



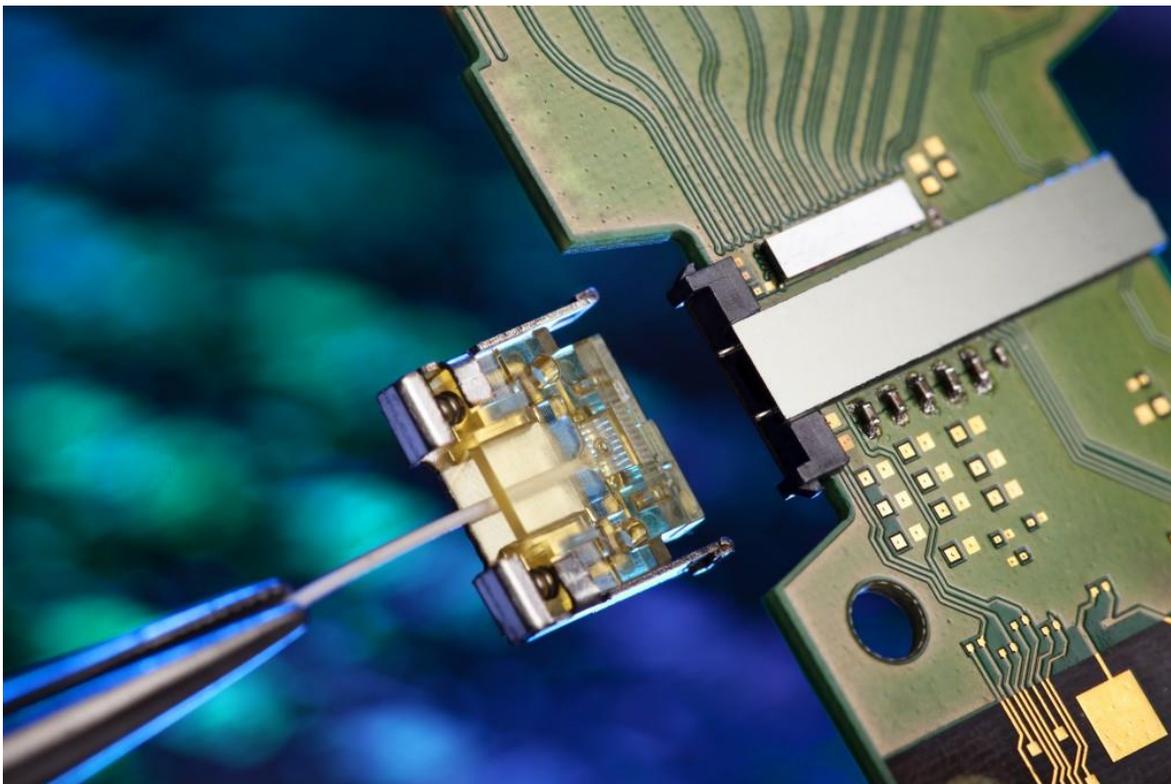
Stony Brook University  
*College of Engineering  
and Applied Sciences*

September 2019

Undergraduate Guide

To

**Electrical Engineering**



Source: Intel



Department of Electrical & Computer Engineering  
Stony Brook University  
Stony Brook, NY 11794-2350

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This guide is to be used as an aid for students planning course sequences within the Electrical Engineering major. All students should consult the **University Undergraduate Bulletin and Bulletin Supplements** for official academic information and regulations.

THE INFORMATION CONTAINED IN THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE

# **1. INTRODUCTION**

Electrical Engineering is one of the CEAS programs leading to the Bachelor of Engineering degree. It is a rigorous four-year program that provides thorough training in the fundamentals of electrical engineering. Beginning in the third year, students may also choose to specialize in either microelectronics or telecommunications. All electrical engineering study culminates in the fourth year in an original design project, working in a team with other students and under the supervision of a faculty member. All students have a faculty advisor who consults with them on course selection, academic progress, and career preparation.

