6V, 0-5A, 80W</td>
<td>Agilent E3631A</td>
<td>24</td>
</tr>
<tr>
<td>Function Generators</td>
<td>20 MHz Function/Arbitrary Waveform Generator</td>
<td>Agilent 33220A</td>
<td>24</td>
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<td>Multimeters</td>
<td>6.5 Digits Digital multimeter</td>
<td>Agilent 34401A</td>
<td>24</td>
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<tr>
<td>PCs</td>
<td>Convertible Mini-Tower, PC Processor E6600 2.40GHz, 1066, 4MB L2 DC/VT (222-3398)</td>
<td>Dell Precision T390</td>
<td>24</td>
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<tr>
<td>Data Acquisition Kits</td>
<td>• Electronic Instrumentation Training KitNI</td>
<td>National Instruments</td>
<td>24</td>
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<td></td>
<td>• ELVIS Board 778748-02 NI</td>
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<td></td>
<td>• ELVIS/PCI-6251 Bundle</td>
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#### Table C-2: General Purpose Computing Laboratories (S-105C and S-105D)

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<th>Equipment</th>
<th>Description</th>
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<td>PCs</td>
<td>Dual Core 2.66 GHz, 2 GB RAM, 250 GB HD, NVIDIA Quadro FX 570, DELL 1908FP LCD</td>
<td>Dell Precision T3400</td>
<td>57</td>
</tr>
<tr>
<td>Printers</td>
<td></td>
<td>HP LaserJet 9040</td>
<td>2</td>
</tr>
<tr>
<td>Scanner</td>
<td></td>
<td>HP ScanJet 8250</td>
<td>1</td>
</tr>
</tbody>
</table>
### Table C-3: Microprocessor Development Laboratory (S-115)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
<th>Model</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCs</td>
<td>Dual Core 2.66 GHz, 2 GB RAM, 250 GB HD, NVIDIA Quadro FX 570, DELL 1908FP LCD</td>
<td>Dell Precision T3400</td>
<td>18</td>
</tr>
<tr>
<td>Printer</td>
<td></td>
<td>HP LaserJet 2200</td>
<td>1</td>
</tr>
<tr>
<td>Fume Extraction Unit</td>
<td>Bench Mounted w/ 700mm Extraction Arm &amp; Alfa Nozzle</td>
<td>Filtronic</td>
<td>2</td>
</tr>
<tr>
<td>Solder station</td>
<td>FM-202 Soldering System</td>
<td>Hakko</td>
<td>2</td>
</tr>
<tr>
<td>Magnifier</td>
<td>Big Eye I DMXLC Series Magnifier</td>
<td>Prolite</td>
<td>2</td>
</tr>
<tr>
<td>Function Generators</td>
<td>20 MHz Function/Arbitrary Waveform Generator</td>
<td>Agilent 33220A</td>
<td>14</td>
</tr>
<tr>
<td>Power Supply</td>
<td>80W Power Supply, 8V, 8A or 20V, 4A</td>
<td>Agilent E3644A</td>
<td>7</td>
</tr>
<tr>
<td>DC power supplies</td>
<td>Triple output: 0- +25V, 0-1A; 0- -25V, 0- 1A; 0- 6V, 0-5A, 80W</td>
<td>Agilent E3631A</td>
<td>14</td>
</tr>
<tr>
<td>Digital Multimeter</td>
<td>Handheld multimeter</td>
<td>Fluke 179</td>
<td>14</td>
</tr>
<tr>
<td>Multimeter</td>
<td>Handheld multimeter</td>
<td>Fluke 8012A</td>
<td>14</td>
</tr>
<tr>
<td>Oscilloscopes</td>
<td>Mixed Signal Oscilloscope: 100 MHz, 2 analog &amp; 16 digital ch.</td>
<td>Agilent MSO6012A</td>
<td>7</td>
</tr>
<tr>
<td>Microcontroller Development Kits</td>
<td>Explorer 16 Starter Kit</td>
<td>PIC</td>
<td>56</td>
</tr>
<tr>
<td>Microcontroller Development Kits</td>
<td>MSP430 100 Pin Package Board and USB Programmer</td>
<td>Texas Instruments</td>
<td>56</td>
</tr>
<tr>
<td>Microcontroller Development Kits</td>
<td>C8051F340 Development Kit</td>
<td>INTEL</td>
<td>56</td>
</tr>
<tr>
<td>Speed Spindle</td>
<td>Quick Circuit - Standard Speed Spindle (8K-24K rpm ), Pneumatic controlled Z-Axis, USB connectivity, Work area = 6” x 12”</td>
<td>T-Tech</td>
<td>1</td>
</tr>
</tbody>
</table>

### Table C-4: General Purpose Computing Laboratory (S-121)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
<th>Model</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCs</td>
<td>Pentium 4 3.2 GHz, 1 GB RAM, 80 GB HD, NVIDIA Quadro FX 1400, DELL 1905FP LCD</td>
<td>Dell Precision 370</td>
<td>28</td>
</tr>
<tr>
<td>PCs</td>
<td>Pentium 4 2.8 GHz, 1 GB RAM, 80 GB HD, NVIDIA Quadro FX 500, DELL 1905FP LCD</td>
<td>Dell Precision 360</td>
<td>2</td>
</tr>
</tbody>
</table>
### Table C-5: Computer Engineering Capstone Design Laboratory (S-122 and S-123)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
<th>Model</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCs</td>
<td>Dual Core 2.4 GHz, 2 GB RAM, 160 GB HD, NVIDIA Quadro FX 550, DELL 1908FP LCD</td>
<td>Dell Precision 390</td>
<td>8</td>
</tr>
<tr>
<td>PCs</td>
<td>Pentium 4 3.2 GHz, 1 GB RAM, 80 GB HD, NVIDIA Quadro FX500, DELL 1901FP LCD</td>
<td>Dell Precision 360</td>
<td>17</td>
</tr>
<tr>
<td>Scanner</td>
<td></td>
<td>HP LaserJet 4200</td>
<td>1</td>
</tr>
<tr>
<td>Printer</td>
<td></td>
<td>HP LaserJet 4050</td>
<td>1</td>
</tr>
<tr>
<td>Oscilloscopes</td>
<td>2-Channels, 500MHz Oscilloscope</td>
<td>Agilent 54610B</td>
<td>2</td>
</tr>
<tr>
<td>Oscilloscope</td>
<td>2-Channels, 60MHz Oscilloscope</td>
<td>HP 54603B</td>
<td>1</td>
</tr>
<tr>
<td>Oscilloscope</td>
<td>2-Channels, 150MHz Oscilloscope</td>
<td>GW-Instek GDS 820C</td>
<td>1</td>
</tr>
<tr>
<td>Universal System</td>
<td>Multimeter, function generator, DC power supply (0-30V, 2A; 15V, 1A; 5V, 2A), and counter in one unit.</td>
<td>Metex MS-9150</td>
<td>6</td>
</tr>
<tr>
<td>DC power supplies</td>
<td>Triple output: 0-6V, 2.5A; -20 – 0 - 20V, 0.5A</td>
<td>Agilent E3630A</td>
<td>2</td>
</tr>
<tr>
<td>Signal Generator</td>
<td>15 MHz Function/Arbitrary Waveform Generator</td>
<td>Agilent 33120A</td>
<td>2</td>
</tr>
</tbody>
</table>

### Table C-6: ECE Computer Networking Laboratory (S-122A)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
<th>Model</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCs</td>
<td>Pentium 4 2.4 GHz, 512 MB RAM, 40 GB HD, ATI RADEON FIRE GL 8800, DELL 1702FP LCD</td>
<td>Dell Precision 350</td>
<td>14</td>
</tr>
<tr>
<td>Access Servers</td>
<td>Pentium 4 3.2 GHz, 512 MB RAM, 40 GB HD, NVIDIA Quadro FX500, DELL 1702FP LCD</td>
<td>Dell Precision 360</td>
<td>2</td>
</tr>
<tr>
<td>Routers</td>
<td></td>
<td>CISCO 1750</td>
<td>6</td>
</tr>
<tr>
<td>Routers</td>
<td></td>
<td>CISCO 2801</td>
<td>6</td>
</tr>
<tr>
<td>Routers</td>
<td></td>
<td>CISCO 2811</td>
<td>18</td>
</tr>
<tr>
<td>Switches</td>
<td></td>
<td>Catalyst 2950</td>
<td>3</td>
</tr>
<tr>
<td>Switches</td>
<td></td>
<td>Catalyst 2950</td>
<td>10</td>
</tr>
<tr>
<td>Switches</td>
<td></td>
<td>Catalyst 3560</td>
<td>10</td>
</tr>
</tbody>
</table>

### Table C-7: Integrated Circuits Design Laboratory (S-210)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
<th>Model</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCs</td>
<td>Dual Core 2.4 GHz, 2 GB RAM, 250</td>
<td>HP xw4400</td>
<td>22</td>
</tr>
<tr>
<td>Equipment</td>
<td>Description</td>
<td>Model</td>
<td>Quantity</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>PCs</td>
<td>Dual Core 2.66 GHz, 2 GB RAM, 250 GB HD, NVIDIA Quadro FX 570, DELL 908FP LCD</td>
<td>Dell Precision T3400</td>
<td>12</td>
</tr>
<tr>
<td>PCs</td>
<td>Dual Core 2.4 GHz, 2 GB RAM, 160 GB HD, NVIDIA Quadro FX 550, DELL 908FP LCD</td>
<td>Dell Precision 390</td>
<td>2</td>
</tr>
<tr>
<td>Oscilloscopes</td>
<td>2-Channels, 500MHz Oscilloscope</td>
<td>Agilent 54610B</td>
<td>14</td>
</tr>
<tr>
<td>Signal Generator</td>
<td>15 MHz Function/Arbitrary Waveform Generator</td>
<td>Agilent 33120A</td>
<td>14</td>
</tr>
<tr>
<td>Multimeters</td>
<td>6.5 Digits Digital multimeter</td>
<td>Agilent 34401A</td>
<td>14</td>
</tr>
<tr>
<td>Spectrum Analyzers</td>
<td>2.3 GHZ spectrum analyzer</td>
<td>Agilent 8560E</td>
<td>4</td>
</tr>
<tr>
<td>DSP Development Boards</td>
<td>DSP development kit with Texas Instruments assembly and floating point tools including Code Composer</td>
<td>TI TMS320C31</td>
<td>12</td>
</tr>
<tr>
<td>DSP Development Boards</td>
<td>DSP development kit with Texas Instruments assembly and floating point tools including Code Composer</td>
<td>TI TMS320C6711</td>
<td>12</td>
</tr>
</tbody>
</table>

Table C-8: Communications and Digital Signal Processing (S-222E)
APPENDIX D – INSTITUTIONAL SUMMARY

The Institution

University of Puerto Rico, Mayaguez Campus
Dr. Jorge Velez Arocho, Chancellor

Type of Control

Land-grant institution under state control

History of Institution

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

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

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

Today, the Mayagüez Campus of the University of Puerto Rico continues its development in the best tradition of a Land Grant institution. It is a co-educational, bilingual, and non-sectarian school comprising the Colleges of Agricultural Sciences, Arts and Sciences, Business Administration, Engineering, and the Division of Continuing Education and Professional Studies. At present, the campus population is composed of 12,108 students, 1,924 regular staff members and 1,037 members of the educational staff.
Student Body

The University of Puerto Rico has 11 campuses. The campus of Mayagüez is the only one in the public university system where Bachelor of Science degrees in engineering are offered. Each year, the College of Engineering receives applications from an average of 1800 of Puerto Rico’s best high school students.

Of all the applicants to engineering (as their first, second or third choice) 35.8% were admitted and registered, 58.7% were not admitted, and 5.5% were admitted but declined registration at our programs. In general terms around 4 of 10 applicants are admitted and registers in our engineering programs.

Based on type of high school (public or private) the applicants come from: 39.1% from private schools are admitted and register, but lower percentages, 30.1% from public schools do. Four out of ten students from private schools are accepted and register, while only 3 out of 10 students from public schools do.

The distribution of applicants admitted and registered was the same for the eight senatorial districts comprising Puerto Rico. The rejection rate and the number of applicants are larger for the Mayagüez district.

The number of students, stratified by gender, represents approximately 65% and 35% percentages for males and females respectively. The general population of Puerto Rico shows almost a 50%-50% split between males and females.

