

Graduate Option in Electronics
Department of Electrical and Computer Engineering
University of Puerto Rico at Mayagüez

Introduction

This document defines the Electronics Option in the Electrical Engineering Graduate Program at UPRM. The purpose of the document is to provide a description of the option and its associated research and to guide the graduate students in the preparation of their programs of study.

Description of the Area and Research Facilities

The Electronics Area of the ECE Department encompasses course offerings along with fundamental and applied research that embrace contemporary topics such as solid state electronics, analog, digital, and mixed-signal circuit design. Modern laboratories and computer equipment are available to support both teaching and research activities in these areas, preparing the graduate students for design and development activities at either the academic or industrial level. The research interests of the ECE Department electronics faculty fall into diverse areas, many of them corresponding to interdisciplinary categories. Examples of this diversity include electronic design automation, embedded systems, low-voltage/low-power IC design, programmable ICs, rapid systems prototyping, and advanced computer architectures, among others

Research infrastructure for the Electronics Area includes three main laboratories:

- **Integrated Circuit Design Laboratory (ICDL)**
ICDL supports senior and graduate level activities in the design and testing of analog, digital, and mixed-signal integrated circuits and systems. It provides industry-grade software tools, such as CADENCE, for the design entry and validation of integrated circuits in bipolar and MOS technologies.
- **Rapid Systems Prototyping Laboratory (RASP)**
The RASP Laboratory supports graduate level activities in the field of rapid prototyping digital and mixed-signal electronic systems.
- **Electronic Testing and Characterization Laboratory (ETC)**
The ETC Laboratory supports graduate level activities associated with the integration of hardware setups and software algorithms to automate the tasks of testing and characterizing electronic devices and circuits.

Academic Background

Students entering the program must have the following background:

- | | |
|---------------------------------------------|-----------------------|
| • Microprocessors | INEL 4206 |
| • Combinational and Sequential Logic Design | INEL 4205 |
| • Electronics I & II | INEL 4201 & INEL 4202 |
| • Programming Languages | INGE 3016 |

- Differential Equations
- Probability and Statistics

MATE 4009
ININ 4010

Applicants without the proper preparation in any of these areas will be recommended by the Department’s Graduate Committee to take appropriate remedial courses.

Academic Requirements:

The academic requirements of the Electronics Option in the Electrical Engineering Graduate Program can be categorized:

- Technical Interest Area Courses – *represent the major research thrusts in Electronics (refer to next page); every student must approve at least 2 courses in a single interest area*
- Technical Elective Courses – *any technical interest area course outside of the technical interest area selected by the student*
- Elective Courses – *any course outside the technical interest area courses*
- Advanced Math Courses - *includes all 5000 level math courses and above*
- Doctoral Course - *INEL 8295 “Advanced Topics in Electronics”*
- Doctoral Seminar – *INEL 8998, student must register every semester*
- Thesis or Project

Table 1. summarizes the degree requirements for the different graduate programs.

Table 1. Degree Requirements for the Electronics Option

Degree	Ph.D.	Master of Science	Master of Engineering	
			Plan I	Plan II
Course Type	Total Credits	Total Credits	Total Credits	Total Credits
Technical Interest Area	9	9	9	12
Technical Electives	9	9	9-12	15-18
Electives	6	6	6	6-9
Advanced math courses	6	0	0	0
Doctoral course	6	0	0	0
Doctoral seminar	1	0	0	0
Thesis or project	12	6	3-6	0
Total	49	30	30	36

* Students seeking a M.E. Plan II must pass an oral examination on their project.

** Students seeking a Ph.D pass the Qualifying Exam and the Comprehensive Exam, and successfully defend their dissertation.

*** All graduate students are allowed to take up to nine (9) credits in 5000 level courses.

Technical Interest Area Courses:

The Electronics Option in the Electrical Engineering Graduate Program is organized into 3 technical interest groups.

1. Computer and Embedded Systems

- INEL 6009 – Computer System Architecture
- INEL 6048 – Advanced Microprocessor Interfacing
- INEL 6506 – Network Performance Analysis
- INEL 6050 – Advanced Digital Signal Processing Algorithms
- ICOM 5026 – Computer Networks

2. Electronic Design and Applications

- INEL 60XX – Analog Integrated Circuit Design
- INEL 6615 – Active Microwave Circuits
- INEL 5265 – Analog Integrated Circuit Design
- INEL 5205 – Instrumentation
- INEL 5207 – Design with Op-Amps and Analog ICs

3. VLSI Systems and Digital Design

- INEL 6079 – Advanced IC Design Techniques
- INEL 6080 – VLSI Systems Design
- INEL 5206 – Digital System Design

Course Schedule*:

Table 2. Preliminary Course Offering years 2016 - 2020

Course	S-16	F-16	S-17	F-17	S-18	F-18	S-19	F-19	S-10	F-10
INEL 5265		X		X		X		X		X
INEL 5205		X		X		X		X		X
INEL 5206		X		X		X		X		X
INEL 5207	X		X		X		X		X	
INEL 52xx	X		X		X		X		X	
INEL 5209										
INEL 6009	X		X		X		X		X	
INEL 6085		X		X		X		X		X
INEL 6080			X			X			X	
INEL 6079	X			X			X			X
INEL 60xx		X			X			X		
INEL 6048	X			X			X			X
INEL 8295		X			X			X		

*The projected course offering is not guaranteed; it will depend on the availability of the resources. Please verify with the area coordinator for up to date information.

Course Sequence Samples:

All graduate students must submit a program of study before registering for a second semester. Also, note that students **must** present their dissertation, thesis or project proposal before registering on Doctoral Dissertation, Master Thesis or Master Project for a third time.

