

# **GRADUATE STUDENT MANUAL**

***DEPARTMENT OF  
ELECTRICAL AND COMPUTER ENGINEERING***

**FALL 2011 / SPRING 2012**

**FOR**

- **ELECTRICAL ENGINEERING**
- **COMPUTER ENGINEERING**
- **TELECOMMUNICATION NETWORKS**
- **SYSTEMS ENGINEERING**
- **ELECTROPHYSICS**
- **WIRELESS INNOVATION**



NEW YORK UNIVERSITY

discover the power of polythinking

[www.poly.edu](http://www.poly.edu)

1-800-polytech

**BROOKLYN • LONG ISLAND • WESTCHESTER**

Brooklyn: 6 Metrotech Center, Brooklyn, NY 11201

Long Island: 105 Maxess Road, Melville, NY 11747

Westchester: 40 Saw Mill Road, Hawthorne, NY 10532



# POLYTECHNIC INSTITUTE OF NEW YORK UNIVERSITY

## Department of Electrical and Computer Engineering

### GRADUATE STUDENT MANUAL

This manual contains material not included in the Polytechnic Catalog, as well as corrections and updated modifications to the material in that Catalog. Useful information is provided concerning departmental rules and procedures, as well as requirements for the following graduate degrees offered by the department.

#### ELECTRICAL ENGINEERING (EE)

MASTER OF SCIENCE (Electrical Engineering)  
DOCTOR OF PHILOSOPHY (Electrical Engineering)

#### COMPUTER ENGINEERING (CompE)

MASTER OF SCIENCE\* (Computer Engineering)

#### TELECOMMUNICATION NETWORKS (TN)

MASTER OF SCIENCE\*\* (Telecommunication Networks)

#### SYSTEMS ENGINEERING (SE)

MASTER OF SCIENCE (Systems Engineering)

#### ELECTROPHYSICS (EP)

MASTER OF SCIENCE (Electrophysics)

#### WIRELESS INNOVATION (WI)

MASTER OF ENGINEERING IN INTERDISCIPLINARY STUDY\*\* (Wireless Innovation)

#### BIOMEDICAL ENGINEERING (BE)

MASTER OF SCIENCE \*\*\* (Biomedical Engineering)

#### **Note:**

- (1) As MS degree requirements change from time to time, a student may follow the requirements in existence at the time of entry to the program, up to 5 years after entering. Alternatively, the new rules may be followed if that is preferable.
- (2) Ph.D. requirements, being more qualitative than quantitative, may be modified on an individual basis to adapt to departmental changes in degree requirements.

\* Offered jointly by Electrical and Computer Engineering (ECE) and Computer and Information Science (CIS) Departments.

\*\* Offered jointly by ECE, CIS and Management Departments.

\*\*\* Offered jointly by ECE Department and SUNY Downstate Medical Center.

**POLYTECHNIC INSTITUTE OF NEW YORK UNIVERSITY**  
**LONG ISLAND GRADUATE CENTER**

**Melville, NY**

POLYTECHNIC INSTITUTE OF NEW YORK UNIVERSITY University's Long Island Graduate Center is located in The Melville Corporate Center at 105 Maxess Road, near the Huntington Quadrangle. The center serves as an important resource for Long Island's engineering and technology community.

Dr. Frank Cassara is the director of the center and academic director for the electrical and computer engineering programs. The University has also appointed a corporate Advisory Council of noted Long Island business leaders. Chaired by Philip A. Teel, Vice President, Northrop Grumman, the council advises the University on the continuing education needs of Long Island industry.

Students at the Long Island Graduate Center can choose to pursue a master's program, take a 12-credit graduate certificate program or enroll in selected courses. The programs include management, computer science, wireless innovation, systems engineering, electrical engineering, computer engineering, and telecommunication networks. Classes are offered in the evening, Monday through Thursday and during the day on Saturday. For more information, contact Dr. Frank Cassara by e-mail at [cassara@rama.poly.edu](mailto:cassara@rama.poly.edu) or by telephone at (631) 755-4300.

# Table of Contents

Page No.

<b>I.</b>	<b>ENTRANCE REQUIREMENTS FOR MASTER DEGREE PROGRAMS .....</b>	<b>1</b>
	<b>EARLY GRADUATE ADMISSION.....</b>	<b>1</b>
<b>II.</b>	<b>MASTER DEGREE REQUIREMENTS.....</b>	<b>2</b>
	<b>1. MASTER OF SCIENCE ELECTRICAL ENGINEERING (MSEE) .....</b>	<b>2</b>
	<i>ENTRANCE REQUIREMENTS .....</i>	<i>2</i>
	<i>COURSE REQUIREMENTS .....</i>	<i>2</i>
	<i>IMAGE PROCESSING OPTION FOR THE MSEE .....</i>	<i>4</i>
	<i>RF/MICROWAVES OPTION FOR THE MSEE .....</i>	<i>5</i>
	<i>CONCENTRATION IN CONTROLS AND ROBOTICS.....</i>	<i>7</i>
	<i>COMPLETELY ONLINE MSEE OPTION.....</i>	<i>7</i>
	<b>2. MASTER OF SCIENCE COMPUTER ENGINEERING (MCOMPE).....</b>	<b>10</b>
	<i>ENTRANCE REQUIREMENTS .....</i>	<i>10</i>
	<i>COURSE REQUIREMENTS .....</i>	<i>10</i>
	<b>3. MASTER OF SCIENCE TELECOMMUNICATION NETWORKS (MSTN).....</b>	<b>13</b>
	<i>ENTRANCE REQUIREMENTS .....</i>	<i>13</i>
	<i>COURSE REQUIREMENTS .....</i>	<i>13</i>
	<b>4. MASTER OF SCIENCE SYSTEMS ENGINEERING (MSSE) .....</b>	<b>15</b>
	<i>ENTRANCE REQUIREMENTS .....</i>	<i>15</i>
	<i>COURSE REQUIREMENTS .....</i>	<i>16</i>
	<b>5. MASTER OF SCIENCE ELECTROPHYSICS (MSEP) .....</b>	<b>16</b>
	<i>ENTRANCE REQUIREMENTS .....</i>	<i>16</i>
	<i>COURSE REQUIREMENTS .....</i>	<i>17</i>
	<b>6. MASTER OF ENGINEERING (MENG) IN INTERDISCIPLINARY STUDY IN ENGINEERING (WIRELESS INNOVATION) .....</b>	<b>17</b>
	<i>ENTRANCE REQUIREMENTS .....</i>	<i>18</i>
	<i>COURSE REQUIREMENTS .....</i>	<i>18</i>
	<b>7. MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING (MSBE) .....</b>	<b>19</b>
<b>III.</b>	<b>GRADUATE CERTIFICATES.....</b>	<b>20</b>
	<b>1. GRADUATE CERTIFICATE IN COMPUTER ENGINEERING.....</b>	<b>20</b>
	<b>2. GRADUATE CERTIFICATE IN IMAGE PROCESSING .....</b>	<b>21</b>
	<b>3. GRADUATE CERTIFICATE IN TELECOMMUNICATION NETWORK MANAGEMENT.....</b>	<b>21</b>
	<b>4. GRADUATE CERTIFICATE IN WIRELESS COMMUNICATION .....</b>	<b>22</b>
	<b>5. GRADUATE CERTIFICATE IN POWER SYSTEMS MANAGEMENT.....</b>	<b>22</b>
	<b>6. GRADUATE CERTIFICATE IN POWER ELECTRONICS AND SYSTEMS .....</b>	<b>23</b>
<b>IV.</b>	<b>DOCTORAL PROGRAM.....</b>	<b>24</b>
	<b>1. GENERAL.....</b>	<b>24</b>
	<b>2. ADMISSION TO PROGRAM.....</b>	<b>24</b>
	<b>3. QUALIFYING EXAMINATION.....</b>	<b>24</b>
	<b>4. COURSE REQUIREMENTS.....</b>	<b>25</b>
	<b>5. EXAMPLES OF APPROPRIATE MAJOR AND MINOR AREAS FOR THE PH.D. DEGREE .....</b>	<b>25</b>
	<b>6. TRANSFER CREDIT.....</b>	<b>25</b>
	<b>7. GUIDANCE COMMITTEE.....</b>	<b>26</b>

8. AREA EXAMINATION FOR EE .....	26
9. REGISTRATION FOR PH.D. DISSERTATION CREDITS.....	26
10. SUBMISSION OF THE THESIS AND FINAL EXAMINATION .....	27
11. SEMINAR ATTENDANCE REQUIREMENT .....	27
12. PUBLICATION REQUIREMENT .....	27
13. FULL-TIME STUDY FOR PH.D. DEGREE.....	27
14. TIME LIMIT FOR PH.D. PROGRAM.....	27
15. LEAVE OF ABSENCE .....	28
<b>V. SCHOLARSHIPS AND FINANCIAL AID.....</b>	<b>29</b>
<b>TYPES OF SCHOLARSHIPS AND AID .....</b>	<b>29</b>
1. TEACHING ASSISTANTS.....	29
2. GRADUATE RESEARCH ASSISTANTSHIPS IN TELECOMMUNICATIONS .....	29
3. RESEARCH ASSISTANTS.....	29
4. GRADUATE STUDENT EMPLOYMENT AND TRAININGS.....	29
5. TEACHERS AIDE .....	30
<b>VI. TRANSITION POLICY FOR STUDENTS ENROLLED BEFORE FALL 2007.....</b>	<b>31</b>
1. SPECIAL VARIABLE CREDIT GUIDED STUDY COURSES TO HELP YOU EARN EXACTLY 30 CREDITS (FOR MS STUDENTS) .....	31
2. HOW TO REGISTER FOR A VARIABLE CREDIT COURSE.....	32
3. CERTIFICATE REQUIREMENTS FOR CURRENT STUDENTS.....	33
4. PH.D. STUDENT MINOR REQUIREMENT .....	33
5. PH.D. STUDENT SEMINAR ATTENDANCE REQUIREMENT .....	33
6. FULL TIME EQUIVALENCY AND MAITENANCE OF STUDY.....	33
<b>VII. ECE GRADUATE COURSE LISTING.....</b>	<b>34</b>
<b>VIII. FACULTY ROSTER BY AREAS OF SPECIALIZATION IN ELECTRICAL AND COMPUTER ENGINEERING (ECE).....</b>	<b>39</b>
<b>IX. GRADUATE STUDENT ADVISORS .....</b>	<b>41</b>
<b>X. CATEGORIZATION OF COURSES BY CONCENTRATION.....</b>	<b>42</b>

---

## I. ENTRANCE REQUIREMENTS FOR MASTER DEGREE PROGRAMS

Applicants to all programs are expected to have demonstrated the capacity for successful graduate study, e.g., by having at least a B average in undergraduate technical courses. The GRE examination is required for all international applicants. Students not meeting entrance requirements will be considered on an individual basis, and may be admitted subject to the completion of appropriate courses to remove deficiencies in preparation.

MS in EE	Admission to the MS program in Electrical Engineering requires a Bachelor's degree in Electrical Engineering from an accredited institution. The MSEE is also offered as an online degree program.
MS in CompE	Admission to the MS in Computer Engineering Program requires a Bachelor's degree in Computer Engineering, Electrical Engineering or Computer Science from an accredited institution. Candidates are expected to have knowledge of logic circuits design, state analysis and synthesis techniques, computer architecture, data structures and algorithms, and C or C++ programming.
MS in TN	Admission to the MS program in Telecommunication Networks requires a Bachelor's degree in Computer Science, Computer Engineering or Electrical Engineering, with a superior undergraduate record from an accredited institution. The GRE is recommended. Applicants are expected to have basic knowledge of computer fundamentals such as programming in C++, data structures, and computer architecture. If not, they will have to take the preparatory courses CS 530, CS 540, and CS 580 as a condition for acceptance. These courses may not be applied to the MSTN degree. The MSTN is also offered as an online degree program.
MS in SE	Admission to the MS program in Systems Engineering requires a Bachelor's degree in engineering or science from an accredited institution, including undergraduate courses in differential equations, probability, linear systems, feedback control, and computer programming.
MS in EP	Admission to the MS program in Electrophysics requires a Bachelor's degree in engineering or science from an accredited institution, including undergraduate courses in differential equations, electromagnetic theory, quantum and solid-state physics, and linear systems.
MEng in WI	Admission to the Master of Engineering program in Interdisciplinary Study in Engineering (Wireless Innovation) requires a bachelor's degree in Electrical Engineering, Computer Engineering or Computer Science from an accredited institution, with a superior undergraduate record, including undergraduate courses in differential equations and probability. Students with deficiencies in these areas may be admitted if they take appropriate introductory courses to remedy the deficiencies.
MS in BE	Refer to section II.7 of this manual for the requirement of admission to the MS program in Biomedical Engineering.

### **Early Graduate Admission**

A Polytechnic undergraduate who is within 18 credits of completing the B.S. degree and otherwise meets criteria for admission to graduate degree status may apply for conditional admission to graduate study. If accepted, the student will simultaneously be pursuing two degrees, taking both graduate and undergraduate courses for no longer than one year. Graduate courses taken during that year, and not used to satisfy undergraduate degree requirements, are not included in the nine-credit transfer limit for Master's degree programs.

---

## II. MASTER DEGREE REQUIREMENTS

Descriptions of graduate courses can be found in the following web site: <http://www.poly.edu/ece/graduate/revisedprogs/index.php>. Description of online graduate courses can be found on the following website: <http://www.poly.edu/epoly>. A grade point average of B average is required in all graduate courses taken at NYU-Poly except those used for the undergraduate degree. No more than 9 of 30 credits may be taken outside NYU-Poly, and such credits are not used to compute this grade point average. B average is also required in the courses taken to satisfy core and sequence courses. These courses must all be taken at Polytechnic Institute of New York University. If some of these courses are excused because they were taken as part of an undergraduate program or were awarded transfer credits, substitute courses approved by the adviser will be used in calculating this average. In any case, a total of 30 credits are required for the degree. Deviations from these course requirements must be certified by a letter of approval from the ECE Graduate Committee.

An increasing number of traditional graduate courses are available online for convenient study. An online version of a course is treated to be equivalent to an on-campus course.

### 1. MASTER OF SCIENCE ELECTRICAL ENGINEERING (MSEE)

#### Entrance Requirements

Admission to the Master of Science in Electrical Engineering Program requires a Bachelor's in Electrical Engineering from an accredited institution, with a superior undergraduate academic record. Students not meeting all these requirements will be considered for admission on an individual basis and may be admitted subject to the completion of appropriate undergraduate and/or introductory level graduate electrical engineering courses to remove deficiencies in preparation. Such graduate courses count toward the master's degree.

#### Course Requirements

To obtain the MS in Electrical Engineering degree, students must complete a total of 30 credits of courses, as described below.

#### **GROUP 1: Core Courses**

9 credits

Three courses (3 credits each) from the following:

EL5373	Internet Architecture and Protocols
EL5473	Introduction to VLSI System Design
EL5613	Introduction to Electric Power Systems
EL6113	Signals, Systems and Transforms
EL6253	Linear System
EL6303	Probability Theory
EL6413	Analog and High Frequency Amplifier Design
EL6713	Electromagnetic Theory and Applications

The core courses cover fundamental material and should be taken as early as possible. An advanced course subsequent to a core course may be taken in lieu of the core course, upon approval by an ECE graduate adviser.

**GROUP 2:** Two sequences each containing two courses, one course in each sequence may be a core course in Group 1. Both sequences must be in EL or CS courses and at least one must be an EL sequence. Approved course sequences are provided in the ECE Graduate Student Manual.