Our engineering undergraduate enrollment, 5,099, places our college in the 10th position of United States Engineering Schools. Georgia Institute of Technology ranked number one with 7,341 students. Our engineering college granted 590 bachelor’s degrees in 2006-2007, ranking number one in the degrees granted to Hispanics and 23rd in the US. From which, 35.4% are granted to women, ranking 6th.

Regional or Institutional Accreditation

The Middle States Association of Colleges and Secondary Schools (MSA)
   Initial accreditation - 1946
   Last accreditation - 2005

The Council of Higher Education (CES)
   Last accreditation - 2005

Personnel and Policies

Promotion
Upon the respective recommendations of the Personnel Committee of the Department, the Department Director, the Personnel Committee of the Faculty and the Dean of the Faculty; action is then taken by the Administrative Board toward the promotion of the candidate. The minimum service requirements for promotion and the salary adjustments that go with them, as per the 2007-2008 salary scale for engineers and architects, are presently as follows:

<table>
<thead>
<tr>
<th>Ph.D’s</th>
<th>Service Requirement</th>
<th>Monthly Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor to Assistant Professor</td>
<td>4 years</td>
<td>$598</td>
</tr>
<tr>
<td>Assistant Professor to Associate Professor</td>
<td>6 years</td>
<td>$650</td>
</tr>
<tr>
<td>Associate Professor to Professor</td>
<td>8 years</td>
<td>$942</td>
</tr>
</tbody>
</table>

Upon special recommendation (discretionary):
Instructor to Assistant Professor | 1 year | $598 |
Assistant Professor to Associate Professor    3 years    $650  
Associate Professor to Professor         5 years    $942

<table>
<thead>
<tr>
<th>Master’s</th>
<th>Service Requirement</th>
<th>Monthly Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor to Assistant Professor</td>
<td>6 years</td>
<td>$335</td>
</tr>
<tr>
<td>Assistant Professor to Associate Professor</td>
<td>8 years</td>
<td>$655</td>
</tr>
<tr>
<td>Associate Professor to Professor (Promotion not contemplated)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Upon special recommendation: (discretionary):  
| Instructor to Assistant Professor           | 4 years             | $335            |
| Assistant Professor to Associate Professor  | 5 years             | $655            |
| Associate Professor to Professor            | 6 years             | $787            |

**Tenure**  
After a minimum of five years of service, and upon recommendation from the Personnel Committee of the Department, the Department Director, the Personnel Committee of the Faculty, and the Dean of the College, the Administrative Board will extend or deny tenure. Tenure by itself does not convey a salary adjustment.

**Faculty salaries**  
Faculty salaries, throughout the University of Puerto Rico system, are established by the Board of Trustees. The salary scales are uniform, and depend on the rank of the professor, his/her academic degree, and the number of years of service with the institution. Revisions in salary scales occur at the discretion of the Board of Trustees. The Board’s policy is to maintain uniform salary scales throughout the University System. Exceptions to this rule are those professional fields in which faculty recruiting is difficult: medical health sciences, engineering, architecture, law, and planning. As a result, faculty salaries in the Mayagüez Campus are higher in the College of Engineering than in the Colleges of Arts and Sciences, Business Administration, and Agricultural Sciences. The total income that a faculty member receives from the University can be substantially higher than the salary specified in the scale for his/her rank, academic preparation, and years of service. This is so because extra compensations are paid for administrative work, for teaching in excess of the 12 credit hours regular teaching load, for research in sponsored projects if the faculty member carries a full teaching load, and for teaching or research during summers. In summary, this demonstrates that there are mechanism in place to reward productivity and hard work, and that faculty income can reach levels competitive enough to assure an adequate stability of the teaching body.

**Retirement Program**  
The regulations of the Retirement System of the University of Puerto Rico state that all University employees are required to participate in the pension plan, except:

- Compensated on an hourly basis
- Employed in a temporary position for less than nine (9) months
- Regularly employed for less than 18 hours per week
- Employed in a substitute position
- Employed as a visiting professor
- Providing services under contract, except if the contract agreement requires full- or part-time employment and they have similar benefits and obligations to those of a regular employee participating in the pension plan
- Persons receiving a pension from another government retirement system, unless this pension is suspended during the time of employment at the University
- Persons who receive credit for their services at the University in a pension plan from any other federal government retirement system

In order to be able to begin receiving the pension, the person should meet two basic requirements: age and years of service. Once these have been met, the pension to be received upon retirement will be equal to a percent of the average of the 36 months of highest salary received during the employee’s participation in the plan.

\[ \% \times \text{Average Compensation} \times \text{Years of Service} = \text{Annuity} \]
The percentage used is determined by the years of service credited by the Retirement System at the date of termination of service. In order to be eligible for a pension by age and/or years of service, the person must have between 10 and 30 credited years. The percentage rate starts at 1.5% per year, and can be as much as 75%. The average compensation will depend on the maximum salaries (cap) upon which the person chooses to base his/her contributions. The higher the factors in the equation, the higher the pension will be. We indicate how to achieve the highest possible factors below.

The maximum salary for contribution—or cap, as it is commonly called—is the highest salary on which the person can base his/her contributions to the pension fund. This is the amount that will determine how high the average compensation will be when calculating the pension benefit.

Through June 30, 1998, the maximum salary for contributions of $35,000 was applicable to all pension plan participants, except those with 20 credited years of service on June 30, 1979, who had no cap or maximum salary.

At present, participants contribute at different percentage rates depending on the regulations that cover them, in some cases, by choice. Currently, there are three types of maximum salary for contribution:

<table>
<thead>
<tr>
<th>Cap</th>
<th>Contribution Paid</th>
<th>Adjustment For Social Security</th>
<th>Maximum Pension</th>
<th>To Whom This Applies</th>
</tr>
</thead>
<tbody>
<tr>
<td>$35,000</td>
<td>5% and 4/6.5% coordinated</td>
<td>$437.50</td>
<td>$2,187.50</td>
<td>Participants who entered the system before July 1998 and have not decided to change caps.</td>
</tr>
<tr>
<td></td>
<td>7% and 8% supplemented</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$50,000</td>
<td>9% coordinated (previously 9% paid 5% or 4/6.5%)</td>
<td>$625.00</td>
<td>$3,125.00</td>
<td>Participants who entered the system after July 1, 1998 and those who entered earlier, but have voluntarily changes to this cap.</td>
</tr>
<tr>
<td></td>
<td>9% supplemented (previously paid 7% or 8%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$60,000</td>
<td>11% coordinated (previously 9% paid 5%, 4/6.5%, or 9%)</td>
<td>$750.00</td>
<td>$3,750.00</td>
<td>Participants who have voluntarily changed to this cap.</td>
</tr>
<tr>
<td></td>
<td>7%, 8%, or 9% supplemented</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Participants in the $50,000 cap can change to the $60,000 cap at any time. Those in the $35,000 cap can change to the $50,000 or $60,000 caps. The regulations established for this say that 9% or 11%, respectively, will be retroactively effective through July 1, 1998. These regulations also establish that differences in contributions will be charged at the
rate in effect at the time for the years prior to July 1998, during which time the caps exceeded those currently in place. The payment includes interest, at the rate of 8% from the point that the differences begin through the final date of payment.

Participants who made mandatory contributions to the pension fund beginning on or after July 1, 1998 contribute 9%, up to maximum salary of $50,000. However, those participants who began contributing to the fund on or after July 1, 2002 may opt for the $50,000 cap (9%) or the $60,000 cap (11%).

The University contributes 15% of the employee’s salary to the cost of the program.

Health insurance:
The University contributes $509.48 a month to the cost of the health insurance program of each of its employees.

Social Security:
The University contributes 7.65 percent of the salaries of its employees to the Social Security System, to the salary ceiling fixed every year by the Federal Government.

Other benefits:
All University employees are entitled to free tuition for their children and spouses enrolled in the institution. They also receive a 10 percent discount on all purchases at the Campus bookstore, and a Christmas bonus, which varies every year. For this past Christmas the bonus was $1025.00.

Educational Unit

The organization chart of the Mayagüez Campus is shown in Table D-7 (A), as suggested, towards the end. As illustrated, there is an Administrative Board at a hierarchical level immediately below that of the Chancellor. As per the University Law, the Board serves as an advisory body to the Chancellor on the general operation of the Campus.

The College of Engineering is organized into six academic departments: Chemical Engineering, Civil Engineering and Surveying, Electrical and Computer Engineering, Industrial Engineering, Mechanical Engineering, and Engineering Science and Materials. Of these, Engineering Science and Materials is a non-degree granting department, which offers the core courses common to all programs. The Department of Electrical and Computer Engineering offers two separate programs in Electrical Engineering and Computer Engineering. The Department of Civil Engineering and Surveying also offers two separate programs in Civil Engineering and Surveying. The Surveying program is a four-year non-accredited program. A Research & Development Center and the Cooperative Education Program also form part of the College of Engineering.

The following constitute the administrative corps of the College of Engineering:

- **Dr. Ramón E. Vásquez Espinosa**: Dean
- **Vacant**: Associate Dean (Academic Affairs)
- **Dr. José Colucci Rios**: Associate Dean (Research)
- **Prof. Waldermar Ramírez**: Associate Dean (Administrative Affairs)
- **Dr. Mario Rivera Borrero**: SEED Office Coordinator
- **Dr. David Suleiman**: Interim Director, Dept. of Chemical Engineering
- **Prof. Ismael Pagán Trinidad**: Director, Dept. of Civil Engineering & Surveying
- **Dr. Ricardo López**: Associate Director, Dept. of Civil Engineering & Surveying
The following mission statements of the College of Engineering were approved by the faculty in its general meeting held on May 8, 2001.

Provide Puerto Rico, our neighbors, and the rest of the world with professionals having a strong education in engineering and related areas, with rich environmental, ethical, cultural, and social sensitivities; with capacity for critical thinking and for becoming leaders in their fields.

It is also our mission to conduct research, expand and disseminate knowledge, promote an entrepreneurial spirit, provide service to the community, and pursue the innovation and application of technology for the benefit of our global society, with particular emphasis on Puerto Rico.

Credit Unit

The University of Puerto Rico’s definition of a semester credit for courses falls within the context of EAC’s assumption that one semester credit hour represents one class hour or three laboratory hours per week, and that one academic year normally represents at least 28 weeks of classes, exclusive of final examinations. At the University of Puerto Rico in Mayaguez, each of the two semesters comprises 15 weeks of classes.

Instructional Modes

Traditional on-campus instruction is employed in all programs.

Grade-Point Average

The grade point average required for graduation is 2.00. In addition, engineering graduates must have earned a grade point average of 2.00 in the courses taken within their major fields as per the stipulations of the College of Engineering. However, no such conditions exist at the institutional level.

Academic Supporting Units

A. Department of Chemistry

http://www.uprm.edu/wquim/

Dr. Francis Patrón, Director
The Department of Chemistry was founded in 1948 and offers a Bachelor of Science degree in Chemistry, which has been fully approved by the American Chemical Society since 1978. The department also offers a graduate program leading to a Doctor of Philosophy degree in Applied Chemistry and a Master of Science degree in Chemistry, the latter since 1959. The Chemistry Department collaborates with the interdisciplinary Master of Science in Food Technology and the Bachelor of Science in Biotechnology programs together with the departments of Chemical Engineering and Biology and the School of Agriculture. The Chemistry Department is the largest service department offering laboratory courses within the University of Puerto Rico system.

The mission of the department is to offer students a program of excellence in chemistry by means of a formal education, research and community service, to enable them to develop as professionals in the various fields of chemistry. Students completing the program are made aware of the problems that affect the Puerto Rican and international communities and of their responsibilities and opportunities as citizens and scientists in areas such as education, industry, government, and scientific research. The Chemistry Department’s Student Affiliate Chapter has been selected by the American Chemical Society’s Department of Educational Activities as outstanding on numerous occasions.

The department hosts several research groups and two research centers: the Center for Protein Characterization and Function, and the Center for Development of Chemical Sensors. An outreach program, Science on Wheels, is also housed within the departmental facilities.

**B. Department of Economics**

[http://econ.uprm.edu/](http://econ.uprm.edu/)

**Dr. Wilfredo Ruiz Oliveras, Director**

The Department of Economics is engaged in the dual function of providing professional training to students majoring in Economics and rendering teaching services to students of other departments on the Mayagüez Campus of the University of Puerto Rico. Student professional training is offered through an academic program which emphasizes the development of quantitative methods and techniques necessary for economic analysis. The program requires a three semester sequence in mathematics, one year of mathematical statistics and one semester course in econometrics, as well as one year seminar course in research methodology. Upon successful completion of this program, students are awarded a Bachelor of Arts degree with a concentration in Economics. Teaching services, on the other hand, are designed for students who take introductory and intermediate economics courses as requirements and/or electives within their major field of study.