Throughout their program, the students work in state-of-the-art instructional laboratories that include computer-aided circuit design, lasers, machine vision and computer graphics, microprocessor systems design, microwave and RF electronics, digital signal processing and the most up to date electronic communications.

## **Career Opportunities in Electrical Engineering**

Electrical engineering, a professional field since 1884, offers a wealth of career choices. The Institute of Electrical and Electronics Engineers, the largest professional organization in the world, lists over thirty specialized areas, ranging from microwave theory and techniques, instrumentation and measurements, and broadcast technology to consumer electronics and engineering in medicine and biology. Current growth areas include telecommunications, signal processing, optoelectronics, microelectronics, pattern recognition, machine vision, artificial intelligence, and robotics.

Electrical engineers are recruited for a variety of fields including energy, aeronautics, communications, testing laboratories, computer technology of hardware and software, and systems for finance and banking. For example, a communications engineer may work on improving communications networks by designing efficient systems for commercial applications, tactical and traffic control systems, or satellite surveillance systems. A circuit design engineer may design, develop, and manufacture electronic circuits for a variety of applications including microcomputers.

Stony Brook electrical engineering students may work as interns in engineering and high-technology industries where they can apply their classroom and laboratory knowledge to real-world practice, gaining those skills as preparation for their careers. Upon graduation they are employed by companies in the New York region and across the nation including BAE Systems, North Atlantic Industries, Omnicon Group, GE Energy, Boeing, Zebra Technologies, National Grid, PSEG, Data Device Corp., Texas Instruments, J.P. Morgan, and Ford Motors. Many students also choose to continue to pursue graduate degrees in engineering, business, law or medicine.

## **ECE Mission and Needs of Constituencies:**

The ECE Department seeks to educate engineers who will possess the basic concepts, tools, skills, and vision necessary to maintain the technological and economic competitiveness of United States.

The department achieves this through a balance of required courses and judicious choices of technical electives in three stages of undergraduate studies in electrical and computer engineering. The first teaches students basic mathematics and science; the second teaches the fundamental techniques of analysis and design of systems; and the third teaches in depth some specialized areas of electrical and computer engineering through choices of technical electives taken during the junior and senior years.

The mission of the ECE Department continues a tradition of excellence by honoring our commitments to students, faculty, alumni, and the University. More specifically, for our students, we strive:

- To provide undergraduates with the broad education necessary for careers in the public/private sector, or to pursue advanced professional degrees;
- To provide undergraduates with a deep understanding of both fundamentals and contemporary issues in electrical and computer engineering; and
- To engage graduate students with focused instruction and research opportunities for careers in the public/private sector.

For our faculty, we strive to

- provide support and resources for them to develop as dedicated scholars, devoted educators, and innovative researchers so that they may enjoy long fulfilling, and challenging careers; and
- support a collegial environment rich with autonomy, teamwork, discourse, and inquiry.

For our alumni, we strive to:

- maintain productive ties to enhance their opportunities for lifelong learning and leadership, as well as to benefit from their skills, knowledge, and experience.

For the University, we strive to:

- work towards our goals of supporting a challenging and engaging community and to enhance the quality of life for all.

Our mission statement has a preamble followed by declarations of four interconnected commitments to the students, faculty, alumni and the University. Furthermore, the needs of industry are implied from the statements of commitments. Therefore, the major constituencies of our program are students, faculty, alumni, and industry.

## **Program Educational Objectives (PEO):**

The electrical engineering program has five program educational objectives (**PEOs**):

**PEO1:** Our graduates should excel in engineering positions in industry and other organizations that emphasize design and implementation of engineering systems and devices.

**PEO2:** Our graduates should excel in the best graduate schools, reaching advanced degrees in engineering and related discipline.

**PEO3:** Within several years from graduation our alumni should have established a successful career in an engineering-related multidisciplinary field, leading or participating effectively in interdisciplinary engineering projects, as well as continuously adapting to changing technologies.