6-12 credits

---

APPROVED TWO-COURSE SEQUENCES:

Systems and Information Science

EL5013 – EL5023 or EL6013 or EL6023 or EL6033 (Wireless Communications)  
EL5023 – EL5033 (Wireless communications)  
EL5123 - EL6123 (Image Processing)  
EL5363 - EL5373 or EL6373 or EL6383 or EL7353 (Communication Networks)  
EL5823 - EL5123 (Medical Image Processing)  
EL5823 - EL6823 (Medical Imaging)  
EL6013 - EL6023 or EL6033 or EL6063 or EL6333 (Communications)  
EL6023 - EL6033 or EL5023 (Wireless Communications)  
EL6063 - EL6073 (Information and Coding Theory)  
EL6113 - EL7133 or EL6183 (Signals & Systems)  
EL5253 - EL6233 (System Theory)  
EL5223 - EL8223 (Controls and Robotics)  
EL6253 - EL7253 or EL6233 (Linear Systems)  
EL6303 - EL6313 (Probability & Stochastic Processes)  
EL6313 – EL6333 (Stochastic Processes & Detection and Estimation)  
EL6383 - EL7373 (High-Speed Networking/Switching)  
EL7133 - EL7163 or EL6183 (Digital Signal Processing)  
EL6233 - EL8233 (Optimal Controls)  
EL7353 - EL7363 (Communication Networks)

Computer Science

CS6033 - 6043 (Algorithms)  
CS6133 - 6143 or CS6183 (Architecture)  
CS6233 - 6243 (Operating Systems)  
CS6413 - 6423 (Compilers)  
CS6613 - 6623 (Artificial Intelligence)  
CS 6823 - EL6393 (Network Security, Advanced Network Security)

Fields and Waves

EL5733 - EL5463 (Microwave Engineering)  
EL6713 - EL6723 (Electromagnetic Fields and Waves)

Materials Science, Electronics, and Power

EL5473 - EL6443 (VLSI Systems)  
EL5493 - EL6443- (Computer Engineering)  
EL6413 - EL6423 or EL6433 (Electronic Circuits)  
EL5673 - EL6603 (Power Electronics)  
EL5613 - EL6623 or 6633 or 6643 or 6653 (Power Systems)  
EL5673 or EL5683 or EL6603 - EL6683 (Power Electronics and Drives)  
EL6603 - EL6663 (Power Electronics and Distributed Generation)  
EL6633 - EL6643 (Power Transients)

Other sequences require special approval of the Graduate Adviser. Overlapping sequences do not count for two sequences.

**GROUP 3:** Approved electives, which may include up to 6 credits of graduate courses offered by any science, engineering or management department

Total 9-15 Credits  
30 credits

---

**Out-of-department courses:**

At least 24 credits must be in EL prefixed courses. A 3-credit course in other science or engineering disciplines may be used to substitute an EL course upon approval by an ECE graduate adviser. (CS5XX level courses cannot be counted towards MS degree.) Remaining credits can be from any graduate courses in science, engineering or management.

**Thesis, project, and reading:** A master's thesis (EL997x, minimal 6 credits) or an MS project (EL9953 or EL9963, 3 credit each) or a reading course (EL9933 or EL9943, 3 credit each) may be included as part of the elective courses in group 3. Oral defense of the master's thesis with at least three professors in attendance is required. The total credits for thesis, projects, and readings should not exceed 9 credits within the 30 credits required for the MS degree. At most 3 credits can be taken for reading.

**GPA requirements:** An overall GPA of  $\geq 3.0$  in all graduate courses taken at Polytechnic is required. In addition, a 3.0 average is required in the combination of the five to seven courses offered to satisfy groups 1 and 2.

**Image Processing Option for the MSEE**

This option allows a concentration in courses relating to digital image and video processing while fulfilling the requirements for the MS in ELECTRICAL ENGINEERING.

A - Required Courses 21 credits

EL5123 Image Processing  
EL6113 Signals, Systems and Transforms  
EL6123 Video Processing  
EL6253 Linear Systems  
EL6303 Probability Theory  
EL7133 Digital Signal Processing  
CS6643 Computer Vision & Scene Analysis

The core courses for the MS in EE are satisfied by EL6303, EL6253 and EL6113.

B - The two required two-semester sequences are satisfied by EL5123/EL6123 and EL6113/EL7133.

C - Approved Electives 9 credits

Approved electives, which may include up to 6 credits of graduate courses offered by any science, engineering or Management department. The recommended electives are:

EL5253 Applied Matrix Theory  
EL5363 Principles of Communication Networks  
EL5823/BE6203 Medical Imaging I  
EL6183 Digital signal processing lab  
EL6233 System Optimization Method  
EL6313 Stochastic Processes  
EL6823/BE6213 Medical Imaging II  
EL7163 Multiresolution Signal Decomposition  
EL9953 Advanced Project I

Total 30 credits

Students who complete the Image Processing Option will also satisfy the requirement for a Graduate Certificate in Image Processing (see page 22).

For further information regarding Image Processing concentration, contact Prof. Yao Wang by e-mail at [yao@poly.edu](mailto:yao@poly.edu) or by telephone at (718) 260-3469.

---

## STUDY PLAN

Suggested Courses for MS EE, focused on Image Processing

<i>Semester</i>	<i>Course number</i>	<i>Course title</i>	<i>Credit</i>
1st Semester	EL5123	Image Processing	3
	EL6303	Probability	3
	EL6113	Signals and Systems	3
2nd Semester	EL6123	Video processing	3
	EL7133	Digital Signal Processing	3
	EL6183	DSP Lab	3
3rd Semester	EL6253	Linear systems	3
	CS6643	Computer Vision	3
	EL5823	Medical Imaging	3
4th Semester (or summer)	EL 995	Advanced Project	3
Total	10 courses		30 credits

### Note:

Note: Students who lack in matrix algebra are advised to take EL5253 (advanced matrix theory) in the first semester, in lieu of EL6113. In that case, EL6113 and EL6183 should be taken in later semesters. And one can skip either EL5823 or EL7133.

Students who had equivalent of EL6113, can skip EL6113, and take EL7133 and EL7163 instead of EL6113 and EL7133.

### Job opportunities:

Companies or research labs designing or operating imaging and video systems (Philips, Thomson, HP, IBM, TI, Mitsubishi Electric, Apple, Sharp, Sony, etc)

Network service or equipment providers and their research labs (AT&T, Verizon, Cisco, Qualcomm, etc.)

Medical imaging equipment providers (GE, Siemens, Philips, etc.)

Startups offering video services (video surveillance, video streaming, etc.)

### \*MS thesis:

Students are encouraged to take MS thesis (6 credits) to gain more practical experience. The thesis can replace one course in the third semester and the advanced project. Students can start the MS thesis in the summer, after the first 2 semesters.

For further information, contact Prof. Yao Wang, yao@poly.edu

## **RF/Microwaves Option for the MSEE**

The ECE Department offers a MSEE option in RF/Microwaves while fulfilling the requirements for the MS in ELECTRICAL ENGINEERING. The RF/Microwave option is designed to meet the growing needs of companies for highly trained professionals skilled in the area of RF and Microwave Engineering. Curriculum highlights for the RF/Microwave option include RF Engineering, Microwave Devices & Circuits, Radar, Antennas, Analog and Digital Communications, Spread Spectrum, Communications Lab and Electronic Design with a choice of Concentration in Radar/Antenna or Communications/RF Electronics.

A - Core Courses:

18 credits

- EL5463 Intro to RF/Microwave Integrated Circuits
- EL5733 RF & Microwave Systems Engineering
- EL6113 Signals, Systems and Transforms

EL6303 Probability  
 EL6713 Electromagnetic Theory and Applications  
 EL9313 Analog & Digital Communications

B - Choose one of the following Concentrations: 12 credits

**RADAR/ANTENNA CONCENTRATION**

EL6723 Electromagnetic Radiation & Antennas  
 EL6333 Detection and Estimation Theory (with applications to Array Processing)  
 EL9333 Fundamentals of Radar  
 EL9343 Radar Tracking and ECM

Or

**COMMUNICATIONS / RF ELECTRONICS CONCENTRATION**

EL6413 Analog and High Frequency Amplifier Design  
 EL6423 RF Electronics for Wireless Applications  
 EL5023 Wireless Information Systems Lab I  
 EL9323 Spread Spectrum Techniques

Total 30 credits

For further information regarding RF/Microwave area, contact Prof. Frank Cassara by e-mail at [cassara@rama.poly.edu](mailto:cassara@rama.poly.edu) or by telephone at (631) 755-4360.

**STUDY PLAN**

Suggested Courses for MS in EE, focused on RF/Microwaves & Electromagnetics

<i>Semester</i>	<i>Course number</i>	<i>Course title</i>	<i>Credit</i>
1st Semester	EL6713	Electromagnetics and Application	3
	EL6303	Probability Theory	3
	EL5733	RF and Microwave Systems Engineering	3
2nd Semester	EL5463	Introduction to RF/Microwave Integrated Circuits	3
	EL6723	Antennas and Radiation	3
	EL6113	Signal, Systems and Transforms	3
3rd Semester	EL6753	UHF Propagation in Wireless Systems	3
	EL6413	Analog and High-Frequency Amplifier Design	3
	EL5753	Introduction to Plasma Engineering	3
4th Semester	EL9953 or EL6423	Advanced Projects with Professors Das or Kuo, or RF Electronics for Wireless Applications	3
Total	10 courses		30 credits

**Skills Learned:**

Learn graduate-level electromagnetic theory, RF/Microwave circuit principles, antenna theory and wave propagation concepts, for application in RF/Microwave systems used in wireless communication, satellite communication and radar.

**Job Opportunities:**

Wireless Communication companies, such as Motorola, Lucent Technology, Verizon, Satellite Communication companies, such as Hughes, Motorola, Raytheon, Defense companies such as Raytheon, Northrup Grumman, Lockheed Martin.

Any company that needs expertise in design of RF circuit and antenna hardware

---

**\*MS thesis:**

Students are encouraged to take MS thesis (6 credits) to gain more in-depth knowledge. The thesis can replace the fourth semester course (EL9953 or EL6423), and any of the three courses in the third semester. Students are advised to start the MS thesis in the summer, after the first 2 semesters.

MS Thesis would also prepare students for research jobs or doctoral studies.

**Concentration in Controls and Robotics**

The following courses are recommended for the graduate students interested in the Control Systems and/or Robotics areas:

1. EL5223 Sensor Based Robotics
2. EL5253 Applied Matrix Theory
3. EL6243 System Theory and Feedback Control
4. EL6223 Nonlinear and sampled-Data Control Systems
5. EL6233 System Optimization Methods
6. EL6253 Linear Systems
7. EL7253 State Space Design for Linear Control Systems
8. EL8223 Applied Nonlinear Control
9. EL8233 Optimal Control Theory
10. EL8253 Large Scale Systems and Decentralized Control
11. Digital Control/Robotics Laboratory. Projects may be taken at any time with permission of the Instructor (Prof. F. Khorrami).

The following may be taken as sequences: EL6253 and EL7253; EL6233 and EL6253; EL6243 and EL7253.

For further information regarding Controls and Robotics area, contact Prof. Zhong-Ping Jiang by e-mail at [zjiang@control.poly.edu](mailto:zjiang@control.poly.edu) or by telephone (718)260-3646.

**Completely Online MSEE Option**

The Master of Science in Electrical Engineering is now available as a completely online program. The online program makes a Polytechnic degree available to students who do not live in the New York metropolitan area. The admissions policy is identical for applicants to both the online degree and conventional degree programs. Participants in the online program will face the same challenging coursework required of all Polytechnic students to earn a master degree (see this website <http://www.poly.edu/epoly/programs/ee/index.php> for detailed information). An on campus student can also choose to take online courses.

The program comprises three core courses, two two-course sequences and electives that provide knowledge and experience across a number of sub disciplines within electrical engineering. Each online course awards 3 credits for successful completion and is considered equivalent to an on-campus course. Additional courses are expected to be available online in the near future.

**Course Requirements**

A - Three courses from among the following core courses: 9 credits

- EL6114 Signals, Systems and Transforms
- EL6304 Probability
- EL6414 Analog and High Frequency Amplifier Design
- EL5374 Internet Architecture and Protocols (Effective Fall 2006)

B - Two one-year sequences in EL or CS courses which may include the above courses. At least one EL sequence must be made. One course can be accounted only for one sequence.

**APPROVED TWO-COURSE SEQUENCES:**

Systems and Information Science

6-12 credits

- EL5364 - EL5374 or EL6374 or EL7354 (Communication Networks)
- EL6384 - EL7374 (High-Speed Networking/Switching)
- EL6014 - EL6024 or EL6034 (Communications)
- EL6024 - EL6034 (Wireless Communications)
- EL6114 - EL7134 (Signals & Systems)
- EL6304 - EL6014 or EL6024 or EL6034 (Communications)

C - Approved Electives

- EL6014 or EL6024 or EL6034 (Wireless Communications)
- EL5364 - EL5374 or EL6374 (Communication Networks)
- EL7134 (Signals & Systems)
- EL6384 (High-Speed Networking/Switching)
- EL6754 (UHF Propagation for Wireless Systems)
- EL7374 (High Performance Switches and Routers)

Total 9-15 Credits  
30 Credits

For further information about the online courses and enrollment procedures, please contact Prof. I-Tai Lu by e-mail at itailu@rama.poly.edu or by telephone at (631)755-4226.

**STUDY PLAN**

Suggested Courses for MS in EE, focused on DSP

<i>Semester</i>	<i>Course number</i>	<i>Course title</i>	<i>Credit</i>
1st Semester	EL 6253	Linear Systems	3
	EL 6303	Probability	3
	EL 6113*	Signals and Systems	3
2nd Semester	EL 7133	Digital Signal Processing	3
	EL 6183	DSP Lab 3	3
	EL 6313	Stochastic Processes	3
3rd Semester	EL 5123	Image Processing	3
	EL 7163	Wavelets & Filter Banks	3
	EL 9133	Biomedical Signal Processing	3
4th Semester	EL 995	Advanced Project	3
Total	10 courses		30 credits

**Note:**

EL 7163 (Wavelet Transforms and Filter Banks) may replace any course in third or fourth semester

\* Qualified students may skip EL 6113 and go directly into EL 7133 in which case EL 7133 can be used as a core course.

**Job opportunities:**

DSP is used many telecommunication and device companies (Motorola, Texas Instruments, Philips, Mitsubishi Electric, Sharp, Sony, General Electric, etc).

---

**\*MS thesis:**

Students may complete an MS thesis (EL 997, 6 credits) instead of EL 995 and any course in the third semester.

**STUDY PLAN**

Suggested Courses for MS EE, focused on wireless communication

Group 0: Core Courses

EL5373 Internet Architecture and Protocols  
EL5473 Introduction to VLSI System Design  
EL5613 Introduction to Electric Power Systems  
EL6113 Signals, Systems and Transforms  
EL6253 Linear System  
EL6303 Probability Theory  
EL6413 Analog and High Frequency Amplifier Design  
EL6713 Electromagnetic Theory and Applications

Group 1: Basic Wireless Courses

EL5013 Wireless Personal Communication Systems  
EL5023 Wireless Information Systems Lab I  
EL5033 Wireless Information Systems Lab II  
EL6013 Principles of Digital Communications: Modulation and Coding EL6023 Wireless Communications: Channel Modelling and Impairment Mitigation EL6033 Modern Wireless Communication Techniques and Systems

Group 2: Advanced Wireless Courses

EL6063 Information Theory  
EL6073 Error Control Coding  
EL7023 Space-Time Wireless Communications  
EL90X3 Select Topics in Wireless Communication  
EL 6333 Detection and Estimation Theory

Group 3: Telecommunication Courses

EL 5363 Principles of Communication Networks  
EL 5373 Internet Architecture and Protocols  
EL 6373 Local and Metropolitan Area Networks  
EL 6383 High-Speed Networks  
EL 6393 Advanced Network Security

Group 4: Probability and Signal Processing Courses

EL 6113 Signals, Systems and Transforms  
EL 6303 Probability Theory  
EL 6313 Stochastic Processes  
EL 7133 Digital Signal Processing

Option 1

Semester One

1. EL 6303 Probability Theory (core course 1)
2. One course from group 1
3. One course from group 1

---

Semester Two

1. One course from group 0 (Core course 2: example: EL 6113 )
2. One course from group 1
3. One course from groups 1, 2, 3, or 4

Semester Three and/or Summer

1. One course from group 0 (Core course 3: example: EL 5373 )
2. One course from group 1
3. One course from groups 1, 2
4. One course from groups 1, 2, 3, or 4

Option 2

Semester One

1. EL 6303 Probability Theory (core course 1)
2. One other course from group 0 (Core course 2: example: EL 6113 )
3. One course from group 1

Semester Two

1. One course from group 0 (Core course 3: example: EL 5373 )
2. One course from group 1
3. One course from groups 1, 2, 3, or 4

Semester Three and/or Summer

1. One course from group 1
2. One course from group 1
3. One course from groups 1, 2
4. One course from groups 1, 2, 3, or 4

## 2. MASTER OF SCIENCE COMPUTER ENGINEERING (MScCompE)

### Entrance Requirements

Admission to the MS program requires a bachelor's degree in computer engineering, electrical engineering or computer science from an accredited institution. Students not meeting these requirements are considered for admission on an individual basis and may be admitted subject to the completion of appropriate courses to remove any deficiencies in preparation. Topics in which deficiencies must be removed include logic circuits design, state analysis and synthesis techniques, computer architecture, data structures and algorithms and C or C++ programming. Students not meeting entrance requirements will be considered on an individual basis, and may be admitted subject to the completion of appropriate courses to remove deficiencies in preparation.