The common purpose of both functions is to develop students’ ability to think clearly and objectively in dealing with economic decisions and problems. Students are trained specifically to replace value judgments and prejudices with sound economic reasoning based on an objective and rational analysis. Besides these two functions, economic research and the promotion of economic education are two integral elements within the Department.
C. Department of English

http://www.uprm.edu/english/

Dr. Betsy Morales, Director

The Department of English provides various courses of instruction for all students attending the Mayagüez Campus.

With regards to the general requirement in English, three separate 12 credit-hour sequences exist within the Department of English.

A. *The Basic Sequence*: INGL 3101, 3102, 3201, 3202.

B. *The Intermediate Sequence*: INGL 3103, 3104 and six additional credit-hours in English Department courses to be chosen from an approved list of courses provided by the English Department.

C. *The Honors Sequence*: Six credit-hours are granted to students by means of Advanced Placement. Students must then take INGL 3211 and 3212 to complete their requirement. Note that although these two courses carry 3000-level numbers, they are actually second year courses.

Academic Senate Certification 88-24 stipulates that ONLY a score of 4 or 5 on the Advanced Level Test of the College Board may be used to place entering first year students directly into second year courses by granting them six credit hours of advanced placement.

Note that students who start in one sequence can not take courses in one of the other sequences to satisfy the university's English requirement. For example, students in the "Intermediate Sequence" may not take either INGL 3201-3202 or INGL 3211-3212 to satisfy their second year requirement.

Students who score below 570** on the ESLAT (English as a Second Language Achievement Test) will be placed in the basic sequence of courses: INGL 3101, INGL 3102, INGL 3201, INGL 3202.

The intermediate sequence of courses, starting with INGL 3103 and INGL 3104, is for entering students at UPR/Mayagüez who have scored above 570** on the ESLAT (English as a Second Language Achievement Test), but who have either not taken the Advanced Level Test in English or not qualified for advanced placement in the Honors Program of the English Department by obtaining a score of 4 or 5 on that test. Students with a score of 3 on the Advanced Level Test will be placed in INGL 3103.

Students who successfully pass INGL 3103 and INGL 3104 must take six more credit-hours in English Department courses in order to satisfy the university requirement in English.

The English Department also offers additional course work in the areas of conversational English, public speaking, advanced composition, creative writing, technical writing, literature, and linguistics. All students have an opportunity to take such additional courses in English to meet their particular needs.

For those students who desire to major in English, the department offers a two-track program leading to the degree of Bachelor of Arts in English. All students are required to take a common core of courses which includes: "Introduction to Linguistics,"
"Phonetics," "Survey of English Literature" (two semesters), "Survey of American Literature" (two semesters), and "English Expository Writing." Beyond these required core courses, students choose to emphasize coursework in the area of literature or linguistics.

The department also administers an English course for international graduate students who have only minimal competence in English. The English Department also works with other Departments of the University to offer students an opportunity to receive certificates in Education, Film, and Office Management.

The English Department offers a graduate program leading to the degree of Master of Arts in English Education (M.A.E.E.). This program is grounded in the areas of linguistics, literature, and pedagogy. Although students may ultimately concentrate in one of these areas, they are required to take designated courses from each area. The program is designed for classroom teachers at all levels of instruction.

D. Department of Geology
http://geology.uprm.edu/
Dr. Johannes Schellekens, Director

The Department of Geology offers a program leading to a Bachelor of Science degree in Geology. As part of degree requirements, majors have to conduct a supervised research project in their final year. The Department also offers advanced undergraduate courses for qualified students in the graduate programs in Biology, Physics, Marine Sciences and Civil Engineering. The principal objective of the Geology Program is to prepare students for professional positions in industry and government, and for careers in academic research and teaching.

The Department operates a microseismic network, laboratories with analytical instruments including an electron microprobe, x-ray fluorescence and x-ray diffraction spectrometers, and a mass spectrometer, as well as geochemical, remote sensing and geophysical laboratories.

The Department hosts the Puerto Rico Seismic Network (Red Sísmica), which operates and maintains the most extensive array of seismological instrumentation in the northern Caribbean from a separate building adjacent to the department. The popular Geology Museum and departmental collections are currently being updated in new facilities within a two-minute walk from the Physics building.

E. Department of Hispanic Studies
http://www.uprm.edu/hispanicos/
Dr. Jaime Martell Morales, Director

The Department of Hispanics Studies, established in 1956 as the Spanish Department, offers a Bachelor of Arts in Hispanic Studies. It provides courses of instruction for all students on campus, as well as courses which are required by other academic programs.

The Department of Hispanic Studies offers a program which emphasizes the dual aspects of language and literature. It offers specialized courses in Spanish Language, Hispanic Philology, as well as Spanish, Latin-American, and Puerto Rican literatures. The
Department also offers a graduate program leading to the degree of Master of Arts in Hispanic Studies.

F. Department of Humanities
http://www.uprm.edu/humanidades/
Dr. Dana Collins, Director
The Department of Humanities became a separate department in 1968 upon the division of the former Department of English and Humanities. The first degree offered by the Department was the Bachelor of Arts in Comparative Literature. Since 1971, it has also offered degrees in the areas of: Plastic Arts, Theory of Art, Philosophy, and French Language and Literature. In addition to courses related to these areas, the Department regularly offers courses in: Asian culture, biblical studies, classical languages and literatures, German, Italian, Latin-American culture, music, and theatre, as well as a two-semester survey course in humanities, which is a requirement for many students at UPRM.

Department facilities include an art gallery, a specialized library and study room for our majors, two computer centers, one which includes an Interactive Francophone Laboratory, a theatre workshop and an interdisciplinary research center for practical and professional ethics and the philosophy of science and technology. The Department hopes to expand its art facilities in the near future.

The mission of the Humanities Department must be understood in the context of the overall mission of the University of Puerto Rico at Mayagüez. The Department teaches our students to appreciate human culture, diversity and to value knowledge. The Department of Humanities promotes research among its faculty, and it is a key instrument in the development of educational offerings and cultural activities conducive to the intellectual, aesthetic and moral formation of well-rounded human beings.

The Department is especially interested in advancing studies in the fields of philosophy, the fine arts, literature and languages. This Department understands that knowledge and awareness brought by the study and appreciation of the liberal arts can only provide a better understanding and appreciation of ourselves and our society. It pays special attention to the formation of its cadre of majors: future artists, intellectuals, creative leaders in various professions, teachers, professors, researchers, but it also looks upon itself as responsible for providing the higher education offerings and services by which our citizenry in general may avail itself of what is most important and enriching in our cultural heritage. The Department also promotes the exploration of other cultures and societies in order to inspire in our students a global understanding of culture and the development of humanity.

G. Department of Mathematics
http://math.uprm.edu/
Dr. Julio C. Quintana, Director
The Department of Mathematics offers three programs leading to the Bachelor of Science degree: Pure Mathematics, Computer Science, and Mathematics Education. The Bachelor of Science degree in Mathematics provides a solid preparation for students, enabling
them to follow careers in industry, in government, in the field of education or to pursue graduate studies.

Courses in Computer Science are frequently updated to keep pace with this rapidly changing field. Statistics is emerging as an important component of the Department and a growing number of courses in this field are also available. The Department of Mathematics also offers two programs leading to a Master of Science degree.

One program is in Scientific Computing and the other is in Mathematics which includes specializations in Pure Mathematics, Applied Mathematics and Statistics. The Department of Mathematics participates in an Interdisciplinary Program leading to a Ph.D. degree in Computing and Information Sciences and Engineering, with the Department of Electrical and Computer Engineering.

Advanced placement tests may be used to obtain credit for one or more of the following courses: MATE 3005, MATE 3086, MATE 3171, MATE 3172, and MATE 3031. The Department of Mathematics requires a minimum of C in all courses which are part of the student’s major field of study.

H. Department of Physical Education

http://www.uprm.edu/edfi/

Dr. Ana Elena Muñiz Olivari, Director

Mission
To serve our society developing educators, creating, and investigating in the areas of physical education, sports and recreation with the purpose of promoting healthy lifestyles.

Vision
Responding to societal dynamics, the Department of Physical Education strives to become the finest educational, creative, and scientific development center in physical education, sports, and recreation. As the north of our aspirations, we establish the constant search for knowledge and its dissemination.

Values
Being aware of the respect for individual differences, we promote professional, social, and ethical responsibility.

Program Educational Objectives
Our department graduates will be able to:
1. Address the challenges that they will face in their careers.
2. Pursue life-long learning.
3. Engage in physical activities.
4. Continue to develop problem-solving skills.
5. Exhibit leadership and team building skills.
6. Provide service to the profession, to our government, and our society.
7. Function as effective members of interdisciplinary teams.
8. Apply current technologies in physical education, sports, fitness, and recreation.

Program Outcomes
The students from our department will demonstrate:
1. Ability to understand and apply fundamental knowledge of physical education, sports, fitness, and recreation.
2. Proficiency in a minimum of four (4) recognized mayor physical education areas, such as: (1) teaching, (2) sciences applied to physical education and sports, (3) strength and fitness, (4) sports skills, (5) physical education and sport management, (6) recreation, and (7) coaching.
3. Ability to conduct research and to critically analyze and interpret data in at least one of the mayor areas of study.
4. Ability to identify, formulate, and solve problems in physical education, sports, fitness, and recreation using modern tools, techniques, and skills.
5. Play an effective role in multidisciplinary professional work groups, solving problems in physical education, sports, fitness, and recreation.
6. Ability to communicate effectively.
7. Understand the importance of compliance with professional practice and legal issues such as: certification standards, medical issues in sports, and safety among others.
8. Broad education necessary to understand the impact of physical education on health, general welfare, sport activities safety, and teaching in a global context.
9. Commitment to engage in lifelong learning and physical activity.
10. Awareness of contemporary social, cultural, economic, artistic, aesthetic, environmental, and physical education issues.

I. Department of Physics

http://www.uprm.edu/fisica/

Dr. Héctor J. Jiménez González, Director

The Department of Physics offers Bachelor of Science degree programs in Physics and in Physical Sciences, and a Master of Science program in Physics. The Bachelor of Science program in Physics is the traditional program designed for students who wish to obtain a solid background in the field. It prepares students to work in government and private laboratories, to pursue graduate work in physics or to teach physics at the secondary level if additional courses in education are taken to obtain the teacher's license required by the Department of Education. This program is recommended to students who would like to pursue a career in Physics.

The Bachelor of Science Program in Physical Sciences is directed specifically to the preparation of secondary school teachers in the physical sciences. The program includes most of the courses in education required for certification by the Department of Education. However, it can also be used by students who do not want to make a commitment to any of the traditional fields of study in the physical sciences and require a broader preparation in general science.

J. Department of Social Sciences

http://www.uprm.edu/socialsciences/

Dr. Douglas Santos, Director

The Department of Social Sciences was established in 1960 as a result of the merging of the School of Sciences and the Division of General Studies into the College of Arts and Sciences.
As a unit within the College of Arts and Sciences, the Department collaborates in the academic preparation of individuals in making independent choices and participating effectively in public decisions which affect the community and society as a whole.

In order to achieve these goals, the Department provides programs leading to a Bachelor of Arts degree in several areas in the social sciences for individuals who will enter public service or will pursue graduate studies. It also offers courses which are required by the curricula of other academic programs on campus.

This dual goal is accomplished through the common objectives of its academic program in General Social Sciences, History, Political Science, Psychology and Sociology and through the specific objectives of each of these academic disciplines.

K. Department of Engineering Science and Material  
[http://www.uprm.edu/ciym/](http://www.uprm.edu/ciym/)  
Dr. Walter Silva, Director  
The Engineering Science and Materials Department integrates an interdisciplinary faculty who are responsible for teaching basic introductory engineering courses. This centralized department offers common and fundamental engineering courses under one administration; providing an efficient platform outside of the specialized department.

Those courses related to basic Engineering Science are as follows: Engineering Graphics, Computer Programming, Numerical Methods, Applied Mechanics, Fluid Mechanics, and Engineering Materials. A broad, yet in-depth, knowledge of all of these areas is indispensable in every field of engineering, not only for further studies, but also for the successful practice of the engineering profession. The Department of Engineering Science and Materials also offers interdisciplinary elective courses which are well within the competence of its faculty.