**PEO4:** Our graduates are expected to continue personal development through professional study and self-learning.

**PEO5:** Our graduates are expected to be good citizens and cultured human beings, with full appreciation of the importance of professional, ethical and societal responsibilities.

## **Student Outcomes:**

To prepare students to meet the above program educational objectives (PEOs), a set of student outcomes that describes what students should know and be able to do when they graduate, have been adopted. We expect our graduates to attain:

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

## **2. DEGREE REQUIREMENTS FOR ELECTRICAL ENGINEERING**

Students following a program of study leading to a Bachelor of Engineering must satisfy the general education requirements of the university, as well as, the requirements of the major, which consist of a core of mandatory courses and a set of electives. The B.E. degree program is periodically evaluated by the national Accreditation Board for Engineering and Technology (ABET). This board, comprising various professional engineering organizations, ensures a consistent engineering curriculum throughout the United States. **The B.E. program in Electrical Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.**

### **2.1 ABET Requirements for Electrical Engineering**

ABET requires that students have a sound training in mathematics (including probability and statistics), natural sciences, computer sciences, humanities, social sciences, communication skills, and engineering topics. Engineering topics include engineering science and engineering design. Content of the former category is determined by the creative application of basic science skills, while the content in the latter category focuses on the process of devising a system, or component, or process. Design has been integrated into the four year program, beginning with a freshman course *ESE 123 Introduction to Electrical and Computer Engineering*. This course concentrates on the design issues of real systems through the fabrication of a working prototype. This course also serves as a vehicle for informing the students of the needs for understanding the fundamentals of basic mathematics and sciences. Sophistication in the use of design tools and analytical skills are continuously developed through a series of required courses taken during the sophomore and junior years, culminating in a capstone senior design project.

## 2.2 Stony Brook Curriculum (SBC)

The general education requirements of the University, referred to as the Stony Brook Curriculum (SBC), are summarized in Table 1 and must be satisfied by all students. SBC requirements are divided into four categories: 1) Demonstrate Versatility, 2) Explore Interconnectedness, 3) Pursue Deeper Understanding and 4) Prepare for Life-Long Learning. Category 1 consists of ten areas. Engineering students are exempt from the foreign language requirement (LANG) under this category. By completing the requirements for the electrical engineering major, students meet the requirements of categories 3 and 4. Students should use Table 1 in planning their SBC course assignments.

**Table 1: Stony Brook Curriculum (SBC)  
Requirements for Electrical Engineering Major**

LEVEL	EXAMPLE
<p>1) <b><u>Demonstrate Versatility:</u></b></p> <p><b>WRT:</b> Write Effectively in English  <b>QPS:</b> Master Quantitative Problem Solving  <b>HUM:</b> Address Problems using Critical Analysis and the Methods of the Humanities  <b>SNW:</b> Study the Natural World  <b>TECH:</b> Understanding Technology</p> <p><b>SBS:</b> Understand, Observe, and Analyze Human Behavior and the Structure and Functioning of Society  <b>ARTS:</b> Explore and Understand the Fine and Performing Arts  <b>USA:</b> Understand the Political, Social, and Cultural History of the United States  <b>GLO:</b> Engage Global Issues</p>	<p>WRT 102*  AMS151  ANY  PHY131  ESE123 or  ESE 118  ANY  ANY  ANY  ANY</p>
<p>2) <b><u>Explore Interconnectedness:</u></b></p> <p><b>STAS:</b> Science or Technology and the Arts, Humanities, or Social Sciences</p>	<p>ESE301</p>
<p>3) <b><u>Pursue Deeper Understanding</u></b></p>	<p>ESE440</p>
<p>4) <b><u>Prepare for Life-Long Learning</u></b></p>	<p>ESE441</p>

\* Students are required to complete WRT 101, Introductory Writing Workshop, and WRT 102, Intermediate Workshop A, with a grade of C or higher, or completion of WRT 103, Intermediate Writing Workshop B, with a grade of C or higher.