### Course Requirements

To satisfy the requirements for a MS degree, students must complete a total of 30 credits as described below. Of these, at least 18 credits should be EL credits and at least 6 credits should be CS credits.

**GROUP 1:** Core courses: Choose 3 out of following

9 credits

EL 5363	Principles of Communication Networks
EL 5473	Introduction to VLSI design
EL 5493	Advanced Hardware Design (VHDL)
CS 6133	Computer Architecture I

**GROUP 2:** Two sequences each containing two courses; one course in each sequence may be a core course in Group 1.

Both sequences must be in EL or CS courses and at least one must be an EL sequence. Approved course sequences are provided in the ECE Graduate Student Manual.

6-12 credits

EL5473, 6443	Introduction to VLSI VLSI System Architectures
EL5473, 6383	Introduction to VLSI High-Speed Networking
EL5493, 6443	Advanced Hardware Design (VHDL) VLSI System and Architecture Design
EL6413, 6433	Advanced Electronics: Analog and High Frequency Amplifier Design Digital Integrated Circuit Design
EL5373, 6373	Internet Architecture and Protocols LAN and MAN (Metropolitan Area Networks)
EL6383, 7373	High-Speed Networks High-Speed Switches and Routers
EL7353, 7363	Communication Networks I & II
CS6033, 6043	Algorithms I & II
CS6063, 6073	Software Engineering I & II
CS6233, 6243	Operating Systems I & II
CS6133, 6143	Computer Architecture I & II
CS6133, 6183	Computer Architecture, Fault-Tolerant Computers

**GROUP 3:** Approved electives may be chosen with adviser approval from graduate offerings in EL, CS and, occasionally, pertinent courses from other departments. With adviser approval, students may select other groups or individual courses provided they relate to the various facets of computer engineering.

6-12 credits

#### Image Processing

EL5123	Image Processing
EL6123	Video Processing

#### Embedded Systems

CS6183	Fault-Tolerant Computers
EL5483	Real-Time Embedded Systems

#### Telecommunications & Networking

EL5013	Wireless Personal Communication Systems
EL6013	Principles of Digital Communications: Modulation and Coding
EL6023	Wireless Communications: Channel Modeling and Impairments Mitigation
EL6583	Fiber Optic Communication

#### Computer Systems and Software

CS6063	Software Engineering I
CS6083	Principle of Database Systems
CS6413	Compiler Design and Construction I
CS6273	Performance Evaluation of Computer Systems

**GROUP 4:** Students must take a project (EL9953 or CS9963) that relates to the computer engineering discipline and is approved by an adviser.

Total      3 credits  
30 credits

**Thesis option:** A 6-credit thesis (EL997x) may be selected and used to replace: (1) one elective from Group 3 and (2)

---

the 3-credit project from Group 4.

## STUDY PLAN

Suggested Courses for MS in CompE while focused on Digital VLSI Design

<i>Semester</i>	<i>Course number</i>	<i>Course title</i>	<i>Credit</i>
1st Semester	EL5473	Introduction to VLSI Design	3
	EL5493	Advanced Computer Hardware Design	3
	EL5533	Physics of Nanoelectronics	3
2nd Semester	EL5483	Real Time Embedded System Design	3
	CS6133	Computer Architecture I	3
	EL6443	VLSI System and Architecture Design	3
3rd Semester	CS6143	Computer Architecture II	3
	EL6413	Analog and High Frequency Amplifier Design	3
	EL9413	Advanced VLSI Design Techniques	3
4th Semester	EL9953*	Advanced Project I with Prof. Rose and/or Prof. Karri	3
Total	10 courses		30 credits

### Skills Learned:

CMOS circuit principles, VHDL, layout design and verification, SPICE/Spectre simulation, standard cell design, SKILL programming, computer architecture and microarchitecture

### Job opportunities:

IC design companies, such as IBM, Intel, Freescale, AMD, etc.

### \*MS thesis:

Students are encouraged to take MS thesis (6 credits) to gain more practical experience.

The thesis can replace EL6413 and EL9953.

Students can start the MS thesis in the summer, after the first 2 semesters.

Suggested Courses for MS in CompE while focused on High Speed Networking

<i>Semester</i>	<i>Course number</i>	<i>Course title</i>	<i>Credit</i>
1st Semester	EL5363	Principles of Communication Networks	3
	EL5373	Internet Architecture and Protocols	3
	EL5493	Advanced Computer Hardware Design	3
2nd Semester	EL6383	High Speed Networks	3
	EL7373	High-Performance Switches and Routers	3
	CS6823	Network Security	3
3rd Semester	CS6133	Computer Architecture	3
	EL6393	Advanced Network Security	3
	EL9313	Network Processors	3
4th Semester	EL9953*	Advanced Project I with Professors Chao, Xi, and Xu	3
Total	10 courses		30 credits

---

**Skills Learned:**

high-speed network technology, protocols, security, routers, Ethernet switches, optical access networks, quality of service control, hardware & software designs

**Job Opportunities:**

Network equipment companies, such as Cisco, Juniper, Fortinet, Force10...

Network providers, such as AT&T, Verizon'

Data center of finance companies, such as JP Morgan, Merrill Lynch'

Any companies that need networking skills to plan or operate their networks.

**\*MS thesis:**

Students are encouraged to take MS thesis (6 credits) to gain more practical experience.

The thesis can replace EL9313 and EL9953.

Students can start the MS thesis in the summer, after the first 2 semesters.

### 3. MASTER OF SCIENCE TELECOMMUNICATION NETWORKS (MSTN)

#### Entrance Requirements

Admission to a Master of Science in Telecommunication Networks requires an undergraduate degree in computer science, computer engineering or electrical engineering, with a superior undergraduate record from an accredited institution. The Graduate Record Exam (GRE) is recommended. Applicants having comparable degrees in other fields will be considered for admission on an individual basis. Generally, entering students are expected to have a basic knowledge of computer fundamentals, such as programming in C++, data structures and computer architecture. Students having superior academic credentials but lacking sufficient background are admitted with conditional status pending satisfactory completion of several individually specified preparatory courses. These preparatory courses include CS 5303 Introduction to Computer Science and CS 5403 Data Structures. However, no credit will be allowed for any of the preparatory courses toward this degree. Other preparatory courses may be required. In some cases students will be invited to an interview to determine the necessary preparatory courses they need to complete. Successful completion of the preparatory courses with a 3.0 GPA or better is a necessary condition for transfer to regular status. Admission with advanced standing is accepted in accordance with Polytechnic regulations published in this catalog. A maximum of 9 credits may be applied to the MS in Telecommunications Networks from previous graduate work at an acceptable institution.

#### Course Requirements

To satisfy the requirements for a master's degree, students must complete a total of 30 credits as described below, with an overall average of 3.0. In addition, a 3.0 average is required in the core courses described in GROUP1 and GROUP2 below. Students, who have satisfactorily completed equivalent courses, as determined by the MSTN advisor, may be allowed to replace required core courses in Group1 and 2 courses with other courses, starting with the remaining Group2 course. For example, a student who has previously taken a course equivalent to EL 5373 will be required to take all the remaining four courses in Group 2. If a student has previously taken two or more equivalent courses from Group 1 and 2, these additional courses can be replaced by advanced courses. Permission of the MSTN advisor is required for all course substitutions.

**GROUP 1: Required Core Course****3 Credits**

EL5363 Principles of Communication Networks

---

Students who have satisfactorily taken a course equivalent to EL 5363, e.g., EE 136, or otherwise as determined by the MSTN advisor can replace this course by a course from Group 2, as explained above.

**GROUP 2: Additional Core Courses**

12 Credits

Students are required to take 4 out of the 5 courses listed below.

EL5373	Internet Architecture and Protocols	or	CS6843	Network Protocols I
EL6373	Local and Metropolitan Area Networks	or	EL6383	High Speed Networks
CS6133	Computer Architecture I	or	CS6233	Operating Systems I
CS6273	Performance Evaluation of Computer Systems (the latter requires EL5363 and EL6303 as prerequisites)	or	EL7353	Communication Networks I
CS6823	Network Management & Security			

In certain rare circumstances, and with approval of the program's director, other computer science and electrical engineering courses may be used to fulfill the core requirement. Students may not take both CS6843 and EL5373.

**GROUP 3: Project Requirement**

3 Credits

All students in the Telecommunication Networks Program are required to take a project course, either CS6873 Project in Telecommunication Networks or EL9953 Advanced Project I, depending on whether the project advisor is from the CS or ECE departments, respectively. Students must obtain a project adviser and have a project plan approved before registering. The project should be completed in one semester. After obtaining the program director's approval, students may substitute the required 3-credit project with a 6-credit MS thesis. The extra 3 credit for the thesis will be counted towards the program elective in GROUP 4.

**GROUP 4: Program Elective Courses**

12 Credits

Students are required to take four courses (not already counted towards the core requirement) from the following partial list of courses. Other courses are possible with the approval of the program director.

EL 5013	Wireless Personal Communication Systems
EL 5023	Wireless Information Systems Lab I
EL 5143	Multimedia Laboratory
EL 6013	Principles of Digital Communication
EL 6023	Wireless Communications
EL 6033	Modern Wireless Communication Techniques & Systems
EL 6063	Information Theory
EL 6303	Probability
EL 6313	Engineering Applications of Stochastic Processes
EL 6383	High-Speed Networks
EL 6393	Advanced Network Security
EL 7353	Communications Networks I
EL 7363	Communications Networks II
EL 7373	High-Performance Routers and Switches
CS 6033/6043	Design & Analysis Algorithms I/II
CS 6133/6143	Computer Architecture I/II
CS 6233/6243	Operating Systems I/II
CS 6063	Software Engineering I
CS 6083	Principles of Database Systems
CS 9053	Introduction to Java Programming

MG graduate courses: Relevant graduate course in the management department can be taken with the approval of the MS Telecommunication Networks advisor. No more than two MG courses can be counted towards the MSTN degree.

Total 30 credits

---

## STUDY PLAN

### Suggested Courses for MS TN

<i>Semester</i>	<i>Course number</i>	<i>Course title</i>	<i>Credit</i>
1st Semester	EL5363	Principles of Communication Networks	3
	EL5013	Wireless Personal Communication Systems	3
	EL6303	Probability	3
2nd Semester	EL5373	Internet Architecture and Protocols	3
	EL7353	Communication Networks I	3
	EL6373 or EL6383	Local and Metropolitan Area Networks or High Speed Networks	3
3rd Semester	EL9953*	Advanced Project I	3
	EL7363	Communications Networks II	3
	CS6133 or CS6233	Computer Architecture I or Operating Systems I	3
4th Semester	CS6823	Network Management & Security	3
Total	10 courses		30 credits

### Skills Learned:

Communication Network Principles, Internet Architecture and Protocols, Network Analysis and Design, Network Management and Security, High Speed and Wireless Networks

### Job opportunities:

Data center of finance companies, such as JP Morgan, Merrill Lynch, ....  
Any companies that need networking skills to plan or manage their networks.  
Network equipment companies, such as Cisco, Juniper, Fortinet, Force10...  
Network service providers, such as AT&T, Verizon, ....

### \*MS thesis:

Students are encouraged to take MS thesis (6 credits) to gain more practical experience. The thesis can replace EL9953. Students can start the MS thesis in the summer, after the first 2 semesters.

## 4. MASTER OF SCIENCE SYSTEMS ENGINEERING (MSSE)

The MS in Systems Engineering degree program has been revamped. The revised program focuses on analysis, operation, maintenance, and design of complex systems.

### Entrance Requirements

The entrance requirement for a Master of Science in Systems Engineering is a Bachelor's degree in engineering or science from an accredited institution, with at least a B average in undergraduate technical courses. It is noted that for some tracks, students should have taken undergraduate courses in differential equations, probability, linear systems, feedback control and computer programming. Deficiencies in any of the subject matters should be addressed by taking the required courses for any particular track.

---

## **Course Requirements**

To satisfy the requirements for an MS in Systems Engineering, students must complete three core courses and two tracks at least one of which must be a core track. A minimum of three courses should be taken in a track. One course in each track may be a core course. The remaining credits (up to 9 credits) can be chosen from any science, engineering and management courses. If a student elects to write a MS thesis (6 credits), then only two courses in a track are required. The total number of credits required is 30 and at least 15 credits should be from EL prefixed courses. A GPA of 3.0 or above is required in all graduate courses.

**Core Courses:** Three courses chosen from among the following: 9 Credits

EL5213	Introduction to Systems Engineering
EL6213	System Modeling, Analysis and Design
EL6233	Systems Optimization Methods
EL6253	Linear Systems
EL6303	Probability
MG8203	Project Management

**Core Tracks:** 6-18 Credits

Network Management (EL5363, 5373, 6373, 7353, 7363)  
Mobile Communications (EL5013, 5023, 6013, 6023, 6033)  
Systems and Automation (EL5223, 5253, 6253, 8223)  
Energy Systems (EL5613, 6623, 6633, 6653)  
Large Scale Systems Modeling and Control (EL6253, 7253, 8253, 92x3)  
Multimedia Applications (EL5123, 5143, 6113, 6123, CS6643)

**Elective Tracks:** 0-9 Credits

Computer Systems and Security (CS6813, 6823, 9043, EL6393)  
Software Engineering (CS6063, 6073, 6083, 6183)  
Operations Research and Management (MG6303, 6461, 8203, FE6023)  
Financial Engineering (FE6023, 6083, 6103, 6411, 6291)  
Biological Systems (Selected courses with prefix BE, CH, CM, subject to advisor approval)

**Free Electives** 0-9 Credits

Any courses in science, engineering or management

Total: 30 Credits

## **5. MASTER OF SCIENCE ELECTROPHYSICS (MSEP)**

### **Entrance Requirements**

The entrance requirements for a Master of Science in Electro physics are a bachelor's degree in engineering or science from an accredited institution, with a superior undergraduate record, including undergraduate courses in differential equations, electromagnetic theory, quantum and solid-state physics and linear systems. Students with deficiencies in these areas may be admitted if they take appropriate introductory courses to remedy these deficiencies. Outstanding students are advised to apply for financial aid in the form of research fellowships teaching fellowships or partial tuition remission. To satisfy the requirements for an MS in Electro physics, students must complete a total of 30 credits of courses, as described below.

---

## **Course Requirements**

### **GROUP 1: Core Courses**

Three courses (each 3 credits) from among the following:

9 Credits

EL5513	Electro-Optics I
EL5733	RF and Microwave Systems Engineering
EL5753	Introduction to Plasma Engineering
EL6113	Signals, Systems and Transforms
EL6583	Fiber Optic Communications
EL6713	Electromagnetic Theory and Applications

**GROUP 2:** Two sequences each containing two courses; one course in each sequence may be a core course in Group 1. Both of these sequences must be in electrical engineering. Approved course sequences for the program are given in the ECE Graduate Student Manual.