Research in Engineering Science and Engineering Education is an integral part of each professor’s involvement in this Department. In particular, the department is experiencing considerable growth in research on Materials Science and Engineering. This is an interdisciplinary field concerning properties of matter and its applications to engineering and science, including nanotechnology and nanoscience. Elements of applied physics, chemistry, chemical, mechanical, civil and electrical engineering are integrated in this developing field. As a result of their inherent interdisciplinary backgrounds, our faculty members have been instrumental in developing cross-cutting collaborations with other science and engineering departments.

Non-Academic Supporting Units

A. Campus Computer Center  
[http://www.uprm.edu/cti/](http://www.uprm.edu/cti/)  
Víctor Díaz, Director, victord@uprm.edu  
The main Computer Center, or the Center of Information Technology of the University of Puerto Rico Mayagüez Campus is responsible of the administrative information system (Financial, HR and Student System) and some centralized academic services. The Center
is also responsible for the campus data communication backbone and Internet/Internet 2 access.

The Campus has a strong fiber optic communication infrastructure, which connects all buildings throughout the campus with a central system located in the institution’s telephone office building. This infrastructure has been extremely important for improvement, development, and modernization of the communication system within the Mayagüez Campus.

We should also note that the Agricultural Experiment Stations and the Agricultural Extension Service Offices through the Island of Puerto Rico have a robust dedicated Internet access that allows them to communicate with the University of Puerto Rico, Mayaguez Campus.

Internet communication at Mayagüez Campus has increased exponentially. Actually, as an Internet 2 institution, the communication with the outside world is done through an OC3 line (155Mbps).

The Main Computer Center supports the institution’s academic and administrative functions. The main administrative information system is supported by HP Alpha System and is being replaced by new Itanium based servers. A farm of more than 15 Linux based servers complement the administrative services, including the main web based local portal for self-serve services, messaging and general information access. This Portal is called “Mi Portal Colegial”, and it is the institutional adopted platform to develop and implement the electronic services to the whole university community.

For more than eight years, WebCT has been used as the Academic Course Management System for online distance learning. There are also a large number of videoconference systems, including dedicated rooms, for real time distance learning and meetings. The academic colleges and departments have been expanding their computing and technological equipment to allow them to better prepare their students in these areas, and to allow a greater internet access and online services to faculty, students, and employees.

One of the main and most used services developed and maintained by the Main Computer Center for the whole university community is the wireless network. The wireless network allows all university community members to access the Internet and all local online services. More than 120 access points are deployed around the Campus.

B. Library Facilities

http://www.uprm.edu/library/

Prof. Jeannette Valentín Marty, Acting Director, jvalentin@uprm.edu

Library acquisitions and resources are shown in Table D-8 (A).

Library expenditures for the past three years are shown in Table D-8 (B).

There is no separate Engineering Collection in this library. Resources on engineering and related sources are integrated with other materials. Books are housed on the third floor, whereas, magazines and journals are housed on the first and second floors. Government documents are located on the fourth floor. Databases can be accessed in campus and remotely, except those on cd-rom that are kept in the Serials and Electronic Resources
Collection. Videotapes and films are located at the Film Collection on the second floor of Sánchez Hidalgo Building. Some of them are digitized and can be accessed online. All resources are cataloged and classified using the LC and SuDocs classifications, and can be accessed through the online public catalog.

Reference services are offered by thirteen (13) professional librarians who are assigned to the following collections: one (1) to Marine Sciences; four (4) to Reference, four (4) to Serials and Electronic Resources, and four (4) to Puerto Rican Collection. Reference services are also offered at the Film/Video, Alvarez Nazario and at the Music and Oral History Collection.

Interlibrary loan services are offered to the academic community Monday through Friday from 7:30 am to 4:30 pm. The Online Computer Library Center (OCLC) system is used for the transmittal of the loan requests. The ARIEL system was acquired for the electronic delivery of documents. FAX transmission service is also available. Interlibrary loans are offered as free service. Unless a reciprocal agreement has been established with the Institution, some charges will apply.

Professional librarians assist students and faculty in their study and research endeavors. CEDIBI (Center for the Development of Information Literacy and Bibliographic Research) is an initiative developed to establish an Information Literacy Program which incorporates information literacy skills throughout the curriculum at the University of Puerto Rico, Mayagüez Campus. This program has been in operation for the benefit of students and faculty. Bibliographic guides are prepared and distributed among the attendees. Orientation on the use of library resources is offered to freshmen and graduate students, high school students, and anyone requesting such service. Library offers an interdisciplinary course, INTD 3355 (Research Methods in Libraries) as an elective course, which appears under the Office of the Dean of Academic Affairs. The library staff also teaches the following formal courses: AGRO 4019 (Agronomy and Soils Department), CISO 3145 (Social Science Department), and BIOL 3055 (Department of Biology). The library is also a Coordinating Agency of the Puerto Rico Census Data Center. It is a depository of all census publications than can be accessed by the academic community and the general public.

The Serials and Electronic Resources Collection (CRRE) is made up of online databases and paper format. The following databases provide not only bibliographic information, but full text and graphics as well: Academic Search Premier, Business Source Premier, ABI/Inform, Social Sciences Full Text, General Science Full Text, Proquest Agricultural Journals, Proquest Biology Journals, Applied Science and Technology Index, Engineering Village2, CRCNetbase and IEEE Xplore, among others.

The Library is a selective depository of the Federal Depository Library Program of the Government Printing Office. As part of the depository program, many resources are received in paper, online and CD-ROM format, among them USA Pat, Tiger/Line (the Coast to Coast Digital Map Database), several census databases, as well as various databases from the U.S. Geological Survey, the National Oceanic and Atmospheric Administration and others. The library is registered for Government Printing Office (GPO) access online service. The databases available through this service are: Federal Register, Congressional Record, Congressional Bills, United States Code, Public Laws,
and General Accounting Office (GAO) Reports. Many other databases will be available since these will be either online or in CD-rom format.

The library was designated on March 10, 1995 as a United States Patent and Trademark Depository Library. It has a collection of over 3,403,938 million U.S. Trademarks and 7,356,848 Patents. In addition it receives patent abstracts from the Patent Office of Japan and the European Union, as well as publications from the World Intellectual Property Organization.

Library services are fully automated. The online catalogue may be accessed from computers in the Library, or anywhere on and outside the Campus through the Internet. The library is intended to expand the services available to off-site users. In this context, off-site is defined as beyond campus or institutional boundaries, not simply outside the library’s walls. This allows remote users not permanently linked to the library’s server to have access, whereas a server provides access to those workstations on the server’s network.

The College of Engineering counts on the recommendations of a library committee, which is made up of individual departmental representatives. A similar procedure exists in the College of Arts and Sciences, where such committees exist in the Biology, Chemistry, Geology and Physics departments.

The library maintains the following daily service:

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday – Thursday</td>
<td>7:00 am – 10:00 pm</td>
</tr>
<tr>
<td>Monday – Thursday</td>
<td>6:00 a.m.-2:00a.m. (CRRE)</td>
</tr>
<tr>
<td>Friday</td>
<td>7:00 am – 4:30 pm</td>
</tr>
<tr>
<td></td>
<td>6:00 a.m.-4:30 p.m. (CRRE)</td>
</tr>
<tr>
<td>Saturday</td>
<td>12:00 pm – 5:00 pm</td>
</tr>
<tr>
<td>Sunday</td>
<td>2:00 pm – 10:00 pm</td>
</tr>
<tr>
<td></td>
<td>2:00 p.m.-12:00 a.m. (CRRE)</td>
</tr>
<tr>
<td>Holidays</td>
<td>3:00 pm – 8:00 pm</td>
</tr>
</tbody>
</table>

During the period of final exams, services are extended also, until midnight in the Circulation area.

The reference services are available during the same hours the library is open. The stacks are open, except for the Puerto Rican and the Music Collections. The following collections are open as indicated:

- Film/Video Collection: 7:30 am – 6:00 pm
- Music and Oral History Collection: 7:30 am – 11:30 am, 12:30 pm – 4:30 pm
- Alvarez Nazario Collection: 7:30 am – 6:00 pm

The library staff consists of 25 faculty members, 46 non-professional support librarians and 10 technicians, all committed to help the users in their information and research needs. The library services – Circulation/Reserve, Reference/Documents, Puerto Rican Collection and Puerto Rico Census Data Center, periodicals and journals, computer search services, Interlibrary Loans, research and bibliographic information and Audiovisual Services are integrated to serve the entire Mayagüez Campus community.

The seating capacity of the library as of June, 2008 was as follows:
Main Library  885 seats  
Marine Science Collection  26 seats 
AV Projection Classrooms  147 seats 

There are two map-collections: one located at the Reference/Documents Collection, and another at the Puerto Rican Collection. Facilities for transmission of closed circuit TV and satellite are also available. Interactive teleconferences are offered for faculty and students. A program for distance learning was begun on the Campus. The library is an active collaborator in providing both physical (projection rooms) and human resources. Microforms are kept at the following collections: Reference/Documents, Serials and Electronic Resources, and in the Puerto Rican Collection. Phonographic records and audio resources are located at the Music and Oral History Collection.

Physical facilities in this library provide for: one (1) Conference Room (96 seats with 32 tables), two (2) Meeting Rooms (24 seats with tables, 11 seats, 1 table), ten (10) closed study carrels for graduate students and professors; eight (8) study rooms for group discussion; two (2) library instruction rooms; one (1) micro-format room in the Serials and Electronic Resources Collection.

All library functions are automated. A total of 240 computers are distributed throughout the library. The library actually has three local databases: SAMDB (provides access to local newspapers); INDEREF (provides access to biographies); and MARINE (provides access to reprints).

Eleven (11) photocopying machines are centralized on the second floor of the library. Additional machines are located at Puerto Rican Collection, Alvarez Nazario Collection, Marine Science Collection, Reference/Documents Collection, Serials and Electronic Resources Collection and at the Administrative Office.

### C. Placement Office

http://www.uprm.edu/placement/

Sra. Nancy Nieves Arán, Director

**Vision**

Serve as liaison between students and businesses while providing the best and most effective service to all.

**Mission**

Provide students the necessary tools that will help achieve an effective job search, while maintaining lines of communication with businesses and the College community.

**Services**

- Register students and alumni, creating records for our files.
- Assist students and alumni explore the job market.
- Help with the correction of resumes.
- Offer talks to groups of students on resume writing, interviews, job search, etc.
- Coordinate on campus interviews.
- Refer resumes to companies and or agencies.
Announce job opportunities (part-time, summer and permanent).
Keep a list of companies and agencies with their addresses.
Coordinate meetings between student organizations and companies.
Prepare salary statistics.
Prepare annual employment statistics.
Organize Annual Job Fair.
Work with student organizations.

Policies
The following, apply to all students, seniors, graduate and alumni that request our services:
Register at the Placement Office with any member of the staff.
Clear through any staff member, if you miss an interview. Any student who fails in this aspect for a second time will not be allowed future interviews. Remember your actions will reflect on your peers.
Every student must sign up for an interview on their spare time. The Placement Office will not provide excuse letters for missing classes on account of an interview.
There is no limit to the number of interviews a student can have. However, once a student has accepted a job offer, he or she must stop interviewing.
Students that accept a job offer should notify the Placement Office.

Requirements
The following, apply to all students, seniors, graduate and alumni that request our services:
Five or more copies of your resume (preferably in English).
Copy of your course program.
Transcript (preferably in English).
Fill out form 511
Fill out student evaluation form
2x2 photograph (optional).
Every student is responsible for maintaining his/her file updated and with enough copies at the Placement Office.