## 2.3 Checklist For Major Requirements In Microelectronics Track

AMS 151<sup>1</sup> \_\_\_\_\_ (or MAT 131)      PHY 131<sup>2</sup> \_\_\_\_\_ (PHY 125 \_\_\_\_\_ & 133 \_\_\_\_\_)  
 PHY 133 \_\_\_\_\_ (PHY127 \_\_\_\_\_ & 134 \_\_\_\_\_)  
 PHY 132<sup>2</sup> \_\_\_\_\_ OR (PHY126 \_\_\_\_\_)  
 PHY 134 \_\_\_\_\_

AMS 161<sup>1</sup> \_\_\_\_\_ (or MAT 132)

AMS 210 \_\_\_\_\_ (or MAT 211)      AMS 261 \_\_\_\_\_ (or MAT 203)      AMS 361) \_\_\_\_\_ (or MAT 303)

ESE 301 \_\_\_\_\_ (S.B.C. STAS)

ESE 123 \_\_\_\_\_      ESE 124 \_\_\_\_\_      **ESE 211** \_\_\_\_\_

**ESE 118** \_\_\_\_\_      ESE 224 \_\_\_\_\_      **ESE 231** \_\_\_\_\_

**ESE 271** \_\_\_\_\_      **ESE 300** \_\_\_\_\_      ESE 305 \_\_\_\_\_

ESE 306 \_\_\_\_\_      **ESE 311** \_\_\_\_\_      ESE 314 \_\_\_\_\_

ESE 319 \_\_\_\_\_      ESE 324 \_\_\_\_\_      **ESE 330** \_\_\_\_\_

**ESE 337** \_\_\_\_\_      **ESE 372** \_\_\_\_\_      ESE 280 \_\_\_\_\_

**ESE 440** \_\_\_\_\_      **ESE 441** \_\_\_\_\_

Two ESE electives from list<sup>3</sup> (w/C or better) \_\_\_\_\_

Two technical electives<sup>4</sup> from Appendix A: \_\_\_\_\_  
 (one with "C" or better)

Math or science elective<sup>5</sup> \_\_\_\_\_ or \_\_\_\_\_

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All courses in **Bold** must be passed with a minimum grade of **C**

- 1- AMS 151 and AMS 161 can be replaced by (MAT 131 and MAT 132) or (MAT 131 and 171), or (MAT 125, MAT 126 and MAT 127) or (MAT 141 and 142), or (MAT 141 & 171)
- 2- PHY 131/133 and PHY 132/134 can be replaced by (PHY 125, PHY 126 and PHY 127,133,134), or (PHY 141 and PHY 142.). Students taking the three semester sequence should take PHY 125, PHY 127 and PHY 126, in that order.
- 3- Choice of two ESE electives from : ESE 304, ESE325, ESE345, ESE355, ESE366, ESE381
- 4- 2 courses selected from Appendix A.
- 5- Math or Science elective: **one 4-credit course or two three credit courses from** CHE 131(4), CHE141(4), ESG 198(4), BIO202&204, BIO203&205, PHY 251&252(modern Physics), AMS301(3).