6-12 Credits

**GROUP 3:** Approved electives, which may include up to 6 credits of courses offered by any science or engineering program.

9-15 Credits

Minimum Total: 30 Credits

### **Out-of-department courses:**

At least 24 credits must be in EL prefixed courses. A 3-credit course in other science or engineering disciplines may be used to substitute an EL course upon approval by an ECE graduate adviser. Remaining credits can be from any graduate courses in science or engineering.

### **Thesis, project, and reading courses:**

A master's thesis (EL997x, minimal 6 credits) or an MS project (EL9953 or EL9963, 3 credit each) or a reading course (EL9933 or EL9943, 3 credit each) may be included as part of the elective courses in group 3. Oral defense of the master's thesis with at least three professors in attendance is required. The total credits for thesis, projects, and readings should not exceed 6 credits within the 30 credits required for the MS degree. At most 3 credits can be taken for reading.

## **6. MASTER OF ENGINEERING (MEng) IN INTERDISCIPLINARY STUDY IN ENGINEERING (WIRELESS INNOVATION)**

Polytechnic University offers a new degree program, the Master of Engineering in Interdisciplinary Study in Engineering (Wireless Innovation) specifically designed for working professionals. This unique Master's program is designed to meet the growing needs of companies for highly trained wireless professionals skilled at the state of the art in complex issues comprising effective wireless innovation today. Students are exposed to the important technology and business concepts in this burgeoning field, and will be equipped to become its leaders.

The program is offered at Polytechnic Institute of New York University's Long Island Graduate Center. This new graduate-level program features an interdisciplinary approach from a combined effort of the Departments of Management, Electrical and Computer Engineering, and Computer and Information Science. Relevant courses from all three fields are provided in this program.

The program is now offered as a part-time evening graduate program and offers its participants a unique educational experience to be at the forefront of the new economy. It is assumed that most of the program's students are working professionals with full-time jobs. The program's timetable is specifically designed to minimize interruptions and interference in their workday responsibilities.

---

## **Entrance Requirements**

To obtain the degree, students must satisfactorily complete a total of 30 credits in graduate courses with a capstone experience and at least one 12-credit graduate advanced certificate in an engineering department or in the Department of Computer and Information Science. This is the first such graduate interdisciplinary program at Polytechnic Institute of New York University or in the New York City metropolitan area. The advanced certificates and courses required already exist at the university; new ones will be created and approved as the program evolves to meet the needs of students and industry. Admission to the program requires a bachelor's degree from an accredited institution, with a superior academic record and completion of all prerequisite courses. Applicants who are otherwise sufficiently prepared for admission may nevertheless be required to take specific undergraduate and introductory level graduate courses. Such graduate courses may count towards the master's degree, depending on the practice of the department offering the advanced certificate. To administer this interdisciplinary program, each academic department will assign an adviser (or more than one if needed as the program grows). These advisers will form an advisory team to evaluate applicants for admission to the program. Based upon a student's selection of the first certificate, an adviser from the appropriate department will become the student's adviser. Advisers will help student's select appropriate courses and determine their progress. To satisfy the requirements for the Master of Engineering degree, students must complete a total of 30 credits of courses, as described below, and maintain a B average for each certificate.

1. Certificate 1 (required): a 12-credit advanced certificate in any engineering department or in the Department of Computer and Information Science.
2. Additional courses agreed upon by the student and adviser to total 30 credits.

One or more courses in management are generally encouraged. A student may also choose to complete a second certificate as part of the additional courses beyond the first certificate. The majority of the 30 credits must be from engineering disciplines and the first advanced certificate included in the degree must be from one of the advanced certificates listed below. Prospective students must specify the first advanced certificate as part of the application process. There is no option for a thesis in this degree program. An average GPA of at least 3.0 is required in all graduate courses taken at Polytechnic for graduate credit. No more than 9 of the 30 credits may be transferred as part of this degree, based upon prior work at other acceptable institutions in subject matter relevant to this degree. A maximum of 3 transfer credits may be applied toward each certificate.

The degree shall include a capstone experience in one of the following ways: (a) a capstone course within one of the advanced certificates included in the degree; (b) a for-credit internship that builds on the program of study within the degree and is monitored by a faculty adviser\*; or (c) an advanced design course that builds on the program of study and is explicitly designated by the adviser as the capstone course for the student's program of study. Where feasible, Polytechnic will designate in the University catalog a capstone course within each of the advanced certificates. It will generally be a laboratory or design project course or include a major design project. Where this is not done (b) or (c) will be the preferred mode of completing the degree.

*\* There is a general requirement for an intern experience as part of the Master of Science or Master of Engineering degree at Polytechnic. See Academic Policies and Degree Requirements in this catalog.*

## **Course Requirements**

Below is a selection of courses focused on wireless innovation that fulfills requirements for a Certificate in Wireless Communications and for the degree Master of Engineering in Interdisciplinary Studies in Engineering.

**GROUP1:** Required 6 credits

EL6303 Probability (Required)  
EL9953 Advanced Project I (Required)

**GROUP2:** Restricted Electives: Choose 3 courses from the following: 9 credits

EL5013 Wireless Personal Communication Systems

---

EL5023	Wireless Information Networks Lab I
EL5033	Wireless Information Networks Lab II
EL6013	Principles of Digital Communications: Modulation & Coding
EL6023	Wireless Communications: Channel Modeling & Coding
EL6033	Modern Wireless Communications: Techniques and Systems
EL6063	Information Theory
EL6073	Coding Theory
EL7023	Space-Time Wireless Communications
EL6753	Radio Propagation for Wireless Systems

**GROUP3:** Electives. Choose 5 courses in electrical engineering, management or computer science. A maximum of three management courses is allowed. Sample Courses are listed below: 15 credits

EL5363	Principles of Communication Networks
EL6373	Local and Metropolitan Area Networks
EL6393	Advanced Network Security
MG8673	Technology Strategy
MG6073	Marketing
MG7503	Electronic Business
MG8653	Innovation Management
CS6813	Information, Privacy & Security
CS6823	Network Management & Security
CS9153	Mobile Computing

**GPA requirements:** An overall GPA of  $\geq 3.0$  in all graduate courses is required. In addition, a 3.0 average is required in the courses taken to satisfy groups 1 and 2.

## 7. MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING (MSBE)

This is a joint program with SUNY Downstate Medical Center. The program is administered at Polytechnic Institute of New York University by Professor Richard A. Gross. Information about the program is available at the following Web link: <http://www.poly.edu/cbs/graduate/biomedical/curriculum/index.php>. Students interested in this program are referred to Prof. Gross for further details. In the event you are unable to access or download this link, please send your inquiry to Prof. Richard Gross: [rgross@poly.edu](mailto:rgross@poly.edu) or to Professor Yao Wang: [yao@poly.edu](mailto:yao@poly.edu).

The following courses in are co-listed between EL and BE, and can be taken as electives towards the MSEE program:

EL5813/BE6503 Biomedical Instrumentation  
 EL5823/BE6203 Medical Imaging I  
 EL6823/BE6213 Medical Imaging II

---

### III. GRADUATE CERTIFICATES

The Department of Electrical and Computer Engineering offers following Graduate Certificates, each requiring four courses (12 credits). A GPA of 3.0 or higher is required in the four courses to receive the certificate.

- Computer Engineering
- Image Processing
- Telecommunication Network Management
- Wireless Communications
- Power Systems Management
- Power Electronics and Systems

#### 1. GRADUATE CERTIFICATE IN COMPUTER ENGINEERING

Computer engineering is a rapidly growing profession and computer engineers are in the midst of exciting times with unlimited opportunities in all walks of life. For instance, computer engineers interact with and design large supercomputers as well as the ubiquitous personal and portable computers. Furthermore, computer engineers play a key role in networking computers with other computers and intelligent devices. Computer engineers are also involved in such varied projects as designing specialized computer hardware to reconstruct the human genome; monitoring and controlling industrial plants and the environment, computer graphics and robotics; and designing biomedical devices and computer networks. Finally, computer engineers design and develop hardware and embedded hardware-software systems. The graduate certificate in computer engineering is designed for working professionals who seek to acquire an in-depth understanding of the field. The program consists of three required courses and one elective course.

##### Required Courses: (Choose 3)

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL5493	Advanced Hardware Design (VHDL)	3
EL5363	Principles of Communication Networks	3
EL5473	Introduction to VLSI design	3
CS6133	Computer Architecture I	3

##### Recommended Elective Courses: (Choose 1)

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL5483	Real-Time Embedded Systems	3
EL6493	Digital VLSI System Testing	3
EL6443	VLSI System Architectures	3
EL6453	VHDL-Based Behavioral Synthesis	3
EL6413	Analog & High Frequency Amplifier Design	3
EL6433	Digital Integrated Circuit Design	3
CS6143	Computer Architecture II	3
CS6183	Fault-Tolerant Computers	3

Unchosen one from Group 1

**Certificate Coordinator:** For further information regarding the Computer Engineering Certificate, contact Professor Ramesh Karri at 718-260-3596 or send e-mail to rkarri@poly.edu.

---

## 2. GRADUATE CERTIFICATE IN IMAGE PROCESSING

Image processing covers some of the fundamental technology behind applications such as digital television; medical imaging and tele-radiology; and multimedia database and communications. All make use of digital image enhancement, filtering, analysis and compression techniques. This certificate is designed for working professionals who seek to acquire an in-depth understanding of image processing and communication technology. The program consists of three required courses and one elective course.

### Required Courses:

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL5123	Image Processing	3
EL6123	Video Processing	3
CS6643	Computer Vision & Scene Analysis	3

### Recommended Elective Courses: (Choose 1)

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL5823	Medical Imaging I	3
EL6183	Digital Signal Processing Lab	3
EL6113	Signals, Systems & Transforms	3
EL6303	Probability Theory	3
EL6313	Applied Stochastic Processes	3
EL7133	Digital Signal Processing I	3
EL7163	Wavelet Transforms and Filter Banks	3
EL9953/9963	Advanced Project I or II	3

**Certificate Coordinator:** For further information regarding the Image Processing Certificate contact Professor Yao Wang by e-mail at [yao@poly.edu](mailto:yao@poly.edu) or by telephone at (718) 260-3469.

## 3. GRADUATE CERTIFICATE IN TELECOMMUNICATION NETWORK MANAGEMENT

The explosive growth of data networks has brought with it the need for effective network management. The widespread deployment of standards-based solutions (e.g., SNMP) is but a first step in dealing with the complexity of network management. A thorough knowledge of network protocols and network management standards is necessary for any practitioner in this area. This Certificate can be finished completely online.

### Required Courses:

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL5363	Principles of Communication Networks	3
EL5373	Internet Architecture and Protocols (Internet Course)	3
or CS6843	Network Protocols I	3
EL6373	Local and Metropolitan Area Networks	3
CS 6813	Information, Privacy and Security	3
or CS6823	Network Management and Security	3

**Certificate Coordinator:** For further information regarding the Network Management Certificate, contact Professor Yong Liu by e-mail at [yongliu@poly.edu](mailto:yongliu@poly.edu) or by telephone at (718) 260-3959.

---

#### 4. GRADUATE CERTIFICATE IN WIRELESS COMMUNICATION

Wireless telecommunication has experienced remarkable growth since the introduction of cellular telephones. With the licensing by the FCC of spectrum for Personal Communication Services (PCS) and other services such as wireless LANs, wireless Internet, and wireless Personal Area Networks the rate of growth is expected to increase even further. In order to give those with an electrical engineering background the specific knowledge needed to work in this expanding market, Polytechnic has structured a series of four graduate level courses that cover the knowledge needed to compete successfully in this industry. The program consists of one required course and three recommended elective courses. This certificate can be finished completely online.

##### Required Course:

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL6303	Probability Theory	3

##### Elective Courses (choose 3):

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL 5013	Wireless Personal Communication Systems	3
EL 5023	Wireless Information Systems Lab I	3
EL 5033	Wireless Information Systems Lab II	3
EL 6013	Principles of Digital Communications: Modulation & Coding	3
EL 6023	Wireless Communications: Channel Modeling & Impairments Mitigation	3
EL 6033	Modern Wireless Communication Techniques and Systems	3
EL 6063	Information Theory	3
EL 6073	Error Control Coding	3
EL 6753	UHF Propagation for Wireless Systems	3
EL 7023	Space-Time Wireless Communications	3
EL 90x3	Selected Topics in Wireless Communication	3

**Certificate Coordinator:** For further information regarding the Certificate in Wireless Communication, contact Professor Frank Cassara by email at [cassara@rama.poly.edu](mailto:cassara@rama.poly.edu) or by telephone at (631) 755-4360.

#### 5. GRADUATE CERTIFICATE IN POWER SYSTEMS MANAGEMENT

In August 2003, 45 million people in 8 U.S. states and 1 Canadian province experienced the largest electrical blackout in history. Stores were looted, cell phones died, trains stopped running, and water services were disrupted. The incident underscored what professionals in energy industries understand very well: power systems require careful management and thoughtful oversight.

##### Required Courses:

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL 5613	Introduction to Electric Power Systems	3
MG8203	Project Management	3

##### Recommended Elective Courses (Choose 2):

---

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL 6623	Power Systems Economics and Planning	3
MG 8273	Contracts and Specifications	3
EL 9653	Special Tpcs in Power Engineering	3

**Certificate Coordinator:** For further information regarding the Power Systems Management Certificate, contact Professor Dariusz Czarkowski by e-mail at [dczarkow@poly.edu](mailto:dczarkow@poly.edu) or by telephone at (718) 260-3256.

## 6. GRADUATE CERTIFICATE IN POWER ELECTRONICS AND SYSTEMS

With the ever-growing and ever-more critical demand for innovative energy alternatives that integrate with today and tomorrow's power grids, sophisticated power engineers are in high demand. NYU-Poly's unique Power Electronics and Systems Certificate will prepare you for a key role as a power engineer in electric utilities and in the transportation, power equipment, and defense industries.

NOTE: this program is available pending approval by New York State Education Department. The certificate could be a part of the Electrical Engineering, MS degree at NYU-Poly. EL 5613 is a core course in both programs.

### Required Courses:

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL 5613	Introduction to Electric Power Systems	3
EL 5673	Electronic Power Supplies	3

### Recommended Elective Courses (Choose 2):

<u>Course No.</u>	<u>Course Title</u>	<u>Credits</u>
EL 5663	Physics of Alternative Energy	3
EL 5683	Electric Drives Characteristics and Controls	3
EL 6603	Power Electronics	3
EL 6623	Power Systems Economics and Planning	3
EL 6633	Transients, Surges and Faults in Power Systems	3
EL 6643	Relay Fault Protection	3
EL 6653	Power System Stability	3
EL 6663	Distributed Generation Systems	3
EL 6683	Adjustable Speed Drives	3
EL 96X3	Selected Topics in Power Engineering	3

**Certificate Coordinator:** For further information regarding the Power Electronics and Systems Certificate, contact Professor Dariusz Czarkowski by e-mail at [dczarkow@poly.edu](mailto:dczarkow@poly.edu) or by telephone at (718) 260-3256.

---

## IV. DOCTORAL PROGRAM

### 1. GENERAL

Graduate students who have exhibited a high degree of scholastic proficiency and have given evidence of ability for conducting independent research may consider extending their goals toward the doctorate. The degree of Ph.D. is awarded after completing the program of study and research described below, and upon preparation and defense of a dissertation representing an original and significant contribution deemed worthy of publication in a recognized scientific or engineering journal.

### 2. ADMISSION TO PROGRAM

Students entering the doctoral program with a Bachelor's degree must meet the entrance requirements for the Master's program in the appropriate area of concentration and will normally take the qualifying examinations after one year of study at the Polytechnic. Students entering at the Master's level for the Ph.D. in Electrical Engineering program are normally expected to have a Master's in Electrical Engineering. Students with a Master's degree may take the qualifying examinations as soon as they are prepared to do so; however they are expected to take these examinations within the first calendar year. Generally, admission to these Ph.D. programs is conditional on a student achieving a 3.5 grade point average in at least 30 graduate credits. This admission is to enable students to take courses which will prepare them to take the Ph.D. qualifying examinations. Students who want to take the qualifying examinations must apply to the ECE Graduate Committee for permission to do so. Permission will be granted to students whose grade point average is 3.5 or greater at the time the examination will be taken. The program of doctoral study and research actually begins after the candidate passes the departmental qualifying examinations and forms a Guidance Committee (described below).