Faculty Workload
The formal teaching load of a faculty member is twelve (12) academic credit hours. Depending on the interest of the particular faculty member and the needs of the school, this load may consist of a combination of teaching, research, and administrative duties. The teaching load is computed according to the Table of Equivalent Credit Hours for academic activities shown below.
Any teaching, research or administrative duty assigned above the normal twelve credit hours entails extra compensation.
### EQUIVALENT CREDIT HOURS FOR ACADEMIC ACTIVITIES

<table>
<thead>
<tr>
<th>Activity</th>
<th>Contact Hours per week</th>
<th>Equivalents Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coursework: Conference or Discussion</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Coursework: Laboratory</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Coursework: Computation</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Coursework: Seminar</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Supervised Research</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Tutoring – Special Problems</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Thesis or Project Direction</td>
<td>1</td>
<td>1/sem</td>
</tr>
<tr>
<td>Research Work, Divulgation, Administrative Tasks and Services</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Workshops</td>
<td>15 sem hrs</td>
<td></td>
</tr>
</tbody>
</table>
### Table D-1. Programs Offered by the Educational Unit

<table>
<thead>
<tr>
<th>Program Title</th>
<th>Modes Offered</th>
<th>Administrative Head</th>
<th>Administrative Unit or Units (e.g. Dept.)</th>
<th>Submitted for Evaluation</th>
<th>Offered, Not Submitted for Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day</td>
<td></td>
<td></td>
<td>Now Accredited</td>
<td>Not Now Accredited</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>X</td>
<td>Dr. David Suleiman</td>
<td>Chemical Eng. Dept.</td>
<td>X</td>
<td></td>
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<td>BS</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
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<td>MS, ME</td>
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<td></td>
<td>X</td>
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<tr>
<td>PhD</td>
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<td>X</td>
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<tr>
<td>Civil Engineering</td>
<td>X</td>
<td>Prof. Ismael Pagán</td>
<td>Civil Eng. &amp; Surveying Dept.</td>
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<tr>
<td>BS</td>
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<tr>
<td>MS, ME</td>
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<td></td>
<td>X</td>
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<tr>
<td>PhD</td>
<td></td>
<td></td>
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<td>X</td>
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<tr>
<td>Computer Engineering</td>
<td>X</td>
<td>Dr. Isidoro Couvertier</td>
<td>Electrical and Computer Eng. Dept.</td>
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<tr>
<td>BS</td>
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<td>MS, ME</td>
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<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>X</td>
<td>Dr. Isidoro Couvertier</td>
<td>Electrical and Computer Eng. Dept.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>X</td>
<td>Dr. Isidoro Couvertier</td>
<td>Electrical and Computer Eng. Dept.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Now Accredited</td>
<td>Not Now Accredited</td>
</tr>
</tbody>
</table>

- **Programs Offered by the Educational Unit**
- **Modes Offered**:
  - Day
  - Cooperative
  - Off-Campus
  - Alternate Mode
- **Nominal Years to Complete**
- **Administrative Unit or Units (e.g. Dept.)**
- **Submitted for Evaluation**
- **Offered, Not Submitted for Evaluation**

<table>
<thead>
<tr>
<th>Program Title</th>
<th>Program Title</th>
<th>Program Title</th>
<th>Program Title</th>
<th>Program Title</th>
<th>Program Title</th>
<th>Program Title</th>
<th>Program Title</th>
<th>Program Title</th>
<th>Program Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>Chemical</td>
<td>Chemical</td>
<td>Chemical</td>
<td>Chemical</td>
<td>Chemical</td>
<td>Chemical</td>
<td>Chemical</td>
<td>Chemical</td>
<td>Chemical</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Program Title**: Chemical Engineering
- **Administrative Head**: Dr. David Suleiman
- **Administrative Unit or Units (e.g. Dept.)**: Chemical Eng. Dept.
- **Submitted for Evaluation**: X
- **Offered, Not Submitted for Evaluation**: X

- **Program Title**: Civil Engineering
- **Administrative Head**: Prof. Ismael Pagán
- **Administrative Unit or Units (e.g. Dept.)**: Civil Eng. & Surveying Dept.
- **Submitted for Evaluation**: |
- **Offered, Not Submitted for Evaluation**: |

- **Program Title**: Computer Engineering
- **Administrative Head**: Dr. Isidoro Couvertier
- **Administrative Unit or Units (e.g. Dept.)**: Electrical and Computer Eng. Dept.
- **Submitted for Evaluation**: |
- **Offered, Not Submitted for Evaluation**: |

- **Program Title**: Electrical Engineering
- **Administrative Head**: Dr. Isidoro Couvertier
- **Administrative Unit or Units (e.g. Dept.)**: Electrical and Computer Eng. Dept.
- **Submitted for Evaluation**: |
- **Offered, Not Submitted for Evaluation**: |
<table>
<thead>
<tr>
<th>Degree</th>
<th>Title</th>
<th>Credits</th>
<th>Accreditation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>Industrial Engineering</td>
<td>5</td>
<td>X</td>
</tr>
<tr>
<td>MS, ME</td>
<td>Dr. Agustín Rullán</td>
<td>Industrial Eng. Dept.</td>
<td></td>
</tr>
<tr>
<td>BS</td>
<td>Mechanical Engineering</td>
<td>5</td>
<td>X</td>
</tr>
<tr>
<td>MS, ME</td>
<td>Dr. Paul Sundaram</td>
<td>Mechanical Eng. Dept.</td>
<td></td>
</tr>
<tr>
<td>BS</td>
<td>Computing and Information Sciences and Engineering, PhD Multidisciplinary</td>
<td>5</td>
<td>X</td>
</tr>
<tr>
<td>MS, ME</td>
<td>Dr. Nestor Rodríguez, Coordinator</td>
<td>Electrical and Computer Eng. Dept.</td>
<td></td>
</tr>
<tr>
<td>BS</td>
<td>Surveying and Topography, BS</td>
<td>4</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Prof. Ismael Pagán</td>
<td>Civil Eng. &amp; Surveying Dept.</td>
<td></td>
</tr>
</tbody>
</table>

List the titles of all degrees offered by the educational unit responsible for the programs being evaluated, undergraduate and graduate, granted by the institution. If there are differences in the degrees awarded for completion of cooperative education programs, these should be clearly indicated.

1. Give program title as shown on a graduate’s transcript.
2. Indicate all modes in which the program is offered. If separate accreditation is requested for an alternative mode, list on a separate line. Describe “Other” by footnote.
3. Only those programs being submitted at this time for reaccredidation (now accredited) or initial accreditation (not now accredited) should be checked in this column.
4. Programs not submitted for evaluation at this time should be checked in this column.
### Table D-2. Degrees Awarded and Transcript Designations by Educational Unit

<table>
<thead>
<tr>
<th>Program Title</th>
<th>Modes Offered</th>
<th>Name of Degree Awarded</th>
<th>Designation on Transcript</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Engineering</td>
<td>X</td>
<td>Bachelor of Science in Chemical Engineering.</td>
<td>B. S. in Chemical Engineering</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>X</td>
<td>Bachelor of Science in Civil Engineering.</td>
<td>B. S. in Civil Engineering</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td>X</td>
<td>Bachelor of Science in Computer Engineering.</td>
<td>B. S. in Computer Engineering</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>X</td>
<td>Bachelor of Science in Electrical Engineering.</td>
<td>B. S. in Electrical Engineering</td>
</tr>
<tr>
<td>Industrial Engineering</td>
<td>X</td>
<td>Bachelor of Science in Industrial Engineering.</td>
<td>B. S. in Industrial Engineering</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>X</td>
<td>Bachelor of Science in Mechanical Engineering.</td>
<td>B. S. in Mechanical Engineering</td>
</tr>
<tr>
<td>Surveying and Topography</td>
<td>X</td>
<td>Bachelor of Science in Surveying and Topography.</td>
<td>B. S. in Surveying and Topography</td>
</tr>
</tbody>
</table>

Complete the table for all programs, as follows:

1. Give the program title as officially published in catalog.
2. Indicate all modes in which the program is offered. If separate accreditation is requested for an alternative mode, list on a separate line. Describe “Other” by footnote.
3. List degree awarded for each mode offered. If different degrees are awarded, list on separate lines.
4. Indicate how the program is listed on transcript for each mode offered. If different designations are used, list on separate lines.
Table D-3. Support Expenditures

Electrical and Computer Engineering

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>2006-2007(^1)</th>
<th>2007-2008(^2)</th>
<th>2008-2009(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations (not including staff)(^4)</td>
<td>$25,780</td>
<td>$17,755</td>
<td></td>
</tr>
<tr>
<td>Travel(^5)</td>
<td>$4,389</td>
<td>$5,467</td>
<td></td>
</tr>
<tr>
<td>Equipment(^6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Institutional Funds</td>
<td>$44,821</td>
<td>$1,509,667</td>
<td></td>
</tr>
<tr>
<td>(b) Grants and Gifts(^7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Teaching Assistants</td>
<td>$245,177</td>
<td>$199,205</td>
<td></td>
</tr>
<tr>
<td>Part-time Assistance(^8) (other than teaching)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Faculty Salaries</td>
<td>$3,697,696</td>
<td>$3,678,562</td>
<td></td>
</tr>
</tbody>
</table>

Report Department Level and Program Level data for each program being evaluated. Updated tables are to be provided at the time of the visit.

\(^1\) Provide the statistics from the audited account for the fiscal year completed year prior to the current fiscal year.

\(^2\) This is your current fiscal year (when you will be preparing these statistics). Provide your preliminary estimate of annual expenditures, since your current fiscal year presumably is not over at this point.

\(^3\) Provide the budgeted amounts for your next fiscal year to cover the fall term when the ABET team will arrive on campus.

\(^4\) Categories of general operating expenses to be included here.

\(^5\) Institutionally sponsored, excluding special program grants.

\(^6\) Major equipment, excluding equipment primarily used for research. Note that the expenditures (a) and (b) under “Equipment” should total the expenditures for Equipment. If they don’t, please explain.

\(^7\) Including special (not part of institution’s annual appropriation) non-recurring equipment purchase programs.

\(^8\) Do not include graduate teaching and research assistant or permanent part-time personnel.
Table D-3. Support Expenditures

College of Engineering

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditure Category</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations (not including staff)$</td>
<td>$705,831</td>
<td>$632,552</td>
<td></td>
</tr>
<tr>
<td>Travel$</td>
<td>$69,440</td>
<td>$51,931</td>
<td></td>
</tr>
<tr>
<td>Equipment$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Institutional Funds</td>
<td>$223,539</td>
<td>$2,846,323</td>
<td></td>
</tr>
<tr>
<td>(b) Grants and Gifts$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Teaching Assistants</td>
<td>$761,349</td>
<td>$873,884</td>
<td></td>
</tr>
<tr>
<td>Part-time Assistance$ (other than teaching)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Faculty Salaries</td>
<td>$13,358,428</td>
<td>$14,623,228</td>
<td></td>
</tr>
</tbody>
</table>

Report Department Level and Program Level data for each program being evaluated. Updated tables are to be provided at the time of the visit.

1. Provide the statistics from the audited account for the fiscal year completed year prior to the current fiscal year.
2. This is your current fiscal year (when you will be preparing these statistics). Provide your preliminary estimate of annual expenditures, since your current fiscal year presumably is not over at this point.
3. Provide the budgeted amounts for your next fiscal year to cover the fall term when the ABET team will arrive on campus.
4. Categories of general operating expenses to be included here.
5. Institutionally sponsored, excluding special program grants.
6. Major equipment, excluding equipment primarily used for research. Note that the expenditures (a) and (b) under “Equipment” should total the expenditures for Equipment. If they don’t, please explain.
7. Including special (not part of institution’s annual appropriation) non-recurring equipment purchase programs.
8. Do not include graduate teaching and research assistant or permanent part-time personnel.
### Table D-4. Personnel and Students

#### Computer Engineering

Year¹: 2007-2008

<table>
<thead>
<tr>
<th>HEAD COUNT</th>
<th>FTE²</th>
<th>RATIO TO FACULTY³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FT</td>
<td>PT</td>
</tr>
<tr>
<td>Administrative⁴</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Faculty (tenure-track)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Other Faculty (excluding student Assistants)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Student Teaching Assistants</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Student Research Assistants</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Technicians/Specialists</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Office/Clerical Employees</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Others⁵ (Graduate Stipends)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Undergraduate Student enrollment⁶</td>
<td>592</td>
<td></td>
</tr>
<tr>
<td>Graduate Student enrollment</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

Report data for the program unit(s) and for each program being evaluated.

1. Data on this table should be for the fall term immediately preceding the visit. Updated tables for the fall term when the ABET team is visiting are to be prepared and presented to the team when they arrive.

2. For student teaching assistants, 1 FTE equals 20 hours per week of work (or service). For undergraduate and graduate students, 1 FTE equals 15 semester credit-hours (or 24 quarter credit-hours) per term of institutional course work, meaning all courses — science, humanities and social sciences, etc. For faculty members, 1 FTE equals what your institution defines as a full-time load.

3. Divide FTE in each category by total FTE Faculty. Do not include administrative FTE.

4. Persons holding joint administrative/faculty positions or other combined assignments should be allocated to each category according to the fraction of the appointment assigned to that category.