**STUDENTS IN THE MAJOR MAY NOT G/PNC MAJOR REQUIRED COURSES**  
**Fall 2019**

## 2.3 Recommended Course Sequence: Microelectronics

	<u>FALL</u>	Credits	<u>SPRING</u>	Credits
Freshman	<b>AMS 151</b> <sup>1</sup> Calculus I or MAT 131	3-4	<b>AMS 161</b> <sup>1</sup> Calculus II or MAT 132	3-4
	<b>PHY 131/133</b> <sup>2</sup> Gen. Phys I	4	<b>PHY 132/134</b> <sup>2</sup> Gen. Phys. II	4
	<b>WRT102</b> English Comp	3	ESE 124 Programming Fund.	4
	ESE 123 Electronic Design	4	<b>ESE 118 Digital Logic Design</b>	4
	First year Seminar 101	1	First year Seminar 102	1
		15-16		16-17
Sophomore	AMS 361 Calc. IV(or MAT 303)	4	AMS 261 Calc. III (or MAT 203)	4
	AMS 210 Lin. Alg. (or MAT 211)	3	<b>ESE 372</b> Electronics	4
	<b>ESE 271</b> Elect. Cir.	3	ESE 306 Random Sig. Sys.	4
	ESE 305 Det. Sig. Sys.	3	<b>ESE 231</b> Intro. Sem. Dev.	3
	ESE 224 Com. Tech. for Elec. Des. II	3	<b>ESE 211</b> Elect. Lab. A	2
		16		17
Junior	ESE 280 Embedded Sys.Dsgn.I	4	<b>ESE Elective</b> <sup>3</sup>	3
	ESE 314 Elect. Lab. B	3	ESE 324 Elect. Lab. C	2
	ESE 319 Intro. E&M Fields	3	<b>ESE 300</b> Tec. Com. For ECE	3
	<b>ESE 337</b> Dig. Sig. Proc.	3	<b>ESE 311 Analog Integrated Circuits</b>	3
	<b>ESE 330 Integrated Electronics</b>	3	<b>ESE 301 Eng. Ethics</b> (STAS)	3
		16	HUM Course	3
				17
Senior	<b>ESE 440 Eng. Design I</b>	3	<b>ESE 441 Eng. Design II</b>	3
	<b>ESE Elective</b> <sup>3</sup>	3	<b>Technical elective</b> <sup>4</sup>	3
	SBS Course	3	USA Course	3
	Math or Science Elective <sup>5</sup>	4	Technical elective <sup>4</sup>	3
	ARTS Course	3	GLO Course	3
		16		15

### Total credits 128 - 130

All courses in **Bold** must be passed with a minimum grade of **C**

- AMS 151 and AMS 161 can be replaced by (MAT 131 and MAT 132) or (MAT 131 and 171), or (MAT 125, MAT 126 and MAT 127) or (MAT 141 and 142), or (MAT 141 & 171)
- PHY 131/133 and PHY 132/134 can be replaced by (PHY 125, PHY 126 and PHY 127,133,134), or (PHY 141 and PHY 142.). Students taking the three semester sequence should take PHY 125, PHY 127 and PHY 126, in that order.
- Choice of two ESE electives from: ESE 304, ESE325, ESE345, ESE355, ESE366, ESE381
- 2 courses selected from Appendix A.
- Math or Science elective: **one 4-credit course or two three credit courses from** CHE 131(4), CHE141(4), ESG 198(4), BIO202&204, BIO203&205, PHY 251&252(modern Physics), AMS301(3).

**STUDENTS IN THE MAJOR MAY NOT G/PNC MAJOR REQUIRED COURSES**

**Fall 2019**

## 2.4 Checklist For Major Requirements In Telecommunications Track

AMS 151<sup>1</sup> \_\_\_\_\_ (or MAT 131)      PHY 131<sup>2</sup> \_\_\_\_\_ (PHY 125 \_\_\_\_\_ & 133 \_\_\_\_\_)  
 PHY 133 \_\_\_\_\_ (PHY 127 \_\_\_\_\_ & 134 \_\_\_\_\_)  
 PHY 132 \_\_\_\_\_ OR (PHY 126 \_\_\_\_\_)  
 PHY 134 \_\_\_\_\_

AMS 161<sup>1</sup> \_\_\_\_\_ (or MAT 132)

AMS 210 \_\_\_\_\_ (or MAT 211)      AMS 261 \_\_\_\_\_ (or MAT 203)      AMS 361 \_\_\_\_\_ (or MAT 303)

ESE 301 \_\_\_\_\_ (S.B.C. STAS)