### 3. QUALIFYING EXAMINATION

The Ph.D. Qualifying Examination is divided into two sections: the Written section (a written examination requiring broad knowledge and problem solving ability at the undergraduate level and requiring preparation at the first year graduate level in several subject areas related to the student's Area of Research Interest--see examples below), and the Concentration or Oral section (an oral examination which concentrates mainly on the student's Area of Primary Research Interest).

Communications  
Computer and Network Architecture  
Controls and Systems  
Electromagnetics  
Networks  
Power/Power Electronics  
Signal Processing

The Written section will be given in late August or early September of each year and the Oral section in the first week of classes of the Fall semester. A grade-point average of 3.5 or better, with at least one semester of study at Polytechnic, is the normal requirement to sit for the Qualifying Examination. A student who takes the Qualifying Examination for the first time and does not pass, may apply for permission to take the examination one more time. Normally, this permission is granted when the student's first-time performance appears to warrant the second attempt.

If a student does well on the Ph.D. written exam, but fails the Ph.D. oral exam, the department may allow the student to retake the oral exam by itself. However, the department will not allow a student to take the Ph.D. oral exam more than twice, for each time he/she is allowed to take the written exam. Students who are allowed by the department to retake the oral exam must do so by December 31 of the same year. It should be emphasized that the opportunity to retake the oral exam is not guaranteed – it is the exception rather than the rule.

The format of the Qualifying Examination is subject to change from one year to the next. Students should watch for

---

announcements of such changes, which will be made early in the academic year preceding the next offering of the examination.

A student taking the Qualifying Examination must choose one area as the Area of Primary Research Interest. At least one (1) problem from that area must be answered in the Written section of the examination and the Concentration (oral) part of the examination will be on that area. Note that if a student who has passed the Qualifying Examination later wants to change the Area of Primary Research Interest, he/she will be expected to retake portions of the Qualifying Examination: the Oral section almost certainly and the Written section if at least one problem was not solved from the new research area. Application for such a change of Area of Primary Research Interest must be made to the ECE Graduate Committee.

Information about exact examination dates, format, subject areas, etc., and copies of sample questions can be obtained from the ECE Graduate Office.

#### **4. COURSE REQUIREMENTS**

Polytechnic requires that each candidate for the doctorate complete a minimum of 75 credits of academic work beyond the Bachelor's degree, including a minimum of 21 credits of dissertation research. Ph.D. candidates in EE must take a minimum of 42 credits in formal courses (as distinct from "independent study" credits such as reading, project or thesis) as part of this general 75-credits requirement.

The major program of study is developed by the student in consultation with his thesis advisor. The major program should constitute a coherent study in depth of the most advanced knowledge in the student's chosen area of concentration. Attendance at graduate seminars is expected when they are offered in the student's principal area of interest. For candidates in EE, a minimum of 24 course credits in EL courses (past the BS) is required.

Ph.D. candidates in EE are required to take a minimum of 9 credits of courses in a minor area which must be outside EE. The minor must be in an area that is both distinct from, yet consonant with, the student's major area of study. Approval of the minor program is described in Section IV.5.

#### **5. EXAMPLES OF APPROPRIATE MAJOR AND MINOR AREAS FOR THE PH.D. DEGREE**

<u>Major</u>	<u>Minor</u>
1. Communications	1. Computer Science
2. Computer and Network Architecture	2. Mathematics
3. Controls & Systems	3. Physics
4. Electromagnetics	4. Financial Engineering
5. Networks	
6. Power/Power Electronics	
7. Signal Processing	

A student who wishes to work in an area other than one of those listed must request permission to do so from the ECE Graduate Committee before selecting and forming a Guidance Committee.

#### **6. TRANSFER CREDIT**

A student entering with an MS from a reputable graduate program may transfer 30 credits upon evaluation and approval by an ECE Graduate Advisor. Students who have completed graduate courses beyond the master degree at other schools before enrollment at Polytechnic may transfer up to 50 credits towards the Ph.D. degree under certain restrictions listed in the catalog. Application for such transfer should be made in writing to the ECE Graduate Advisor no earlier than July of the year prior to intended graduation. Credits will be allowed only for courses in which B or better grades were received, and only when the student's record at the Polytechnic is a B average (or better) in all graduate courses. All the dissertation research credits (21 credits minimal) must be earned at Polytechnic University. Note that the grades

---

associated with transferred courses are not included in calculating the GPA needed to fulfill the Doctoral program requirement.

## **7. GUIDANCE COMMITTEE**

On passing the qualifying examinations, the graduate student must find a faculty member in the student's area of major research interest who will become the student's thesis advisor. (Please refer to other sections of this Manual for information on current research areas, and research interests of individual faculty members.) Many factors enter into a student's choice of an advisor for his/her Ph.D. research. In addition to the scientific, intellectual and personality factors which influence the pairing of student and professor, financial aspects must also be considered. For most full-time students, the ideal situation is to find an advisor who has a mutually interesting topic, as well as funds available from research grants and contracts which can support the student as a Research Fellow.

Usually, the thesis advisor is a full-time faculty member in the Electrical and Computer Engineering Department and as such is considered chair of the student's Guidance Committee. In cases where a thesis advisor is approved, who is not a member of the Department, then a full-time member of the Department must be included on the Committee and serve as chair.

In consultation with the thesis advisor, the student suggests a Minor Advisor outside of Electrical Engineering and a Guidance Committee composed of three or four members with the thesis advisor usually acting as Chairman. At least one other member of the Guidance Committee must be in the student's area of major research interest. This member may be from outside the Institute. The Minor advisor may, but need not be, a member of the Guidance Committee. The student must submit the names of the members of his Guidance Committee to the ECE Graduate Committee for approval. The Guidance Committee conducts the area examination, thesis defense and approves the final thesis. The thesis advisor approves the major program of study and the Minor advisor approves the minor program. When the requirements for the minor and major are completed the student should have his appropriate advisor certify this in writing to the Office of Graduate Affairs with a copy to the ECE Graduate Office. Guidance Committee appointment form should be obtained from the office of Graduate Center.

## **8. AREA EXAMINATION FOR EE**

The Area Examination consists of a presentation or review by the student of the general background in the problem area the student will be working in. The purpose of the examination is for the student to demonstrate that he/she understands the previous fundamental research of the field in which the student will work. It should be taken early in the Ph.D. program (after no more than 12 thesis credits have been taken) and should not be a review of partial thesis results. It may be in the form of an open seminar which is publicized well in advance to encourage attendance by all interested students and faculty. The Guidance Committee will attend and meet afterward to evaluate the student's performance and assess whether the student demonstrated the depth of knowledge and understanding necessary to carry out research in the area of major research interest.

Postponement of the examination beyond registration for 12 credits of thesis requires the approval of the ECE Graduate Committee. Permission for thesis registration beyond 12 credits may be denied in the absence of completion of the Area Exam.

## **9. REGISTRATION FOR PH.D. DISSERTATION CREDITS**

After passing the qualifying exams, and with the agreement of the Thesis Advisor, the Ph.D. candidate may begin registration for dissertation credits EL 999x. (Requests for exceptions to this precondition should be addressed to the ECE Graduate Committee. The student's failure to abide by this rule may result in loss of credit for the dissertation registration.) A student may register EL999x (x indicates the course is variable credits) in multiples of 1.5 credits each semester, usually not exceeding 9 credits each semester. A minimum of 21 credits is required for the Ph.D. degree. The student must register for thesis continuously, every Fall and Spring semester, unless a Leave of Absence has been granted by the Office of Graduate Studies. The student must be registered for thesis credits in the semester in which the final thesis defense examination is taken.

---

## **10. SUBMISSION OF THE THESIS AND FINAL EXAMINATION**

Upon completion of the doctoral dissertation, the candidate will submit to an oral defense of the thesis. The examination is conducted by the Guidance Committee, but is open to all members of the faculty, and any other appropriate persons who may be invited. Copies of the dissertation will be made available to prospective examiners at a reasonable time in advance of the examination. The Guidance Committee Chairman will notify the Office of Graduate Studies of the candidate's readiness to submit to examination. This should be done at least two weeks prior to the date selected, in order to allow time for the scheduling and public notification of the final examination date. In addition, the student is advised to consult the Office of Graduate Studies in order to meet the requirements and adhere to the regulations on the submission of the final manuscript (reproduction, binding, etc.)

## **11. SEMINAR ATTENDANCE REQUIREMENT**

Ph.D students are required to register for a 0-credit Research Seminars course (EL9900) for at least 4 semesters. Satisfactory grade is given only if the student attends more than 2/3 of the seminars offered in a semester. Part-time students who have difficulty attending the seminar because of work conflict may be exempted from this requirement upon approval of a Graduate Advisor.

## **12. PUBLICATION REQUIREMENT**

To be granted the Ph.D degree, a Ph.D candidate must have at least one submitted journal paper on the thesis research subject. Documentation in the form of a letter of submission to a refereed journal, and acknowledgment of its receipt by the journal, will constitute the required evidence.

## **13. FULL-TIME STUDY FOR PH.D. DEGREE**

Full-time status is defined as 9 or more credits per semester (Fall and Spring) of coursework. After passing the Ph.D. qualifying exam, a student can maintain full-time status by taking 3 or more credits per semester (Fall and Spring).

If the first semester of study is also the student's first semester in an English-speaking country, then a 6-credit load is allowed as full-time status for that semester only, but if and only if the student is enrolled in a Polytechnic-approved English language course during the semester. This course need not be at Polytechnic, but must be approved by the International Student Adviser. Further, the course need not be for credit.

International students must maintain a valid I-20. If the purpose of the study shifts from M.S. to Ph.D., an appropriate I-20 must be sought.

A Ph.D. student, including international student, who has completed all credits toward the degree but has not completed the actual dissertation, is allowed to take two semesters of "maintenance of study" (RE 8880 course) to fulfill the Full Time Equivalency (FTE). This course (1) carries no credit, (2) attests that the student is pursuing full-time work on the dissertation, and (3) involves no tuition payment, but fees are required. Students who plan to take RE 8880 course should complete the application form of FTE available from the Office of Academic Affairs. (NOTE: This policy may change)

Exceptional and rare cases may require additional semesters of "maintenance of status". This requires the approval of the Department Head, Dean, and International Student Advisor (if applicable). (NOTE: This policy may change)

## **14. TIME LIMIT FOR PH.D. PROGRAM**

Full-time students are allowed no more than 6 calendar years (twelve semesters, including intervening summers) to complete the degree, counted from the time of admission to the Ph.D. program. Part-time students are expected to complete all work for the doctorate within six (6) years of passing the Qualifying Examination. In exceptional and rare cases, the duration of the Ph.D. study can be extended upon departmental approval. Any student who exceeds the time limit may be required to retake and pass the advanced portion of the Qualifying Examination in order to continue his/her

---

doctoral program.

## **15. LEAVE OF ABSENCE**

All students, part-time or full-time, must be registered each semester (Fall, Spring) or must seek prior approval for a leave of absence. In emergency situations, permission can be requested after the fact, for no more than one semester.

Any student who is not registered for two consecutive semesters and who did not have prior approval for leaves of absence is automatically terminated at the university. Such students may re-apply at a future time. However, as is present practice, such students are governed by the catalog and rules in effect at the time of re-admission (if granted).

Leaves of absence can be approved for such reasons as medical conditions (all students) or work obligations (not international students) or purely personal reasons (one semester, not international students).

Final approval of leaves of absence is done by the Office of Student Affairs. The recommendation of the adviser is given considerable weight. Documentation is sometimes required.

---

## V. Scholarships and Financial Aid

The Electrical and Computer Engineering Department gives financial aid to graduate students in the form of research and teaching assistantships for qualified graduate students working toward the MS or PhD degrees. Other scholarship aid are available through the University Graduate Center in the form of the Dean's Research Assistantship (DRA) and Graduate Student Employment and Training (GSET).

### Types of Scholarships and Aid

[Teaching Assistants](#)

[Graduate Research Assistantships in Telecommunications](#)

[Research Assistants](#)

[Graduate Student Employment and Trainings](#)

[Teachers Aide](#)

#### 1. Teaching Assistants

Students receiving this award are expected to perform teaching duties that may include one laboratory section per semester in addition to research work supervised by a faculty advisor. The applicant must be a full-time MS or PhD candidate. The compensation for the teaching assistants includes a stipend for 9 months in addition to Full Tuition Remission Scholarship for up to 9 credits per semester. This award is given to current masters and PhD students with excellent academic credentials.

#### 2. Graduate Research Assistantships in Telecommunications

The New York State Center for Advanced Technology in Telecommunications (CATT) invites applications for graduate research assistantships for new entering students interested in pursuing PhD's in the area of telecommunications and distributed information systems. The areas of research at CATT include:

- High Speed Networks
- Wireless Networks
- Network Security
- Multimedia Communications
- Distributed Information Systems

Students with excellent academic credentials are invited to apply. The assistantship offers a stipend and free tuition for a period of one year. Interested students should apply for admission either in the Electrical and Computer Engineering Department or the Computer and Information Science Department at Polytechnic Institute of NYU. The GRE is a requirement for all foreign applicants. For more information call (718) 260-3050 or send e-mail to: [apply@catt.poly.edu](mailto:apply@catt.poly.edu)

#### 3. Research Assistants

This award is paid from research contracts and grants obtained by individual ECE faculty. Faculties have full autonomy in appointing their Research Assistants. Faculties are generally reluctant to fund Research Assistants from their grants unless the student has been in their classes, and has passed the doctoral qualifying examination. However, exceptions may be made for outstanding applicants, and applicants are encouraged to contact faculty in their area(s) of interest. The assistantship covers a monthly stipend (commensurate with the student qualification) and waiver of tuition and fees.

#### 4. Graduate Student Employment and Training

GSET students can work up to a maximum of 300 hours a semester at \$10/hr. The student must be a full time graduate student. GSETs may work in the academic or administrative field in the department. For more information, please see <http://www.poly.edu/admissions/financial/employment>.

---

## 5. Teachers Aide

The ECE department hires qualified graduate students as Teachers Aide for teaching undergraduate and graduate laboratory sessions. The compensation for Teachers Aide is shown in the below table. These positions are open only for current students who have excellent academic records and demonstrated good teaching skills. Openings for these positions vary from semester to semester. Interested students should contact the faculty in charge of hiring directly.

<b>Position</b>	<b>Responsibilities</b>	<b>No. of hours/week</b>	<b>Pay/semester</b>
Lab Instructor	Present an introduction at the start of each lab session to highlight background information, relevancy of the lab exercise to course material, and problems students may encounter during the lab. Also act as a liaison to make sure the Lab Exercise is concurrent with the course lecture.	3 1.5	\$3,000.00 \$1,800.00
Lab Lecturer	Prepare and present lectures and tutorials relating to laboratory course material.	0.5	\$600.00
Recitation	Review the lecture, expand on the concepts, and carry a discussion with the students. Perform derivations or solve problems similar to those assigned to the students.	1	\$420.00
Office Hours	Reinforce any questions relating to the course.	1	\$140.00
Grading	Evaluate and grade home work.	Per Student	\$20.00 per hour

## VI. TRANSITION POLICY FOR STUDENTS ENROLLED BEFORE FALL 2007

The curriculum requirements described in this graduate student manual are the credit-based requirements. For students who have entered before Fall 2007 and have taken some courses in units, please review the following transition policy.