5. Specify any other category considered appropriate, or leave blank.

6. Specify whether this includes freshman and/or sophomores.
Table D-5. Program Enrollment and Degree Data

College of Engineering

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Enrollment Year</th>
<th>Total Undergrad</th>
<th>Total Grad</th>
<th>Degrees Conferred</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1st</td>
<td>2nd</td>
<td>3rd</td>
</tr>
<tr>
<td>CURRENT 2007–2008</td>
<td>FT</td>
<td>786</td>
<td>694</td>
<td>743</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>10</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>1 2006–2007</td>
<td>FT</td>
<td>718</td>
<td>728</td>
<td>716</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>15</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>2 2005–2006</td>
<td>FT</td>
<td>765</td>
<td>672</td>
<td>778</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>18</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>3 2004–2005</td>
<td>FT</td>
<td>720</td>
<td>759</td>
<td>759</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>20</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>4 2003–2004</td>
<td>FT</td>
<td>816</td>
<td>765</td>
<td>734</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>13</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>5 2002–2003</td>
<td>FT</td>
<td>767</td>
<td>753</td>
<td>692</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>27</td>
<td>15</td>
<td>7</td>
</tr>
</tbody>
</table>

Give official fall term enrollment figures (head count) for the current and preceding five academic years and undergraduate and graduate degrees conferred during each of those years. The "current" year means the academic year preceding the fall visit.

FT--full time
PT--part time
Table D-5. Program Enrollment and Degree Data

Computer Engineering

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Enrollment Year</th>
<th>Total Undergrad</th>
<th>Total Grad</th>
<th>Degrees Conferred</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st</td>
<td>2nd</td>
<td>3rd</td>
<td>4th</td>
</tr>
<tr>
<td>CURRENT 2007 – 2008</td>
<td>FT</td>
<td>103</td>
<td>105</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1 2006 – 2007</td>
<td>FT</td>
<td>114</td>
<td>87</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2 2005 – 2006</td>
<td>FT</td>
<td>95</td>
<td>84</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3 2004 – 2005</td>
<td>FT</td>
<td>91</td>
<td>98</td>
<td>112</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4 2003 – 2004</td>
<td>FT</td>
<td>105</td>
<td>111</td>
<td>129</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5 2002 – 2003</td>
<td>FT</td>
<td>116</td>
<td>119</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Give official fall term enrollment figures (head count) for the current and preceding five academic years and undergraduate and graduate degrees conferred during each of those years. The "current" year means the academic year preceding the fall visit.

FT--full time
PT--part time
Table D-6. Faculty Salary Data

College of Engineering

Academic Year 2007 – 2008

<table>
<thead>
<tr>
<th></th>
<th>Professor</th>
<th>Associate Professor</th>
<th>Assistant Professor</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number</strong></td>
<td>96</td>
<td>34</td>
<td>34</td>
<td>7</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>$180,644.40</td>
<td>$134,764.00</td>
<td>$109,784.10</td>
<td>$69,049.0</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>$103,271.80</td>
<td>$83,767.37</td>
<td>$72,448.72</td>
<td>$52,531.9</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>$73,188.00</td>
<td>$58,932.00</td>
<td>$52,188.00</td>
<td>$47,052.0</td>
</tr>
</tbody>
</table>

1 If the program considers this information to be confidential, it can be provided only to the Team Chair.

Computer Engineering

Academic Year 2007 – 2008

<table>
<thead>
<tr>
<th></th>
<th>Professor</th>
<th>Associate Professor</th>
<th>Assistant Professor</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number</strong></td>
<td>31</td>
<td>10</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>$180,644.40</td>
<td>$134,764.00</td>
<td>$99,402.00</td>
<td>$47,052.0</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>$109,040.90</td>
<td>$91,800.83</td>
<td>$74,898.34</td>
<td>$47,052.0</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>$73,188.00</td>
<td>$71,556.00</td>
<td>$63,456.00</td>
<td>$47,052.0</td>
</tr>
</tbody>
</table>

1 If the program considers this information to be confidential, it can be provided only to the Team Chair.
TABLE D-7(A). ORGANIZATION CHART OF THE UNIVERSITY OF PUERTO RICO MAYAGUEZ CAMPUS
TABLE D-7(B). ORGANIZATION CHART OF THE COLLEGE OF ENGINEERING

Dean of Engineering
Dr. Ramón Vásquez

Industrial Advisory Board

Associate Dean (Administrative)
Prof. Waldemar Ramírez

Associate Dean (Research)
Dr. José Colucci Rios

Associate Dean (Academic)
Vacant

SEED Office
Faculty ABET Coordinator
Dr. Mario Rivera

Chemical Engineering
Dr. David Suleiman

Civil Engineering and Surveying
Prof. Ismael Pagán Trinidad

Cooperative Education Program
Mrs. Ellen Acarón

Electrical and Computer Engineering
Dr. Isidoro Couvertier

Engineering Science and Materials
Dr. Walter Silva Araya

Industrial Engineering
Dr. Agustín Rullán

Mechanical Engineering
Dr. Paul Sundaram
TABLE D-7(C). ORGANIZATION CHART OF THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
TABLE D-8. LIBRARY ACQUISITIONS, RESOURCES, AND EXPENDITURES

A. ACQUISITIONS AND RESOURCES

<table>
<thead>
<tr>
<th>Books</th>
<th>Periodicals</th>
<th>Books</th>
<th>Periodicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire Institutional Library</td>
<td>3,095 v.</td>
<td>0</td>
<td>215,349 v.*</td>
</tr>
<tr>
<td>In the following fields (included above)</td>
<td>378 v.</td>
<td>0</td>
<td>26,801 v.***</td>
</tr>
<tr>
<td>Engineering</td>
<td>378 v.</td>
<td>0</td>
<td>26,801 v.***</td>
</tr>
<tr>
<td>Chemistry</td>
<td>90 v.</td>
<td>0</td>
<td>5,287 v. ***</td>
</tr>
<tr>
<td>Mathematics</td>
<td>96 v.</td>
<td>0</td>
<td>15,144 v. ***</td>
</tr>
<tr>
<td>Physics</td>
<td>92 v.</td>
<td>0</td>
<td>8,372 v. ***</td>
</tr>
<tr>
<td>Other Specialty Area (Specify)-(GEOLOGY)</td>
<td>48 v.</td>
<td>0</td>
<td>5,349 v. ***</td>
</tr>
<tr>
<td>All of the above specialty areas (last three years)</td>
<td>AV Material (videos, films, etc.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. LIBRARY EXPENDITURES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Library Current Funds</td>
<td>$5,734,889.00</td>
<td>$5,639,956.00</td>
</tr>
<tr>
<td>Expenditures for the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>2006</td>
<td>2007</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Engineering Unit (Total)</td>
<td>$20,000.00</td>
<td>$20,000.00</td>
</tr>
<tr>
<td>Books</td>
<td>$100,000.00</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Periodicals</td>
<td>$1,430,000.00</td>
<td>$1,460,000.00</td>
</tr>
<tr>
<td>Other Engineering-related Services</td>
<td>$14,450.00</td>
<td>$11,050.00</td>
</tr>
</tbody>
</table>

Note: Sub-categories should add to total for the engineering unit.

* Figures as of May 30, 2008
** Figures as of May 2008
*** Estimated
**** Includes chemistry, mathematics, physics and geology books; periodicals and audio-visual materials. Does not include expenditure in the acquisition of reference books.
Appendix E Surveys

This questionnaire is oriented to evaluate the Electrical Engineering and Computer Engineering programs of the University of Puerto Rico at Mayaguez. It takes approximately 15 minutes to complete it. Your input will help us to improve our program, and it will be tabulated to present the results to accreditation agencies such as ABET. We appreciate your participation.

<table>
<thead>
<tr>
<th>Importance to your Company</th>
<th>Satisfaction with our Graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of math and science</td>
<td>N/A</td>
</tr>
<tr>
<td>Knowledge of basic engineering fundamentals concepts</td>
<td>N/A</td>
</tr>
<tr>
<td>Basic engineering design skills</td>
<td>N/A</td>
</tr>
<tr>
<td>Knowledge of computer science fundamentals and concepts</td>
<td>N/A</td>
</tr>
<tr>
<td>In-depth knowledge and practical experience within his/her area of expertise</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Your experience with graduates of our program has been (mark all that apply)

For each statement, please make a mark in the “Importance to your Company” section, and another in the “Satisfaction with our Graduates” section. You might do only one mark in the N/A (it does not apply) in some of the statements.
<table>
<thead>
<tr>
<th>Importance to your Company</th>
<th>Satisfaction with our Graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential</td>
<td>Very</td>
</tr>
<tr>
<td>Knowledge of Social Sciences and Economics</td>
<td></td>
</tr>
<tr>
<td>Knowledge of Humanities</td>
<td></td>
</tr>
<tr>
<td>Ability to integrate knowledge and skills across discipline boundaries</td>
<td></td>
</tr>
<tr>
<td>Experience in laboratory work and system implementation</td>
<td></td>
</tr>
<tr>
<td>Effective professional and technical communication in <strong>English</strong> to audiences of varied sophistications, orally, in writing or with presentation aids</td>
<td></td>
</tr>
<tr>
<td>Effective professional and technical communication in <strong>Spanish</strong> to audiences of varied sophistications, orally, in writing or with presentation aids</td>
<td></td>
</tr>
<tr>
<td>Ability to organize information</td>
<td></td>
</tr>
<tr>
<td>Ability to work in teams and to interact with the social environment</td>
<td></td>
</tr>
<tr>
<td>Ability to lead effectively</td>
<td></td>
</tr>
<tr>
<td>Commitment to constantly upgrading fundamental knowledge and skills</td>
<td></td>
</tr>
<tr>
<td>Continuation of studies in graduate school</td>
<td></td>
</tr>
<tr>
<td>Ability to distinguish between ideas, opinions, beliefs, and facts</td>
<td></td>
</tr>
<tr>
<td>Ability to understand one's own cultural traditions in a broader context</td>
<td></td>
</tr>
<tr>
<td>Awareness of the ethical and societal aspects of the profession</td>
<td></td>
</tr>
<tr>
<td>Importance to your Company</td>
<td>Satisfaction with our Graduates</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td><strong>Obtain a broad educational experience necessary to understand the impact of electrical/computer engineering problems and solutions within a global and societal context</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ability to apply knowledge of math in the analysis and design of electrical circuits, linear systems, digital systems, computer networks and computer algorithms</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ability to apply knowledge of science in applied mechanics and design of electronic devices</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ability to develop a hypothesis, identify the relevant variables and their dependencies, and establish a sound experimental procedure that will test the hypothesis</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ability to set up and safely perform engineering laboratory test procedures</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ability to analyze, interpret and draw conclusions based on experimental data from experiments within his/her area of expertise</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ability to follow logical and orderly design procedures, choosing the best solution for a given set of criteria and considering design constraints and tradeoffs</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ability to articulate teamwork principles (group dynamics)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Be comfortable breaking up a complex problem into separate tasks, delegating tasks to other team members, and integrating the composite effort of the group into a final solution</strong></td>
<td></td>
</tr>
<tr>
<td>Importance to your Company</td>
<td>Satisfaction with our Graduates</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Ability to communicate effectively with other team members</td>
<td></td>
</tr>
<tr>
<td>Ability to understand problem specifications, physical, and ethical constraints</td>
<td></td>
</tr>
<tr>
<td>Model physical phenomena from the real world using abstraction</td>
<td></td>
</tr>
<tr>
<td>Design with approximations without violating design constraints</td>
<td></td>
</tr>
<tr>
<td>Simplify a design model without violating design constraints</td>
<td></td>
</tr>
<tr>
<td>Ability to effectively describe a problem in a way that can lead to the construction of the solution</td>
<td></td>
</tr>
<tr>
<td>Be capable of defining a possible solution</td>
<td></td>
</tr>
<tr>
<td>Ability to determine the reasonableness of a solution within the physical and ethical context of the problem</td>
<td></td>
</tr>
<tr>
<td>Understand the proper use of the work of other and issues such as plagiarism, copyrights and patents</td>
<td></td>
</tr>
<tr>
<td>Identify the ethical issues faced in the solution of an engineering problem</td>
<td></td>
</tr>
<tr>
<td>Identify the applicability of the professional associations' code of ethics</td>
<td></td>
</tr>
<tr>
<td>Exposure to socio-humanistic areas of study</td>
<td></td>
</tr>
<tr>
<td>Ability to use circuit simulation tools</td>
<td></td>
</tr>
<tr>
<td>Ability to use block diagram drawing tools</td>
<td></td>
</tr>
<tr>
<td>Ability to use software development environments</td>
<td></td>
</tr>
<tr>
<td>Ability to develop a prototype within the area of expertise of the graduate.</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Options</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Which graduates from our programs you usually hire?</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Cross all that applies.</td>
<td>Yes</td>
</tr>
<tr>
<td>Would you recommend hiring a graduate from our programs?</td>
<td>Yes</td>
</tr>
<tr>
<td>Are you a graduate from University of Puerto Rico, Mayagüez?</td>
<td>Yes</td>
</tr>
<tr>
<td>In which type of activities were you or your team/area involved when</td>
<td>Planning</td>
</tr>
<tr>
<td>interacting with graduates of our programs?</td>
<td>Software</td>
</tr>
<tr>
<td>In which type of products were you or your team/area involved when</td>
<td>Software</td>
</tr>
<tr>
<td>interacting with graduates of our programs?</td>
<td>Other</td>
</tr>
<tr>
<td>Are there any objectives you would like to add or modify?</td>
<td>Please specify in the space below.</td>
</tr>
<tr>
<td>Are there any learning outcomes you would like to add or modify?</td>
<td>Please specify in the space below.</td>
</tr>
</tbody>
</table>
Could you offer some recommendations on how the program can better serve your needs as an employer?