ESE 123 \_\_\_\_\_      ESE 124 \_\_\_\_\_      **ESE 211** \_\_\_\_\_

**ESE 118** \_\_\_\_\_      ESE 224 \_\_\_\_\_      **ESE 231** \_\_\_\_\_

**ESE 271** \_\_\_\_\_      **ESE 300** \_\_\_\_\_      ESE 305 \_\_\_\_\_

ESE 306 \_\_\_\_\_      ESE 314 \_\_\_\_\_      ESE 319 \_\_\_\_\_

ESE 324 \_\_\_\_\_      **ESE 337** \_\_\_\_\_      **ESE 340** \_\_\_\_\_

**ESE 342** \_\_\_\_\_      **ESE 372** \_\_\_\_\_      ESE 280 \_\_\_\_\_

**ESE 440** \_\_\_\_\_      **ESE 441** \_\_\_\_\_

Two ESE electives from list<sup>3</sup>(w/C or better) \_\_\_\_\_

Two technical electives<sup>4</sup> from Appendix A: \_\_\_\_\_  
**(one with "C" or better)**

Math or science elective<sup>5</sup> \_\_\_\_\_ or \_\_\_\_\_

All courses in **Bold** must be passed with a minimum grade of **C**

- 1- AMS 151 and AMS 161 can be replaced by (MAT 131 and MAT 132) or (MAT 131 and 171), or (MAT 125, MAT 126 and MAT 127) or (MAT 141 and 142), or (MAT 141 & 171)
- 2- PHY 131/133 and PHY 132/134 can be replaced by (PHY 125, PHY 126 and PHY 127,133,134), or (PHY 141 and PHY 142.). Students taking the three semester sequence should take PHY 125, PHY 127 and PHY 126, in that order.
- 3- Choice of two ESE electives from: ESE346, ESE347, ESE360
- 4- 2 courses selected from Appendix A.
- 5- Math or Science elective: **one 4-credit course or two three credit courses from** CHE 131(4), CHE141(4),ESG 198(4), BIO202&204, BIO203&205, PHY 251&252(modern Physics), AMS301(3)

**STUDENTS IN THE MAJOR MAY NOT G/PNC MAJOR REQUIRED COURSES**

**Fall 2019**

## 2.4 Recommended Course Sequence: Telecommunications

	<u>FALL</u>	Credits	<u>SPRING</u>	Credits
Freshman	<b>AMS 151<sup>1</sup></b> Calculus I or MAT 131	3-4	<b>AMS 161<sup>1</sup></b> Calculus II or MAT 132	3-4
	<b>PHY 131/133<sup>2</sup></b> Gen. Phys.I	4	<b>PHY 132/134<sup>2</sup></b> Gen. Phys. II	4
	<b>WRT102 English Comp</b>	3	<b>ESE 118 Digital Logic Design</b>	4
	ESE 123 Electronic Design	4	ESE 124 Programming Fund.	4
	First year Seminar 101	1	First year Seminar 102	1
		15-16		16-17
Sophomore	AMS 361 Calc. IV(or MAT 303)	4	AMS 261 Calc. III (or MAT 203)	4
	AMS 210 Lin. Alg.	3	<b>ESE 372</b> Electronics	4
	<b>ESE 271 Elect. Cir.</b>	<b>3</b>	ESE 306 Random Sig. Sys.	4
	ESE 305 Det. Sig. Sys.	3	<b>ESE 231</b> Intro. Sem. Dev.	3
	ESE 224 Com. Tech. for Elec. Des. II	3	<b>ESE 211</b> Elect. Lab. A	2
	16		17	
Junior	ESE 280 Embedded Sys.Dsgn.I	4	<b>ESE Elective<sup>3</sup></b>	3
	ESE 314 Elect. Lab. B	3	ESE 324 Elect. Lab. C	2
	ESE 319 Intro. E&M Fields	3	<b>ESE 300</b> Tec. Com. For ECE	3
	<b>ESE 337</b> Dig. Sig. Proc.	3	<b>ESE 342 Dig. Com. Sys.</b>	3
	<b>ESE 340 Basic Comm. Theory</b>	3	<b>ESE 301 Eng. Ethics (STAS)</b>	3
	16	HUM Course	3	
			17	
Senior	<b>ESE 440 Eng. Design I</b>	3	<b>ESE 441 Eng. Design II</b>	3
	<b>ESE Elective<sup>3</sup></b>	3	<b>technical elective<sup>4</sup></b>	3
	SBS Course	3	USA Course	3
	Math or Science Elective <sup>5</sup>	4	technical elective <sup>4</sup>	3
	ARTS Course	3	GLO Course	3
	16		15	