### 1. SPECIAL VARIABLE CREDIT GUIDED STUDY COURSES TO HELP YOU EARN EXACTLY 30 CREDITS (FOR MS STUDENTS)

For students who entered before Fall 07, depending on how many credits you have completed, the remaining number of credits may not be multiples of 3 credits. If you wish to take exactly 30 credits upon graduation, you can choose to take a specially designed variable credit course which can be registered in multiples of 0.5 credits. Please note that you should plan to complete the variable credit course before Fall 2009, preferably sooner, as the university plans to discontinue the offering of such courses by that time.

The following conversion table shows how many courses (full, 3 credit courses, plus remaining variable credits) a student would have to take to complete the MS degree as a function of the number of units completed until the beginning of the Fall 2007 semester.

At Start of Fall 2007						
Full (3-Unit) Courses Completed	Current Units Completed	Current Units Remaining	New Credits Remaining	Full (3-Credit) Courses Remaining	Variable Credit Remaining	
0	0	36	30.0	10	0.0	
1	3	33	27.5	9	0.5	
2	6	30	25.0	8	1.0	
3	9	27	22.5	7	1.5	
4	12	24	20.0	6	2.0	
5	15	21	17.5	5	2.5	
6	18	18	15.0	5	0.0	
7	21	15	12.5	4	0.5	
8	24	12	10.0	3	1.0	
9	27	9	7.5	2	1.5	
10	30	6	5.0	1	2.0	
11	33	3	2.5	0	2.5	
12	36	0	0.0	0	0.0	

The following table offers some examples for students who have taken a combination of ePoly and regular courses, where currently each ePoly course carries an academic load of 3.6 units and will remain unchanged in the new system, i.e., each will carry an academic load of 3 credits (ePoly is effectively following the new system since its inception):

At Start of Fall 2007		Current Units Completed	Current Units Remaining	New Credits Remaining	Full (3-Credit) Courses Remaining	Variable Credit Remaining
Full Courses Completed	Reg					
	ePoly					
1	1	6.6	29.4	24.5	8	0.5
2	1	9.6	26.4	22.0	7	1
2	2	13.2	22.8	19.0	6	1
2	3	16.8	19.2	16.0	5	1
3	1	12.6	23.4	19.5	6	1.5
3	2	16.2	19.8	16.5	5	1.5
3	3	19.8	16.2	13.5	4	1.5
4	1	15.6	20.4	17.0	5	2
4	2	19.2	16.8	14.0	4	2
4	3	22.8	13.2	11.0	3	2
4	4	26.4	9.6	8.0	2	2
5	1	18.6	17.4	14.5	4	2.5
5	2	22.2	13.8	11.5	3	2.5
5	3	25.8	10.2	8.5	2	2.5
6	1	21.6	14.4	12.0	4	0
6	2	25.2	10.8	9.0	3	0
6	3	28.8	7.2	6.0	2	0
6	4	32.4	3.6	3.0	1	0

Please note that Ph.D students can also choose to register such courses to make up to exactly 75 credits.

## 2. HOW TO REGISTER FOR A VARIABLE CREDIT COURSE

Following the university wide convention, the variable credit guided study courses offered by ECE department are given the following numbers:

EL6005 (0.5 credit)                      EL6010 (1.0 credit)  
 EL6015 (1.5 credit)                    EL6020 (2.0 credit)  
 EL6025 (2.5 credit)

These courses will be counted towards free electives.

To register for 2.0 credits or 2.5 credits (EL60XY, XY=20 or 25), you should plan on doing an independent guided study (project or reading) with a professor (option 1). You must speak to a professor in advance to get the commitment from the professor to advise you on this course. The amount of work to be conducted should be commensurate with the number of credits you register. The professor must sign for your registration of EL60XY and is responsible for giving you the grade. As an alternative (option 2), you could also take a regular 3.0-credit EL course (say EL6113) and participate fully in the course, but register for EL60XY and pay only for 2.0 or 2.5 credits. But you must get the approval in advance from the instructor teaching, say, EL6113, and the instructor will give you grade for EL60XY based on your performance in EL6113.

To make up 1.5 credits, you may (option 1) choose regular courses in management or financial engineering that are 1.5 credits (these credits will be counted as free electives). (Last digit in the course number will be "1"). There are quite a few 1.5 credit MG and FE courses that are specially designed for engineering students. Alternatively (option 2), you may speak to an instructor of a regular 3-credit EL course (say EL6113) to see whether you can attend the course up to the midterm to earn 1.5 credits. If the instructor agrees, you will register the variable credit course EL6015 and the instructor for EL6113 will give you a grade for EL6015 based on your half-semester performance in EL6113. Finally (option 3) you can choose to do an independent guided study for 1.5 credits upon approval by an advisor.

To make up 0.5 or 1.0 credits, you may do extra work in a course that you register in the same semester (option 1). For example, if you register for a regular 3-credit course, say EL6113, you can speak to the instructor for EL6113 to see whether you can do additional work in that course that can be counted towards 0.5 or 1.0 credits. This typically can be in the form of mini-project, extra reading and giving presentation or report, computer programming assignment, etc. If the

---

instructor agrees, you must register for the variable credit course (EL60XY, XY=05, 10). The instructor will give you grades for EL6113 and EL60XY separately. Alternatively (option 2) you could do an independent guided study for 0.5 or 1.0 credit upon approval by an advisor.

Note that if you need X.Y credits, it is preferred that you take one guided study course to make up exactly X.Y credits. But if, based on consultation with a graduate advisor or for some other logistic reasons, you prefer to take the guided study course more than once, with total credits X.Y, it is acceptable. For example, if you are missing 2.0 credit, you could take a 1.5 credit course and a 0.5 credit, or other combinations.

### **3. CERTIFICATE REQUIREMENTS FOR CURRENT STUDENTS**

Current policy requires 5 courses at 3 unit each= 15 units=12.5 credits. New policy (effective Fall 07) requires 4 courses at 3 credit each=12 credits. If a student applying for certificate has any course in 3 units, the student must complete at least 12.5 credits including at least 4 courses specified in the revised 12 credit certificate program, and possibly some variable credit reading/project courses related to the certificate that is approved by the certificate director.

Note that students who are in regular MS programs will be likely to take all 5 courses, exceeding the 12.5 credit requirement.

### **4. PH.D. STUDENT MINOR REQUIREMENT**

Current policy requires a Ph.D student to take at least 4 courses from a minor area at 3 unit each=12 unit=10 credits. New policy requires 3 courses at 3 credit each = 9 credits. For any student graduating Fall 07 or after, we will require at least 3 courses (either offered in 3 units or 3 credits) in a minor area.

Note that this means that some current students may have only 9 units in minor upon graduation. This is acceptable as a minimal requirement. A Ph.D advisor may ask the student to take more courses in a minor area if he/she feels that is beneficial for the student.

### **5. PH.D. STUDENT SEMINAR ATTENDANCE REQUIREMENT**

Current policy does not have seminar requirement. New policy requires a Ph.D student to register and pass the 0 credit seminar course (EL9900) at least 4 semesters. (a student must attend  $\geq 2/3$  of seminars in a semester to pass).

Current students (entered before Fall 07) who will graduate in Spring 08 or after must register and pass EL9900 for at least 2 semesters. For students graduating Fall 07 or before, seminar requirement does not apply. For students entering Fall 07 or after, the 4 semester rule apply.

For part-time Ph.D students, who have difficulty to attend the seminars, this requirement can be waived. The waiver needs to be approved by the Chair of the ECE Graduate Curriculum and Standards Committee. The student should submit the approval note when applying for graduation.

All Ph.D advisors must state whether the seminar requirement is satisfied when approving Ph.D graduation, or say the requirement is waived with the attached approval for waiver.

### **6. FULL TIME EQUIVALENCY AND MAINTENANCE OF STUDY**

Full time status for graduate students will be conferred to those students taking 9 credits per semester. For doctoral students who have passed all the qualifying exams as specified by their department, the full time load will be 3 new credits per semester.

Ph.D students who have completed the required number of credits for the Ph.D degree may register the 0-credit maintenance of study course (RE8880) for most two semesters. Note that this policy may change.

## VII. ECE GRADUATE COURSE LISTING

<u>Course Number and Title</u>	<u>Prerequisites</u>	<u>Course Director</u>	<u>Brooklyn Offering Schedule</u>	<u>Old Course Number</u>
EL 5013 Wireless Personal Communications	EE 3404 or equivalent and EL 6303	Prof. David Goodman	F,S	EL501
EL 5023 Wireless Information Systems Lab I	EE 3404 or equivalent	Prof. Frank Cassara	F	EL930
EL 5033 Wireless Information Systems Lab II	EL 5023	Prof. Michael Knox	S	EL933 (special topics)
EL 5123 Image Processing	EE 3054 and MA 3012; MA 2012 or knowledge of basic matrix algebra; C programming skill	Prof. Yao Wang	F	EL512
EL 5143 Multimedia Laboratory	Graduate status or EE 3054 or instructor's permission; co-requisite EE 3404	Prof. Yao Wang	F,S	EL514
EL 5213 Introduction to System Engineering	Graduate Status	Prof. Farshad Khorrami	F	NEW
EL 5223 Sensor Based Robotics	EE 3064	Prof. Farshad Khorrami	S	EL 522
EL 5253 Applied Matrix Theory	MA 2012, MA 2132, MA 2112 and MA 2122	Prof. Zhong-Ping Jiang	F	EL525
EL 5363 Principles of Communication Networks (EL5364, online)	MA 3012 or instructor's permission	Prof. Kang Xi	F,S,X	EL536
EL 5373 Internet Architecture and Protocols (EL5374, online)	EL 5363 or EL 5364 or EE 136	Prof. Yong Liu	F,S,Z	EL537
EL 5463 Introduction to RF/Microwave Integrated Circuits	EE 3604	Prof. Michael Knox	S	EL546
EL 5473 Introduction to VLSI Design	CS 2204 and EE 3114	Prof. Garret Rose	F	EL547
EL 5483 Real Time Embedded Systems	Knowledge of "C" Pascal or other programming language and a basic understanding of computer architecture	Prof. Ramesh Karri	S	EL548
EL 5493 Advanced Computer Hardware Design	CS 1124, CS 2214 and EE 2004	Prof. Ramesh Karri	S	EL549
EL 5513 Electro Optics I	PH 4474 or EE 3604	Prof. Jonathan Chao	F	EL551
EL 5513 Electro Optics II	EL 5513	Prof. Jonathan Chao	as needed	EL 552
EL 5533/PH 5533 Physics of Nanoelectronics	PH 2004 or instructor's permission	Prof. Edward Wolf (PH)	F	EL553/ PH553
EL 5553 / PH 553 Physics of Quantum Computing	PH 2004	Prof. Edward Wolf (PH)		NEW

EL 5613 Introduction to Electric Power Systems	EE 2013	Prof. Zivan Zabar	F	EL561
EL 5663 / PH5 663 Physics of Alternative Energy	PH 2004	Prof. Edward Wolf (PH)		New
EL 5673 Electronic Power Supplies	EE 3824 or equivalent	Prof. Dariusz Czarkowski	S	EL567
EL 5673 Electronic Power Supplies and Controls	EE 3824	Prof. Zivan Zabar	S(Every 2 years)	EL568
EL 5713 Microwave Engineering Laboratory/Project	EE 3604; Co-requisite: EL 5463 or EL 5733	Prof. Nirod Das	as needed	EL970
EL 5733 RF and Microwave Systems Engineering	EE 3604	Prof. Spencer Kuo	F	EL573
EL 5753 Introduction to Plasma Engineering	EE 3604	Prof. Spencer Kuo	as needed	EL575
EL 5813 / BE 6503 Biomedical Instrumentation		Richard Gross (CBS)	S	EL581/ BE650
EL 5823 / BE 6203 Medical Imaging I	CH 6153 or the equivalent background	Prof. Yao Wang	F	EL582/ BE620
EL 6013 Principles of Digital Communications: Modulation and Coding (EL6014, online)	EE 3404 and EL 6303 or equivalent	Prof. Elza Erkip	F	EL601
EL 6023 Wireless Communications: Channel Modeling and Impairment Mitigation (EL6024, online)	EE 3404, MA 3012 and programming skills in MATLAB or equivalent	Prof. I-Tai Lu	S	EL602
EL 6033 Modern Wireless Communication Techniques and Systems (EL6034, online)	EE 3404 and EL 6303	Prof. I-Tai Lu	F	EL603
EL 6063 Information Theory	Graduate status and EL 6303	Prof. Elza Erkip	F	EL606
EL 6073 Error Control Coding (formerly Coding Theory)	Graduate status and basic knowledge of probability and linear algebra	Prof. Andrej Stefanov	S	EL607
EL 6113 Signals, Systems and Transforms (EL6114, online)	Graduate status	Prof. Ivan Selesnick	F,S,X	EL611
EL 6123 Video Processing	Graduate status, EL 6303, and EL 6253	Prof. Yao Wang	S	EL912(Special topics)
EL 6183 Digital signal processing lab	EL 6113 or equivalent	Prof. Ivan Selesnick	F,S	EL912(Special topics)
EL 6213 System Modeling, Analysis and Design	EL 5213	Prof. Farshad Khorrami	S	New
EL 6223 Nonlinear and Sampled-Data Control Systems	Graduate status and EL 6253 and EE 3064 or equivalent	Prof. Zhong-Ping Jiang	S, every two years	EL622
EL 6233 System Optimization Method	Graduate status and EL 5253 or EL 6253	Prof. Zhong-Ping Jiang	S	EL623
EL 6243 System Theory and Feedback Control	Graduate status and EE 3064	Prof. Farshad Khorrami	as needed	EL621
EL 6253 Linear Systems	Graduate status and EE 3054	Prof. Zhong-Ping Jiang	F	EL625
EL 6303 Probability Theory (EL6304, online)	Graduate status and MA 3012	Prof. Unnikrishna Pillai	F,S,Y	EL630

EL 6313	Stochastic Processes	Graduate status and EL 6303	Prof. Unnikrishna Pillai	S	EL631
EL 6333	Detection and Estimation Theory	Graduate status and EL 6313	Prof. Unnikrishna Pillai	F, every 1 to 1.5 years	EL633
EL 6373	Local and Metropolitan Area Network (EL6374, online)	Graduate status and EL 5363 or EL 5364 or EE 136	Prof. Shivendra Panwar	S	EL637
EL 6383	High-Speed Networks (EL6384, online)	Graduate status and EL 5363 or EL 5364	Prof. Kang Xi	S	EL638
EL 6393	Advanced Network Security	CS 6823 or instructor's permission	Prof. Jonathan Chao	F	EL639
EL 6413	Analog and High Frequency Amplifier Design (EL6414 online)	Graduate status, EE 3114 and EE 3124	Prof. Frank Cassara	F	EL641
EL 6423	RF Electronics for Wireless Applications	Graduate status and EL 6413	Prof. Frank Cassara	S	EL642
EL 6433	Digital Integrated Circuit Design	Graduate status and EL 6413	Prof. Frank Cassara	S	EL643
EL 6443	VLSI System and Architecture	EL 5473 or instructor's permission	Prof. Garret Rose	S	EL644
EL 6583	Fiber Optic Communications	PH 4474 or EE 3604	Prof. Spencer Kuo	S	EL658
EL 6603	Power Electronics	Graduate status, EE 3054 and EE 3124	Prof. Zivan Zabar	F, every two years	EL660
EL 6623	Power Systems Economics and Planning	Graduate status and EL 5613	Prof. Dariusz Czarkowski	every three years	EL 662
EL 6633	Transients, Surges and Faults in Power Systems	Graduate status and EL 5613 or equivalent	Prof. Dariusz Czarkowski	F, every two years	EL 663
EL 6643	Relay Fault Protection	Graduate status and EL 6633	Prof. Dariusz Czarkowski	S, every two years	EL664
EL 6653	Power System Stability	Graduate status, EE 3064 and EL 5613	Prof. Zivan Zabar	every two years	EL 665
EL 6663	Distributed Generation Systems	Graduate status, EE 3064 and EL 5613 EE 3824 and EL 5613 or equivalent; co-requisite: EL 6603	Prof. Zivan Zabar	F	EL 666
EL 6683	Adjustable Speed Drives	Graduate status and EE 3824 or equivalent	Prof. Dariusz Czarkowski	Every two years	New
EL 6713	Electromagnetic Theory and Applications	Graduate status and EE 3604	Prof. Nirod Das	F	EL671
EL 6723	Electromagnetic Radiation and Antennas	Graduate status and EL 6713 or EE 3604 with grade B or better	Prof. Nirod Das	S	EL672
EL 6753	UHF Propagation for Wireless Systems	Graduate status and undergraduate electromagnetic course	Prof. Henry Bertoni	as needed	EL675
EL 6823 / BE 6213	Medical Imaging II	EL 5823 / BE 6203	Prof. Yao Wang	S	EL682/BE621
EL 7023	Space Time Wireless Communications	EL 6303 and linear algebra	Prof. Andrej Stefanov	S	EL702