With how many graduates from our program have you interacted in the last three years?

Please send this survey to the following address:

Department of Electrical and Computer Engineering
University of Puerto Rico - Mayagüez Campus
P.O. Box 9042
Mayagüez, PR 00681-9042
Alumni Survey

The information collected in this survey is confidential. The identity of the respondent cannot be associated with the answers. Although the survey is managed by an external company, the collected information will be used entirely and exclusively for accreditation purposes of the undergraduate programs of the Department of Electrical and Computer Engineering at the University of Puerto Rico. Neither the University of Puerto Rico nor the company handling the survey will sell or disclose the collected information to a third party. Tabulated results, however, may be published in the World Wide Web, presentations or journals. By participating in this survey, you agree to permit the University of Puerto Rico to tabulate your answers for the purposes described heretofore.

Electrical/Computer Engineering Alumni Survey

Instructions:
As part of the ABET Accreditation Criteria, each engineering program for which an institution seeks accreditation or reaccreditation must have in place detailed published educational objectives that are consistent with the mission of the institution. Each program must demonstrate its effectiveness in helping its students attain specified educational objectives. In addition, the institution must have a process based on the needs of the program’s various constituencies in which the objectives are determined and periodically evaluated. Since you graduated from one of our programs, we value your opinion and recommendations on various issues regarding the accreditation renewal process.

Student Profile

The following questions will let us understand the profile of our alumni and seniors.

1. Did you graduate in the last three years?
   ☐ Yes ______
   ☐ No ______

2. Degree completed in RUM: (Mark all that applies)
   ☐ BSEE (INEL)
   ☐ BSCompE (ICOM)
   ☐ MSEE
   ☐ MSCompE

3. Gender
   ☐ Male
   ☐ Female

Fundamentals of Engineering Examination

4. Fundamentals of Engineering Examination
   ☐ Took the FE exam
   ☐ Plan to take the FE in the near future
   ☐ Don’t plan to take the FE in the foreseeable future.

Professional Life

5. Which of these items are applicable to you? (Check all that apply)
   ☐ Currently Member of IEEE
   ☐ Currently member of other professional associations (SWE, NSHE, etc)
   ☐ Currently licensed engineer.
   ☐ Active in any government agency related to your profession.
   ☐ Currently working as engineer educator.
   ☐ Entrepreneur
   ☐ Professional engineer consultant
   ☐ Not interested in any of these activities
Life after College: Employment and Graduate Studies

The following questions will let us understand how well your studies relate to your employment. Please select the statement that best describes your situation.

6. Your primary area of concentration in college was:
   - Applied Electromagnetics
   - Communications and Digital Signal Processing
   - Control and Robotics
   - Computing Systems
   - Digital Signal Processing
   - Power
   - Hardware & Embedded Systems

7. Your current employment or advanced studies are in:
   - Applied Electromagnetics
   - Electronics
   - Communications and Digital Signal Processing
   - Power
   - Control and Robotics
   - Hardware & Embedded Systems
   - Computing Systems
   - Digital Signal Processing
   - Other: ________________

8. You are currently living in:
   - USA
   - Puerto Rico
   - Elsewhere

9. You are currently:
   - Working full time (*w)
   - Studying full time (*)
   - Working full time and studying part time. (**)
   - Working and studying part time. (**)
   - None of the above (ojo)

If you are studying

10. Which graduate degree are you pursuing?:
    - MS or PhD in Electrical or Computer Engineering
    - MS or PhD in another engineering field.
    - MS or PhD in a non-engineering field.

11. Which one applies to you.
    - Obtaining and advanced degree is a condition of employment.
    - Employer is paying tuition and/or giving you release time for your studies.
    - I am paying for my studies.

12. After completing your advanced degree your main goal is to:
    - Work in Academia (University teaching/research)
    - Work in industry or corporate research.
    - Expect to be promoted to another position within the same company.
    - No concrete plans

If you are working full-time

13. Your employer is:
    - State or Municipal Government Agency
    - Federal Government Agency
    - For Profit Corporation
    - Non-Profit Corporation
    - I will be self-employed
14. You would classify your current job as:
   - □ Engineering design
   - □ Engineering sales and services
   - □ Manufacturing
   - □ Consulting
   - □ Management/supervisory
   - □ Other

15. What is the salary range?
   - □ Below $30,000
   - □ $30,000 - $34,999
   - □ $35,000 - $39,999
   - □ $40,000 - $44,999
   - □ $45,000 - $49,999
   - □ $50,000 - $54,999
   - □ $55,000 - $59,999
   - □ $60,000 - $64,999
   - □ $65,000 - $70,000
   - □ over $70,000

16. (ojo) If at this time you do not have a firm job offer and you are not studying please indicate the reason:
   - □ I didn’t seek for a job.
   - □ I had several interviews, but I did not receive any offers
   - □ I had several job offers but none satisfying my expectations
   - □ I couldn’t get a job interview
   - □ I am working in a family business
   - □ Other

ECE Program Educational Objectives

We have prepared a statement of the program educational objectives and learning outcomes that, in our view, adequately describes the program that you have followed while at the University of Puerto Rico at Mayagüez. Now we need to know your opinion and recommendations. Please rate how well the program prepared you according to your current needs.

<table>
<thead>
<tr>
<th>Preparation</th>
<th>17. To become a competent electrical/computer engineer.</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 5. Highly satisfied without reservations.</td>
<td>□ 5. Highly satisfied without reservations.</td>
</tr>
<tr>
<td>□ 2. Somewhat satisfied</td>
<td>□ 2. Somewhat satisfied</td>
</tr>
<tr>
<td>□ 1. Unsatisfied</td>
<td>□ 1. Unsatisfied</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>18. To consider ethical issues in your practice.</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 5. Highly satisfied without reservations.</td>
<td>□ 5. Highly satisfied without reservations.</td>
</tr>
<tr>
<td>□ 2. Somewhat satisfied</td>
<td>□ 2. Somewhat satisfied</td>
</tr>
<tr>
<td>□ 1. Unsatisfied</td>
<td>□ 1. Unsatisfied</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>19. To assess the social impact of your proposed solutions to engineering problems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 5. Highly satisfied without reservations.</td>
<td>□ 5. Highly satisfied without reservations.</td>
</tr>
<tr>
<td>□ 2. Somewhat satisfied</td>
<td>□ 2. Somewhat satisfied</td>
</tr>
<tr>
<td>□ 1. Unsatisfied</td>
<td>□ 1. Unsatisfied</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>20. To contribute with your knowledge to the technological and economical development of the</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 5. Highly satisfied without reservations.</td>
<td>□ 5. Highly satisfied without reservations.</td>
</tr>
<tr>
<td>□ 2. Somewhat satisfied</td>
<td>□ 2. Somewhat satisfied</td>
</tr>
<tr>
<td>□ 1. Unsatisfied</td>
<td>□ 1. Unsatisfied</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>society.</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>1.</td>
<td>Unsatisfied</td>
</tr>
<tr>
<td>21.</td>
<td>To contribute with your knowledge to educational development of the society (for example, schools).</td>
</tr>
<tr>
<td>5.</td>
<td>Highly satisfied without reservations.</td>
</tr>
<tr>
<td>4.</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>1.</td>
<td>Unsatisfied</td>
</tr>
<tr>
<td>22.</td>
<td>To contribute to technical training of engineering and non-engineering personnel.</td>
</tr>
<tr>
<td>5.</td>
<td>Highly satisfied without reservations.</td>
</tr>
<tr>
<td>4.</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>1.</td>
<td>Unsatisfied</td>
</tr>
<tr>
<td>23.</td>
<td>To create procedures or assembly manuals and technical documentation of engineering designs both in English and Spanish.</td>
</tr>
<tr>
<td>5.</td>
<td>Highly satisfied without reservations.</td>
</tr>
<tr>
<td>4.</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>1.</td>
<td>Unsatisfied</td>
</tr>
<tr>
<td>24.</td>
<td>To give oral presentations of new products or designs to technical and non-technical audiences both in English and Spanish.</td>
</tr>
<tr>
<td>5.</td>
<td>Highly satisfied without reservations.</td>
</tr>
<tr>
<td>4.</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>1.</td>
<td>Unsatisfied</td>
</tr>
<tr>
<td>25.</td>
<td>To pursue graduate studies.</td>
</tr>
<tr>
<td>5.</td>
<td>Highly satisfied without reservations.</td>
</tr>
<tr>
<td>4.</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>1.</td>
<td>Unsatisfied</td>
</tr>
<tr>
<td>26.</td>
<td>To pursue professional advancement.</td>
</tr>
<tr>
<td>5.</td>
<td>Highly satisfied without reservations.</td>
</tr>
<tr>
<td>4.</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>1.</td>
<td>Unsatisfied</td>
</tr>
<tr>
<td>27.</td>
<td>To be successful in your career.</td>
</tr>
<tr>
<td>5.</td>
<td>Highly satisfied without reservations.</td>
</tr>
<tr>
<td>4.</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>1.</td>
<td>Unsatisfied</td>
</tr>
<tr>
<td>28.</td>
<td>To participate in meetings and professional conferences.</td>
</tr>
<tr>
<td>5.</td>
<td>Highly satisfied without reservations.</td>
</tr>
<tr>
<td>4.</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>1.</td>
<td>Unsatisfied</td>
</tr>
<tr>
<td>29.</td>
<td>To become a licensed engineer.</td>
</tr>
<tr>
<td>5.</td>
<td>Highly satisfied without reservations.</td>
</tr>
<tr>
<td>4.</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>1.</td>
<td>Unsatisfied</td>
</tr>
<tr>
<td>30.</td>
<td>To seek technical and professional information.</td>
</tr>
<tr>
<td>5.</td>
<td>Highly satisfied without reservations.</td>
</tr>
<tr>
<td>4.</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>2.</td>
<td>Somewhat satisfied</td>
</tr>
</tbody>
</table>
## Appendix 3.98

<table>
<thead>
<tr>
<th>Importance</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Unsatisfied</td>
<td>31. To pursue continuous education.</td>
</tr>
<tr>
<td>2. Somewhat satisfied</td>
<td>32. Become educated citizens who, as electrical/computer engineers, contribute by applying, ethically, their specialized knowledge to the educational, cultural, social, technological and economic development of their societies.</td>
</tr>
<tr>
<td>3. Satisfied</td>
<td>33. Demonstrate a combination of analytical, computational, and experimental knowledge and skills to make them competitive within the electrical/computer engineering practice.</td>
</tr>
<tr>
<td>4. Very satisfied</td>
<td>34. Demonstrate communication skills in Spanish and English that enable them to effectively participate and contribute in both linguistic environments.</td>
</tr>
<tr>
<td>5. Highly satisfied without reservations.</td>
<td>35. Value the importance of lifelong learning as demonstrated by pursuing graduate studies, being involved in professional societies, or pursuing professional advancement and success.</td>
</tr>
</tbody>
</table>

Below you find the statement of the current educational objectives of our undergraduate programs. Please rate the importance of each one

<table>
<thead>
<tr>
<th>Importance</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Unsatisfied</td>
<td>31. To pursue continuous education.</td>
</tr>
<tr>
<td>2. Somewhat satisfied</td>
<td>32. Become educated citizens who, as electrical/computer engineers, contribute by applying, ethically, their specialized knowledge to the educational, cultural, social, technological and economic development of their societies.</td>
</tr>
<tr>
<td>3. Satisfied</td>
<td>33. Demonstrate a combination of analytical, computational, and experimental knowledge and skills to make them competitive within the electrical/computer engineering practice.</td>
</tr>
<tr>
<td>4. Very satisfied</td>
<td>34. Demonstrate communication skills in Spanish and English that enable them to effectively participate and contribute in both linguistic environments.</td>
</tr>
<tr>
<td>5. Essential</td>
<td>35. Value the importance of lifelong learning as demonstrated by pursuing graduate studies, being involved in professional societies, or pursuing professional advancement and success.</td>
</tr>
</tbody>
</table>
Senior Survey

The information collected in this survey is confidential. The identity of the respondent cannot be associated with the answers. Although the survey is managed by an external company, the collected information will be used entirely and exclusively for statistical purposes of the accreditation of the undergraduate programs of the Department of Electrical and Computer Engineering at the University of Puerto Rico. Neither the University of Puerto Rico nor the company handling the survey will sell or disclose the collected information to a third party. Tabulated results, however, may be published in the World Wide Web, presentations or journals. By participating in this survey, you agree to permit the University of Puerto Rico to tabulate your answers for the purposes described heretofore.