**Total credits = 128 - 130**

All courses in **Bold** must be passed with a minimum grade of **C**

- 1- AMS 151 and AMS 161 can be replaced by (MAT 131 and MAT 132) or (MAT 131 and 171), or (MAT 125, MAT 126 and MAT 127) or (MAT 141 and 142), or (MAT 141 & 171)
- 2- PHY 131/133 and PHY 132/134 can be replaced by (PHY 125, PHY 126 and PHY 127,133,134), or (PHY 141 and PHY 142.). Students taking the three semester sequence should take PHY 125, PHY 127 and PHY 126, in that order.
- 3- Choice of two ESE electives from: ESE341, ESE346, ESE347, ESE360
- 4- 2 courses selected from Appendix A.
- 5- Math or Science elective: **one 4-credit course or two three credit courses from** CHE131(4),CHE141(4), ESG 198(4), BIO202&204, BIO203&205, PHY 251&252(modern Physics), AMS301(3)

**STUDENTS IN THE MAJOR MAY NOT G/PNC MAJOR REQUIRED COURSES**

**Fall 2019**

## 2.5 Checklist For Major Requirements In General Track

AMS 151<sup>1</sup> \_\_\_\_\_ PHY 131<sup>2</sup> \_\_\_\_\_ (PHY 125 \_\_\_\_\_ & 133 \_\_\_\_\_)  
 (or MAT 131) PHY 133 \_\_\_\_\_ OR (PHY 127 \_\_\_\_\_ & 134 \_\_\_\_\_)  
 AMS 161<sup>1</sup> \_\_\_\_\_ PHY 132 \_\_\_\_\_ (PHY 126 \_\_\_\_\_)  
 (or MAT 132) PHY 134 \_\_\_\_\_

AMS 210 \_\_\_\_\_ AMS 261 \_\_\_\_\_ AMS 361 \_\_\_\_\_  
 (or MAT 211) (or MAT 203) (or MAT 303)

**ESE 301** \_\_\_\_\_ (S.B.C. STAS)

ESE 123 \_\_\_\_\_ ESE 124 \_\_\_\_\_ **ESE 211** \_\_\_\_\_

**ESE 118** \_\_\_\_\_ ESE 224 \_\_\_\_\_ **ESE 231** \_\_\_\_\_

**ESE 271** \_\_\_\_\_ **ESE 300** \_\_\_\_\_ ESE 305 \_\_\_\_\_

ESE 306 \_\_\_\_\_ ESE 314 \_\_\_\_\_ ESE 319 \_\_\_\_\_

ESE 324 \_\_\_\_\_ **ESE 337** \_\_\_\_\_ **ESE 372** \_\_\_\_\_

ESE 280 \_\_\_\_\_ **ESE 440** \_\_\_\_\_ **ESE 441** \_\_\_\_\_

Four ESE electives<sup>3</sup>:

**ESE** \_\_\_\_\_ **ESE** \_\_\_\_\_

**ESE** \_\_\_\_\_ **ESE** \_\_\_\_\_

Two technical electives<sup>4</sup> from Appendix A: \_\_\_\_\_  
 (one with "C" or better)

Math or science elective<sup>5</sup> \_\_\_\_\_ or \_\_\_\_\_

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All courses in **Bold** must be passed with a minimum grade of **C**

- 1- AMS 151 and AMS 161 can be replaced by (MAT 131 and MAT 132) or (MAT 131 and 171), or (MAT 125, MAT 126 and MAT 127) or (MAT 141 and 142), or (MAT 141 & 171)
- 2- PHY 131/133 and PHY 132/134 can be replaced by (PHY 125, PHY 126 and PHY 127,133,134), or (PHY 141 and PHY 142.). Students taking the three semester sequence should take PHY 125, PHY 127 and PHY 126, in that order.
- 3- Choice of four 300-level ESE electives that are not required courses, ESE 476 may also be used.
- 4- 2 courses selected from Appendix A.
- 5- Math or Science elective: **one 4-credit course or two three credit courses from** CHE 131(4),CHE141(4), ESG 198(4), BIO202&204, BIO203&205, PHY 251&252(modern Physics), AMS301(3)