EL 7133 Digital Signal Processing (EL7134, online)	Graduate status and EL 6113 or EL 6114	Prof. Ivan Selesnick	S	EL713
EL 7153 Array Signal Processing	Graduate status, EL 6113 and EL 6313	Prof. S. U. Pillai	every one or two years	New
EL 7163 Wavelet Transforms and Filter Banks (formerly Multiresolution Signal Decomposition: Transforms, Subbands and Wavelets)	Graduate status and EL 7133 or permission from instructor; good knowledge of signals and systems and MATLAB	Prof. Ivan Selesnick	F (every one or two years)	EL716
EL 7253 State Space Design for Linear Control Systems	Graduate status and EL 6253	Prof. Zhong-Ping Jiang	S	EL725
EL 7353 Communication Networks I: Analysis, Modeling and Performance (EL7354, online)	Graduate status, EL 6303 or EL 6304 and EL 5363 or EL5364	Prof. Shivendra Panwar	S	EL735
EL 7363 Communication Networks II: Design and Algorithms	Graduate status and EL 5363 and knowledge of data structures (CS 6033)	Prof. Yong Liu	F	EL736
EL 7373 High Performance Switches and Routers	Graduate status and EL 5363	Prof. Jonathan Chao	S	EL737
EL 8223 Applied Nonlinear Control	Graduate status, EE 3064 and EL 6253 or equivalent	Prof. Zhong-Ping Jiang	F, every two	EL822
EL 8233 Optimal Control Theory	Graduate status, EL 6233 and EL 6253	Prof. Zhong-Ping Jiang	as needed	EL823
EL 8253 Large-Scale Systems and Decentralized Control	Graduate status and EL 7253 or instructor's permission	Prof. Farshad Khorrami	F, every two years	EL825
EL 9013-9093 Selective Topics in Wireless Communications	Specified when offered			EL901-909
EL 9113-9193 Selected Topics in Signal Processing	Specified when offered			EL911-919
EL 9213-9293 Selected Topics in Control Engineering	Specified when offered			EL921-929
EL 9313-9393 Selected Topics in Telecommunications and Networking	Specified when offered			EL931-939
EL 9413-9493 Selected Topics in Computer Electronic Devices and Systems	Specified when offered			EL941-949
EL 9513-9593 Selected Topics in Electro-Optics, Quantum Electronics and Material Science	Specified when offered			EL951-959
EL 9613-9693 Selected Topics in Power Engineering	Specified when offered			EL961-969
EL 9713-9793 Selected Topics in Electrodynamics, Wave Phenomena and Plasmas	Specified when offered			EL971-979
EL 9900 Seminar in Electrical and Computer Engineering				New

EL 9933/9943 Readings in Electrical Engineering I/II	Degree status			EL993-994
EL 9953 Advanced Projects I	Degree status			EL995
EL 9963 Advanced Projects II	Degree status			EL 996
EL 997x Thesis for Degree of Master of Science in Electrical Engineering, Computer Engineering, Electrophysics, or System Engineering	Degree status			EL997
EL 999x Dissertation for Degree of Doctor of Philosophy in Electrical Engineering	Passing Qualifying Examination			EL999

---

## VIII. FACULTY ROSTER BY AREAS OF SPECIALIZATION IN ELECTRICAL AND COMPUTER ENGINEERING (ECE)

### ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT

#### Systems and Signal Processing

Zhong-Ping Jiang, Ph.D.  
Professor

#### Specialization

Nonlinear Control Systems

Farshad Khorrami, Ph.D.  
Professor

Control Systems and Robotics

S. Unnikrishna Pillai, Ph.D.  
Professor

Signal Processing, Spectrum Estimation,  
System Identification

Ivan W. Selesnick, Ph.D.  
Associate Professor

Signal Processing, Wavelet-Based DSP

Yao Wang, Ph.D.  
Professor

Image and Video Processing,  
Pattern Recognition

Dante Youla, MS  
University Professor

Networks, Control Systems,  
Signal Processing

Matthew S. Campisi,  
Industry Assistant Professor

Signal Processing and Communication

#### Fields and Waves

#### Specialization

David C. Chang, Ph.D.  
Professor

Electromagnetic Theory, MMIC

Nirod Das, Ph.D.  
Associate Professor

MMIC, Antennas, Microwave Photonics

Spencer Kuo, Ph.D.  
Professor of Electrophysics

Magnetohydrodynamics, Plasmas

Theodore Tamir, Ph.D.  
University Professor

Electromagnetics, Electro-optics

Henry L. Bertoni, Ph.D.  
Professor Emeritus

Propagation for Wireless Communication

#### VLSI, Electronics and Power

#### Specialization

Frank A. Cassara, Ph.D.  
Professor

Electronic Circuits,  
Wireless Communication Systems

Jonathan Chao, Ph.D.  
Head, ECE Dept. Professor of Computer Engineering

High-Speed Routers,  
Network Security

Dariusz Czarkowski, Ph.D.  
Associate Professor

Power Electronics, Power Quality,  
Electric Power Systems

---

Ramesh Karri, Ph.D.  
Professor

CAD, Configurable Computing,  
Hardware-Software Codesign,  
VLSI Testing

Zivan Zabar, Sc.D.  
Professor

Electric Power Systems and Devices,  
Electromagnetic Propulsion

Garret Rose, Ph.D.  
Assistant Professor

VLSI, Nanotechnology

Hai Li, Ph.D  
Assistant Professor

VLSI

### **Telecommunications and Wireless**

### **Specialization**

Elza Erkip, Ph.D.  
Associate Professor

Wireless Communications,  
Communication and Information Theory

David J. Goodman, Ph.D.  
Professor, Emeritus

Wireless Networks

I-Tai Lu, Ph.D.  
Professor

Wave Propagation, Underwater  
Acoustics, Wireless Communications

Shivendra S. Panwar, Ph.D.  
Professor

Telecommunication Network  
Design and Modeling

N. Sertac Artan, Ph.D  
Industry Associate Professor

Network Security

Peter VOLTZ, Ph.D.  
Associate Professor

Communications, Signal Processing

Yong Liu Ph.D.  
Assistant Professor

Communication Networks

Kang Xi, Ph.D  
Industry Associate Professor

Communication Networks

Michael Knox, M.S.  
Industry Associate Professor

Wireless Communications and Analog  
Circuits

Thanasis Korakis, PhD  
Research Assistant Professor

Communication Networks

Yang Xu, Ph.D  
Research Professor

Network Security, High-Speed Router Design,  
Network-on-Chip, Network Processors

Sundeep Rangan, Ph.D  
Associate Professor

Wireless communications, Information Theory,  
Signal Processing

---

## IX. GRADUATE STUDENT ADVISORS

### Graduate Program Coordinator & Advisor:

Prof. X. K. Chen	xkchen@poly.edu	LC205	718-260-3056
------------------	-----------------	-------	--------------

### Electrical Engineering:

Prof. Yao Wang (Signal Proc)	yao@poly.edu	LC256	718-260-3469
------------------------------	--------------	-------	--------------

Prof. Dariusz Czarkowski (Power)	dcz@poly.edu	LC226	718-260-3256
----------------------------------	--------------	-------	--------------

### Computer Engineering:

Prof. Ramesh Karri	ramesh@duke.poly.edu	LC254	718-260-4011
--------------------	----------------------	-------	--------------

### Telecommunication Networks:

Prof. Yong Liu	yongliu@poly.edu	LC258	718-260-3959
----------------	------------------	-------	--------------

### Systems Engineering

Prof. Zhongping Jiang	zjiang@control.poly.edu	LC214	718-260-3646
-----------------------	-------------------------	-------	--------------

### Electrophysics:

Prof. Nirod Das	ndas@photon.poly.edu	LC262	718-260-3192
-----------------	----------------------	-------	--------------

### Wireless Innovation:

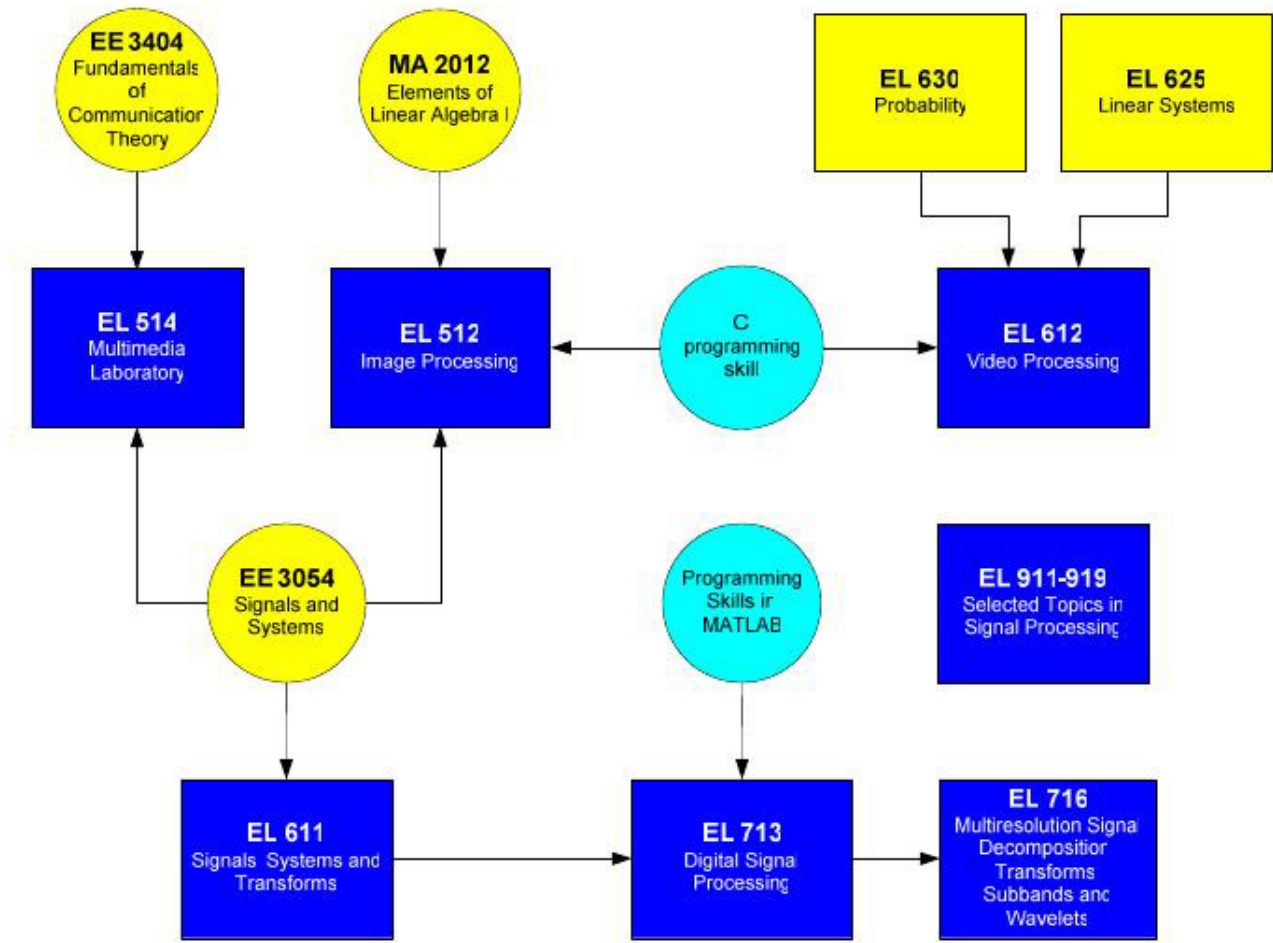
Prof. I-Tai Lu	itailu@rama.poly.edu	LC250	631-755-4226
----------------	----------------------	-------	--------------

For general inquiry and course advising regarding all graduate programs in ECE, please contact Dr. X. K. Chen first. For specific academic questions pertaining to a particular program, please consult faculty advisors listed above.

## X. CATEGORIZATION OF COURSES BY CONCENTRATION

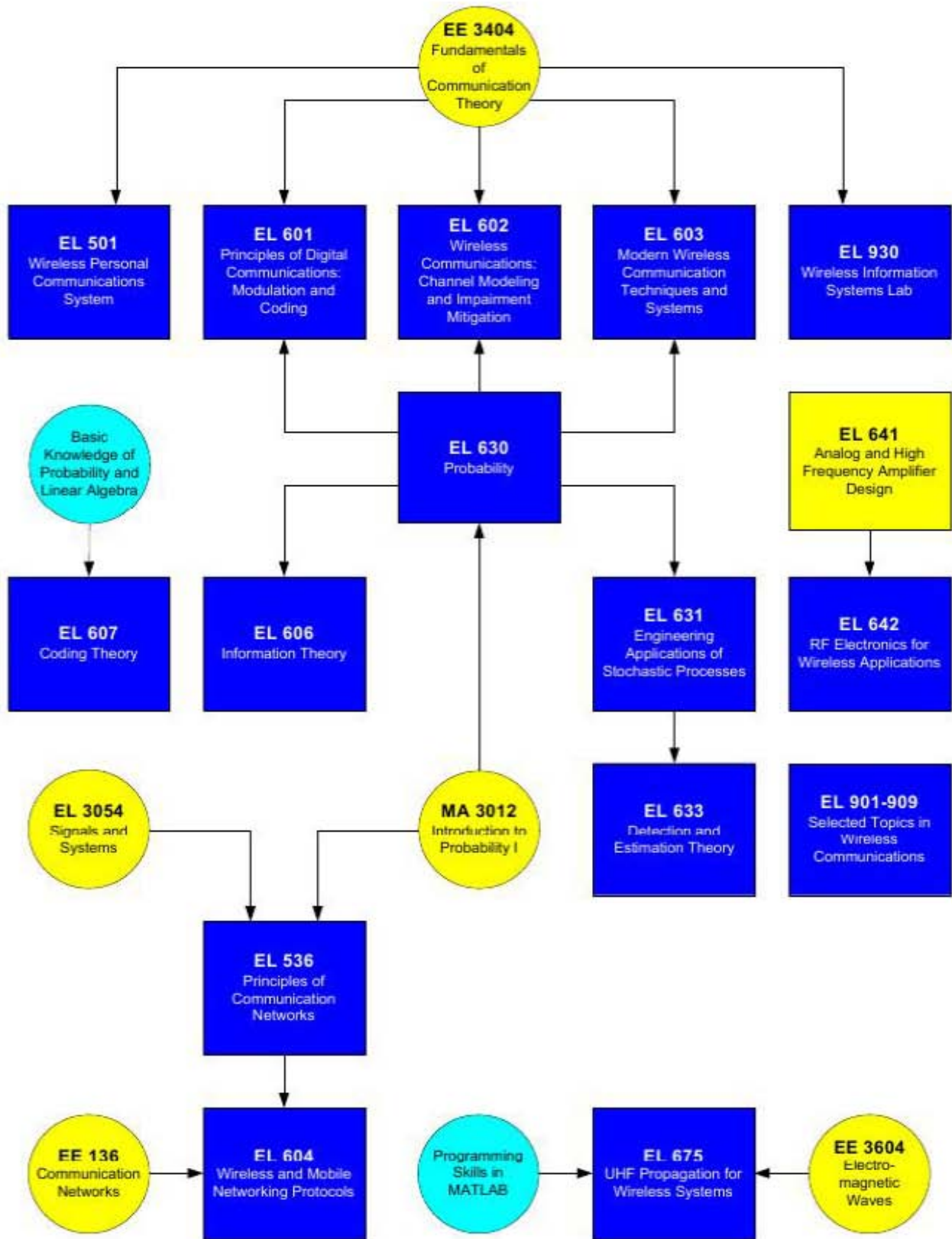
(Please add “3” after every graduate courses number. Use as reference only.)