Electrical/Computer Engineering Senior Survey

Instructions:
As part of the ABET Accreditation Criteria, each engineering program for which an institution seeks accreditation or reaccreditation must have in place detailed published educational objectives that are consistent with the mission of the institution. Each program must have a process based on the needs of the program’s various constituencies in which the objectives are determined and periodically evaluated. Since you are near the completion of the program requirements, we value your opinion and participation on this survey.

<table>
<thead>
<tr>
<th>Student Profile</th>
<th>Your answer to the following questions will let us understand the profile of our graduating students.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Expected date of Graduation: □ Summer Year ______ □ May year ______ □ December year ______</td>
<td>2. Degree to be completed: □ BSEE (INEL) □ BSCompE (ICOM)</td>
</tr>
<tr>
<td>3. Gender</td>
<td>□ Male □ Female</td>
</tr>
</tbody>
</table>

Coop and Undergraduate Research

4. If you participate in Coop, Internship, IAP or REU, did those experiences help you to obtain a job offer or admission to graduate studies?
   □ Yes, it made a strong difference. □ It helped but not decisively. □ No. □ Don’t know.

Student Life

5. Which of these items is applicable to you currently or in the past? (Check all that apply)
   □ Student Member of IEEE
   □ Member of other professional associations (SWE, NSHE, etc)
   □ Member of the Student Government (Consejo de estudiantes).
   □ Active in intramural sports (athletic teams).
   □ Active in on-campus arts/music performing groups.
   □ Active in ROTC, AFROTC.
   □ Active in other student associations.
   □ Active in community/church associations outside campus.
   □ not interested in any of these activities
Fundamentals of Engineering Examination

| 6. Fundamentals of Engineering Examination | ☐ Took the FE exam this semester  
☐ Plan to take it next semester (while in school)  
☐ Plan to take the FE exam after graduation  
☐ Don’t plan to take it in the foreseeable future. |

Life after College: Employment and Graduate Studies

The following questions will let us understand how well your studies relate to immediate plans. Please select the statement that best describes your situation.

| 7. Your primary area of concentration is | ☐ Applied Electromagnetics  
☐ Communications and Digital Signal Processing  
☐ Control and Robotics  
☐ Hardware & Embedded Systems  
☐ Computing System  
☐ Digital Signal Processing  
☐ Electronics  
☐ Power  
☐ Other |

| 8. After graduation, are you planning to: | ☐ Stay in Puerto Rico  
☐ Move to USA  
☐ Move elsewhere |

| 9. After graduating, my near term plans are to: | ☐ Work full time (*w)  
☐ Study full time (*)  
☐ Work full time and study part time. (**)  
☐ Work and study part time. (**)  
☐ No concrete plans at this time (ojo) |

If you plan to continue studying in the near future (within the first year after graduation)

| (*)(**) 10. What is your admission status for graduate education? | ☐ Offered admission, accepted  
☐ Applied to program, awaiting acceptance  
☐ Have not yet applied |

| (*) (**) 11. You will be seeking a: | ☐ MS or PhD. in your field  
☐ MS or PhD in another engineering field.  
☐ MS or PhD in a non-engineering field.  
☐ Other |

| 12. (*) (**) Mark the best situation that applies to you: | ☐ Employer will pay tuition and allows release time for studying  
☐ Employer will pay tuition but you need to work full load  
☐ Study on your own. |

| (*) (**)13. After completing your advanced degree, your main goal is to: | ☐ Work in Academia (University teaching/research)  
☐ Work in industry or corporate research.  
☐ Expect to be promoted to another position within the same company  
☐ No concrete plans |

| (**14. Is obtaining an advanced degree is a condition of employment? | ☐ Yes or ☐ No |

If you plan to work full-time in the near term (within the first year after graduation)

| 15. (*w) (**) If you have accepted an employment offer, what is the salary range? | ☐ below $35,000  
☐ $35,000 - $39,999  
☐ $40,000 - $49,999 |
### (*w) (**16. Your future employer is:

- $50,000 - $59,999
- $60,000 – 69,999
- Over $70,000

- State or Municipal Government Agency
- Federal Government Agency
- For Profit Corporation
- Non-Profit Corporation
- You will be self-employed

### (*w) (**17. Your future job could be classified as

- Engineering design
- Manufacturing
- Consulting
- Management/supervisory
- Engineering sales and services
- Other

### 18. If at this time you do not have a firm job offer and do not plan to study after graduation please indicate the reason: that best fits your situation.

- You didn’t seek for a job nor apply to graduate school.
- You had several interviews, but did not receive offers.
- You couldn’t get a job interview.
- You will work in a family business.
- Other

### Program Educational Objectives

We have prepared a statement of the program educational objectives that, in our view, adequately describes the program that you have followed while at the University of Puerto Rico at Mayagüez. Now we need to know your opinion and recommendations. Please rate how well the program prepared you according to your current needs.

<table>
<thead>
<tr>
<th>Program Educational Objectives</th>
<th>Preparation</th>
</tr>
</thead>
</table>
| 19. To become a competent electrical/computer engineer. | 5. Highly satisfied without reservations  
4. Very satisfied  
3. Satisfied  
2. Somewhat satisfied  
1. Unsatisfied |
| 20. To consider ethical issues in your practice.       | 5. Highly satisfied without reservations  
4. Very satisfied  
3. Satisfied  
2. Somewhat satisfied  
1. Unsatisfied |
| 21. To assess the social impact of your proposed solutions to engineering problems. | 5. Highly satisfied without reservations  
4. Very satisfied  
3. Satisfied  
2. Somewhat satisfied  
1. Unsatisfied |
| 22. To contribute with your knowledge to the technological and economical development of the society. | 5. Highly satisfied without reservations  
4. Very satisfied  
3. Satisfied  
2. Somewhat satisfied  
1. Unsatisfied |
| 23. To contribute with your knowledge to educational development of society (for example, schools). | 5. Highly satisfied without reservations  
4. Very satisfied |
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>25. To create procedures or assembly manuals and technical documentation of engineering designs both in English and Spanish.</td>
<td>5. Highly satisfied without reservations</td>
<td>4. Very satisfied</td>
<td>3. Satisfied.</td>
</tr>
</tbody>
</table>
### Objective 1

<table>
<thead>
<tr>
<th>Importance</th>
<th>5. Essential</th>
<th>4. Very important</th>
<th>3. Moderate importance</th>
<th>2. Somewhat important</th>
<th>1. Little importance</th>
</tr>
</thead>
</table>

34. Become educated citizens who, as electrical/computer engineers, contribute by applying, ethically, their specialized knowledge to the educational, cultural, social, technological and economic development of their societies.

### Objective 2

<table>
<thead>
<tr>
<th>Importance</th>
<th>5. Essential</th>
<th>4. Very important</th>
<th>3. Moderate importance</th>
<th>2. Somewhat important</th>
<th>1. Little importance</th>
</tr>
</thead>
</table>

35. Demonstrate a combination of analytical, computational, and experimental knowledge and skills to make them competitive within the electrical/computer engineering practice.

### Objective 3

<table>
<thead>
<tr>
<th>Importance</th>
<th>5. Essential</th>
<th>4. Very important</th>
<th>3. Moderate importance</th>
<th>2. Somewhat important</th>
<th>1. Little importance</th>
</tr>
</thead>
</table>

36. Demonstrate communication skills in Spanish and English that enable them to effectively participate and contribute in both linguistic environments.

### Objective 4

<table>
<thead>
<tr>
<th>Importance</th>
<th>5. Essential</th>
<th>4. Very important</th>
<th>3. Moderate importance</th>
<th>2. Somewhat important</th>
<th>1. Little importance</th>
</tr>
</thead>
</table>

37. Value the importance of lifelong learning as demonstrated by pursuing graduate studies, being involved in professional societies, or pursuing professional advancement and success.

Please let us know your permanent email address: _______________________________________

Thank you
Appendix F Endorsement letter

To whom it may concern:

Hewlett Packard has been an active recruiter from the “Recinto Universitario de Mayagüez” (RUM) for over 20 years. We find that RUM graduates are very effective employees, with the skill-set required for the variety of jobs performed in our company. This includes R&D, and manufacturing; as well as having the required knowledge for successful transition to other business areas of our company, including finance and supply chain as examples.

In addition, during the last two years, RUM has engaged in a partnership with HP for internship of senior or graduate students where selected students are granted provided at our Palo Alto Research facilities, and eventually transferring to our facility for internship completion. In this case, the students not only have the opportunity to combine senior work and learn competencies in areas of current/future interest of our company, but in addition they effectively serve as technology transfer agents into our R&D groups for product roadmap planning/development.

We find that the quality of the students is not only reflected in the “hard-skills” they bring to the company, but also in the following “soft-skills” of importance to us: good English communication skills, good presentation skills (most can prepare a presentation and stand up in front of an audience and deliver it with confidence), and good levels of resourcefulness (can search proper / current information from the web or other and act upon it).

Former RUM students working at HP have received a variety of recognitions locally and internationally such as: intellectual property generation for our company (patents, trade secrets, etc), have been guest speakers at international forums on several subjects, and have received “distinguished” awards from various professional organizations. Overall, we are very satisfied with RUM education.

Truly yours,

[Signature]

Luis A. López Martínez
Engineering Manager
Hewlett Packard
Puerto Rico Manufacturing Operations
21 March, 2008

Dr. Raúl E. Torres  
Department of Electrical & Computer Engineering,  
University of Puerto Rico at Mayagüez  
PO Box 9042 College Station  
Mayagüez, PR 00681-9042

Dear Dr. Torres:

As a long-standing member of the Industry Advisory Board for UPRM, I wanted to extend our deep appreciation to you and the ECE department for your consistently high caliber of students and curriculum. Raytheon Company is very proud to be associated with the ECE Department, as well as with the entire College of Engineering at UPRM. Having visited and recruited from UPRM for the past 10 years, I have always found the ECE students to be well prepared for industry and business upon graduation. Additionally, the outstanding curriculum prepares them very well for internship and Co-op opportunities with our company as well. The depth and caliber of the ECE curriculum has had a significant, positive impact on the ECE students we have met at UPRM.

It is clear that the ECE Department is achieving its educational objectives and goals for student and faculty performance. I have found that the ECE students are competitive with ECE practices in our industry, and that they thrive in an engineering environment. Additionally, the bilingual environment at UPRM contributes greatly to our diversity recruiting efforts. This diversity also contributes to our industry as well, so the impact of hiring UPRM students and graduates is truly far-reaching. As you know, UPRM is a Strategic School for Raytheon and the ECE students & graduates are an integral part of our focus at UPRM. I am sure that the positive relationships we enjoy with the School of Engineering, and especially within the ECE Department, will continue to flourish. Your program objectives, outcomes, and methods are to be commended.

Your ABET-approved curriculum is a powerful statement of the high-caliber of your ECE Department, and it contributes significantly to our company and to our industry. Please pass on my deepest respect and appreciation to your ECE faculty and administration there, and especially to the wonderful students I met during my recent visit to campus. As always, I enjoyed visiting with Dr. Isidoro Concepción so please give him my warmest regards. I look forward to seeing you, Elizabeth Rivero, and all the ECE Department again on my next visit. Best wishes!

Sincerely,

[Signature]

Sylvester R. Foley III  
University Programs Manager,  
Eastern Region  
Raytheon  
50 Apple Hill Drive (MS: T2SM1)  
Tewksbury, MA 01876