Students entering the doctoral program with a B.S. degree must take the qualifying exam by the end of their second year; those entering the program with a M.S. degree must take the qualifying exam by the end of their first year

Sample course sequences for M.S. and Ph. D. students admitted with a B.S. in Electrical Engineering are shown below for illustration purposes. Please note that the student program of study is flexible and is designed taking into account the student interests, the project or research requirements and the guidance from the student graduate advisor.

Table 3. M.S. Course Sequence

First Semester		
Course		Credits
INEL 6XXX	Technical Interest Area Course	3
INEL 6XXX	Technical Elective Course	3
INEL 5XXX	Elective Course	3
	Total	9
Second Semester		
INEL 6XXX	Technical Interest Area Course	3
INEL 5XXX	Elective Course	3
INEL 6046	Master's Thesis	3
	Total	9
Third Semester		
INEL 6XXX	Technical Interest Area Course	3
INEL 5XXX	Technical Elective Course	3
INEL 6046	Master's Thesis	3
	Total	9
Fourth Semester		
INEL 6XXX	Technical Elective Course	3
INEL 6046	Master's Thesis	0
	Total	3

Table 4. Ph.D. Course Sequence

First Semester		
Course		Credits
INEL 6XXX	Technical Interest Area Course	3
INEL 6XXX	Technical Elective Course	3
INEL 5XXX	Elective Course	3
INEL 8998	Doctoral Seminar	0
	Total	9
Second Semester		
INEL 6XXX	Technical Interest Area Course	3
INEL 6XXX	Technical Elective Course	3
MATE 5XXX	Elective in Advanced Math	3
INEL 8998	Doctoral Seminar	0
	Total	9
Third Semester		
INEL 8295	Advanced Topics in Electronics	3
INEL 6XXX	Technical Interest Area Course	3
INEL 5XXX	Elective Course	3
INEL 8998	Doctoral Seminar	0
	Total	9
Fourth Semester		
INEL 8295	Advanced Topics in Electronics	3
INEL 6XXX	Technical Elective Course	3
MATE 5XXX	Elective in Advanced Math	3
INEL 8998	Doctoral Seminar	0
	Total	9
<i>Qualifying Exam</i>		
Fifth Semester		
INEL 8999	Doctoral Dissertation	3
INEL 8998	Doctoral Seminar	0
	Total	3
Sixth Semester		
INEL 8999	Doctoral Dissertation	3
INEL 8998	Doctoral Seminar	0
	Total	3
<i>Comprehensive Exam</i>		
Seventh Semester		
INEL 8999	Doctoral Dissertation	3
INEL 8998	Doctoral Seminar	0
	Total	3
Eighth Semester		
INEL 8999	Doctoral Dissertation	3
INEL 8998	Doctoral Seminar	1
	Total	4

Table 4. Ph.D. Course Sequence (after M.S.)

First Semester		
Course		Credits
INEL 8295	Advanced Topics in Electronics	3
MATE 5XXX	Elective in Advanced Math	3
INEL XXXX	Technical Elective Course	3
INEL 8998	Doctoral Seminar	0
	Total	9
Second Semester		
INEL 8295	Advanced Topics in Electronics	3
MATE 5XXX	Elective in Advanced Math	3
INEL XXXX	Technical Elective Course	3
INEL 8998	Doctoral Seminar	0
	Total	9
<i>Qualifying Exam</i>		
Third Semester		
INEL 8999	Doctoral Dissertation	3
INEL 8998	Doctoral Seminar	0
	Total	3
Fourth Semester		
INEL 8999	Doctoral Dissertation	3
INEL 8998	Doctoral Seminar	0
	Total	3
<i>Comprehensive Exam</i>		
Fifth Semester		
INEL 8999	Doctoral Dissertation	3
INEL 8998	Doctoral Seminar	0
	Total	3
Sixth Semester		
INEL 8999	Doctoral Dissertation	3
INEL 8998	Doctoral Seminar	1
	Total	4

Faculty

The list below includes the names, contact information, and research interest of the professors associated with the Electronics Option on the ECE Department.

Dr. Omayra Ducoudray, Associate Professor

Office: S-611
Phone: (787)832-4040 Ext. 2432
Email: ducoudray@ece.uprm.edu
Home Page: <http://ece.uprm.edu/~ducoudray>

Research Interests

- Low-voltage, Low-power Analog and Mixed-signal Systems
- Mixed Signal Testing
- BIST

Dr. Manuel Jiménez, Professor

Office: S-222B
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Email: mjimenez@ece.uprm.edu
Home Page: <http://ece.uprm.edu/~mjimenez>

Research Interests:

- Low-power Digital Circuit Design
- CAD Tools for VLSI Physical Design Automation
- Microprocessors & Embedded Systems
- Rapid System Prototyping

Dr. Rogelio Palomera, Professor

Office: S-414
Phone: (787)832-4040 Ext. 3098
Email: palomera@ece.uprm.edu
Home Page: <http://ece.uprm.edu/~palomera>

Research Interests:

- Analog VLSI
- Linear and Non-linear Electronic Circuits
- Fuzzy Systems

Dr. Guillermo Serrano, Associate Professor

Office: S-509
Phone: (787) 832-4040 Ext. 6294
Email: gserrano@ece.uprm.edu
Home Page: <http://ece.uprm.edu/~gserrano>

Research Interests:

- Analog and mixed-signal circuit design
- Sub-threshold design
- Floating-gate transistors

Dr. Manuel Toledo, Associate Professor

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Home Page: <http://ece.uprm.edu/~mtoledo>

Research Interests:

- Computer vision applications
- Embedded systems and instrumentation
- Adaptive optics

Dr. Isidoro Couvertier, Assistant Professor

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Research Interests:

- Computer Networks
- Engineering Education