### Signal Processing



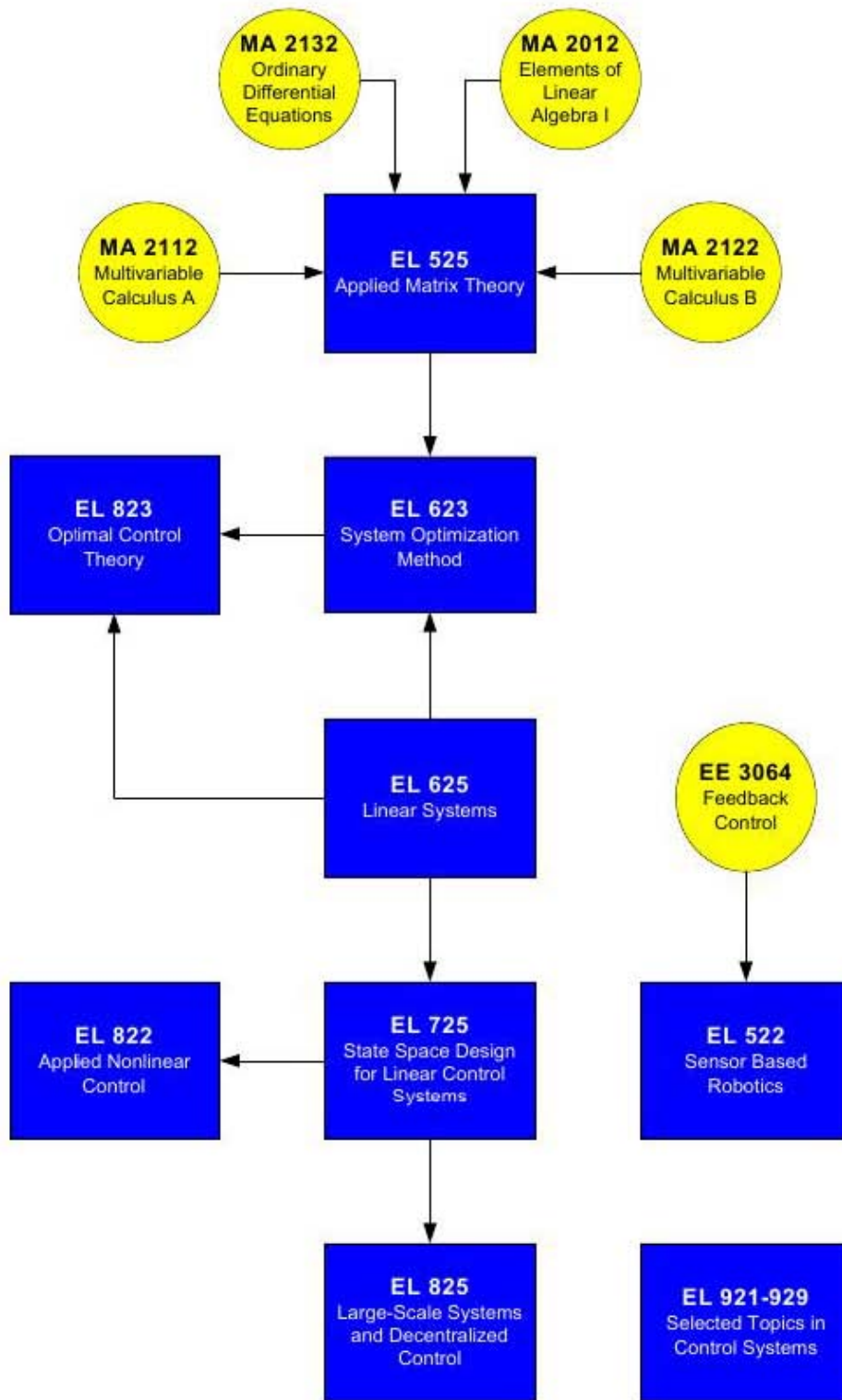
- Graduate Course offered in respective specialization
- Graduate Prerequisite course
- Undergraduate Prerequisite course
- Other Skills required
- Indicates the prerequisites for each course

# Wireless Communication

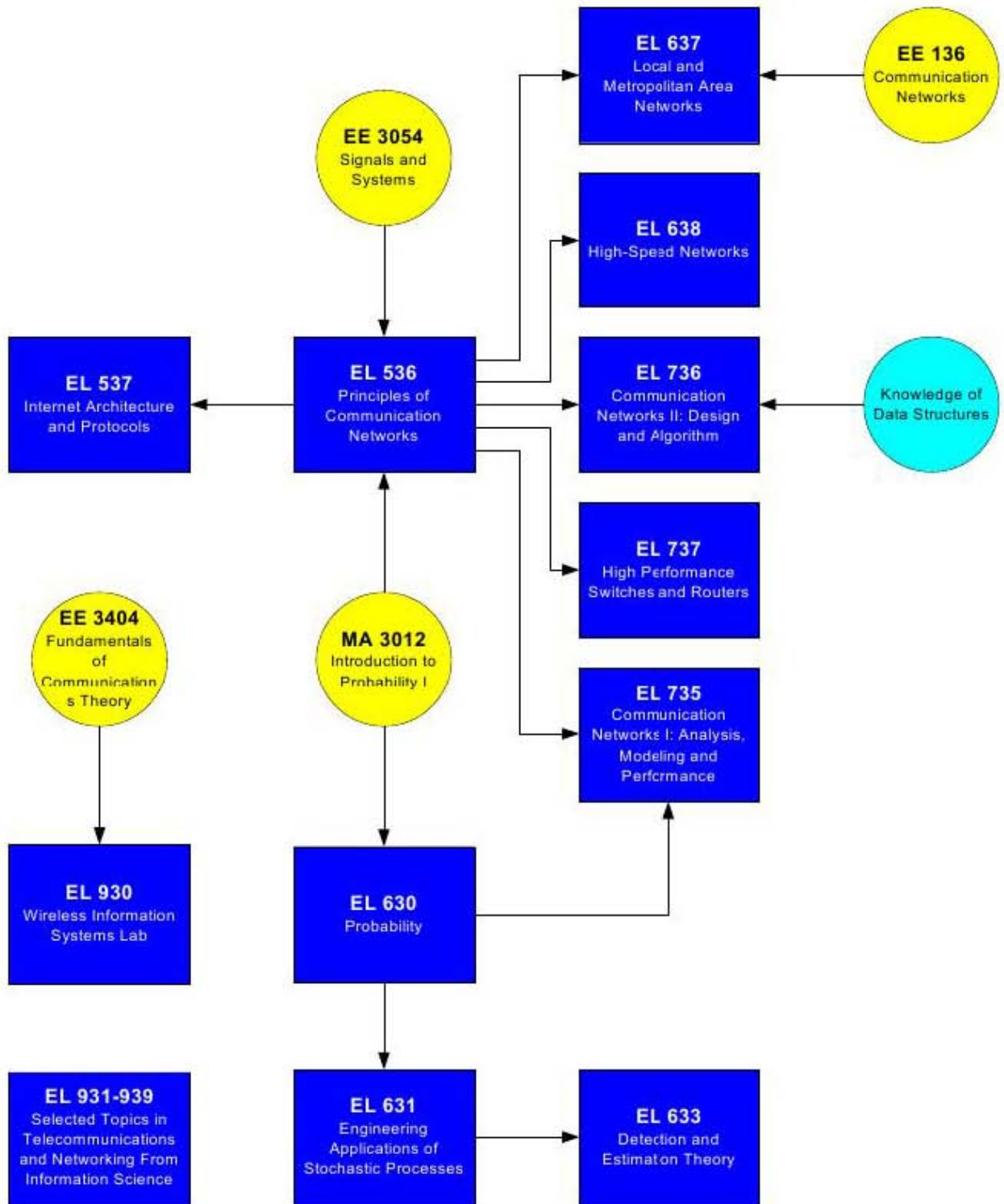


---

# Control Systems

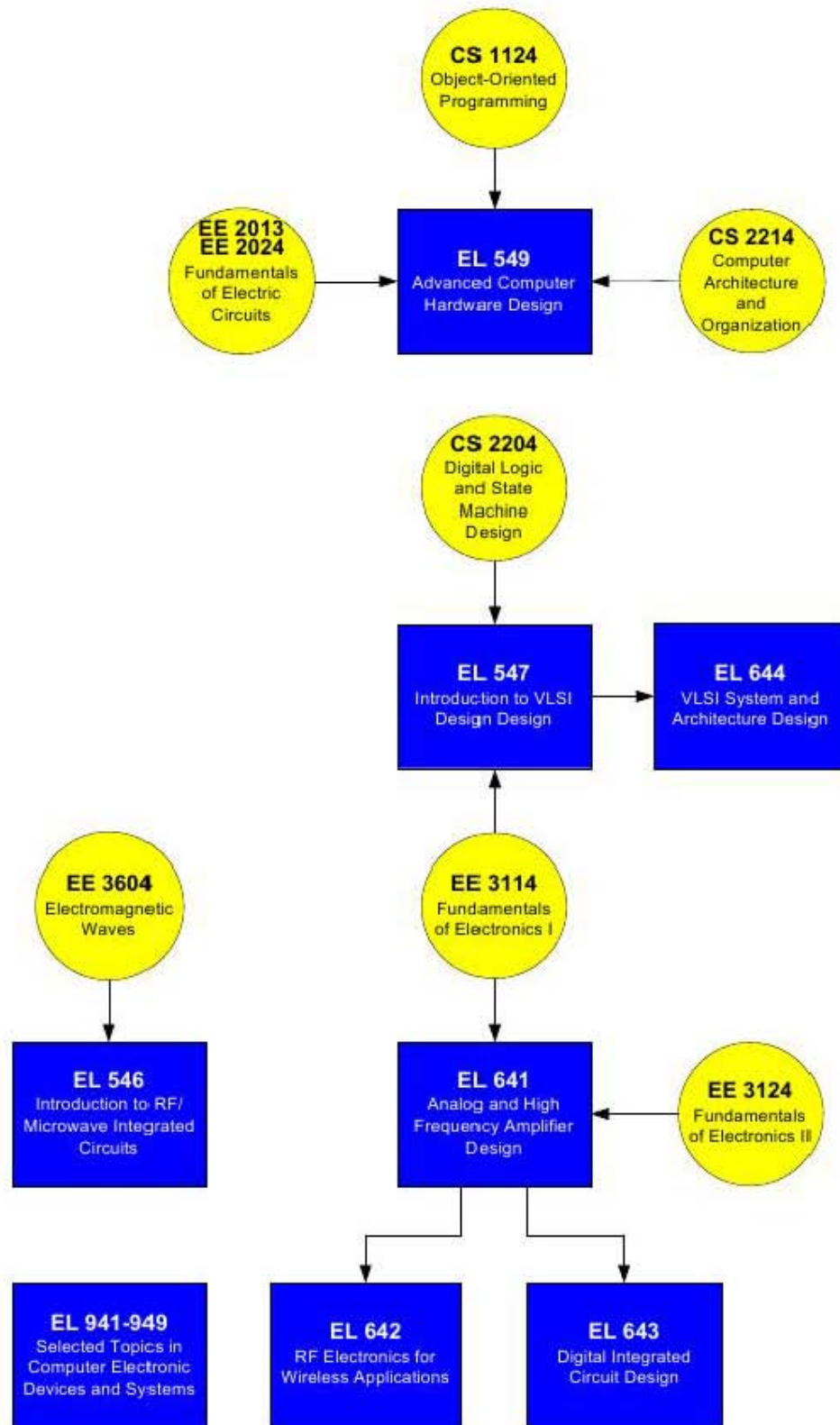


# Telecommunications and Networking



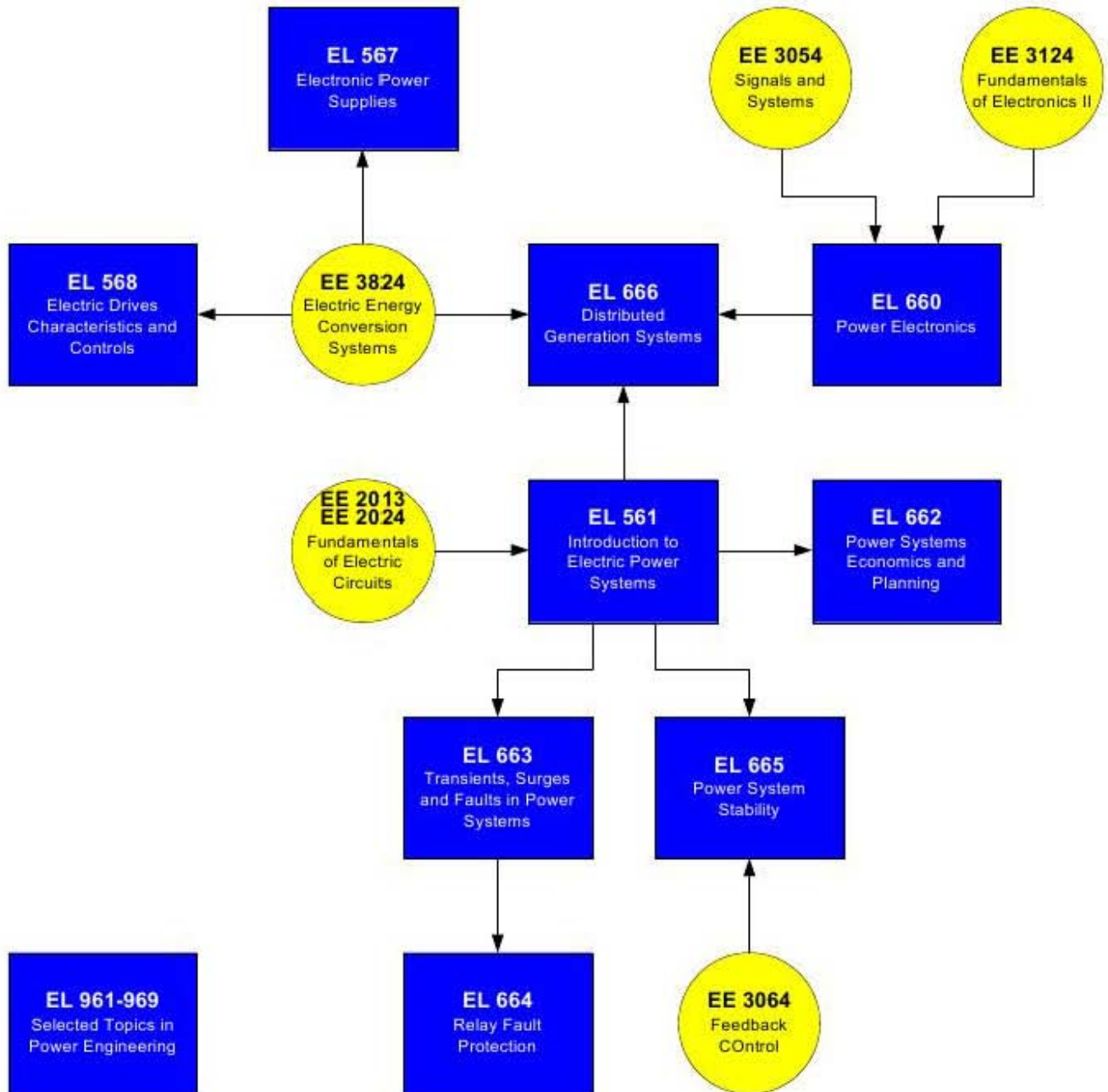
---

# Computer Electronic Devices and Systems



---

# Power Engineering



# Electrodynamics, Wave Phenomena and Plasmas