**STUDENTS IN THE MAJOR MAY NOT G/PNC MAJOR REQUIRED COURSES**  
**Fall 2019**

## 2.5 Recommended Course Sequence: General

	<u>FALL</u>	Credits	<u>SPRING</u>	Credits
Freshman	<b>AMS 151<sup>1</sup></b> Calculus I or MAT 131	3-4	<b>AMS 161<sup>1</sup></b> Calculus II or MAT 132	3-4
	<b>PHY 131/133<sup>2</sup></b> Gen. Phys.	4	<b>PHY 132/134<sup>2</sup></b> Gen. Phys. II	4
	<b>WRT102 English Comp</b>	<b>3</b>	<b>ESE 118 Digital Logic Design</b>	4
	ESE 123 Electronic Design	4	ESE 124 Prog. Fund.	4
	First year Seminar 101	1	First year Seminar 102	1
		15-16		16-17
Sophomore	AMS 361 Calc. IV(or MAT 303)	4	AMS 261 Calc. III (or MAT 203)	4
	AMS 210 Lin. Alg.	3	<b>ESE 372</b> Electronics	4
	<b>ESE 271</b> Elect. Cir.	3	ESE 306 Random Sig. Sys.	4
	ESE 305 Det. Sig. Sys.	3	<b>ESE 231</b> Intro. Sem. Dev.	3
	ESE 224 Com. Tech. for Elec. Des. II	3	<b>ESE 211</b> Elect. Lab. A	2
		16		17
Junior	ESE 280 Embedded Sys.Dsgn.I	4	<b>ESE Elective<sup>3</sup></b>	3
	ESE 314 Elect. Lab. B	3	ESE 324 Elect. Lab. C	2
	ESE 319 Intro. E&M Fields	3	<b>ESE 300</b> Tec. Com. For ECE	3
	<b>ESE 337</b> Dig. Sig. Proc.	3	<b>ESE Elective<sup>3</sup></b>	3
	Math or Science Elective <sup>5</sup>	4	<b>ESE 301 Eng. Ethics</b>	3
		17		17
Senior	<b>ESE 440 Eng. Design I</b>	3	<b>ESE 441 Eng. Design II</b>	3
	<b>ESE Elective<sup>3</sup></b>	3	<b>ESE Elective<sup>3</sup></b>	3
	<b>Technical elective<sup>4</sup></b>	3	USA Course	3
	SBS Course	3	Technical elective <sup>4</sup>	3
	ARTS Course	3	GLO Course	3
		15		15

**Total credits = 128 - 130**

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All courses in **Bold** must be passed with a minimum grade of **C**

- AMS 151 and AMS 161 can be replaced by (MAT 131 and MAT 132) or (MAT 131 and 171), or (MAT 125, MAT 126 and MAT 127) or (MAT 141 and 142), or (MAT 141 & 171)
- PHY 131/133 and PHY 132/134 can be replaced by (PHY 125, PHY 126 and PHY 127,133,134), or (PHY 141 and PHY 142.). Students taking the three semester sequence should take PHY 125, PHY 127 and PHY 126, in that order.
- Choice of four 300-level ESE electives that are not required courses, ESE 476 may also be used.
- 2 courses selected from Appendix A.
- Math or Science elective: **one 4-credit course or two three credit courses from** CHE 131(4), CHE141(4), ESG 198(4), BIO202&204, BIO203&205, PHY 251&252(modern Physics), AMS301(3)

**STUDENTS IN THE MAJOR MAY NOT G/PNC MAJOR REQUIRED COURSES**  
**Fall 2019**

## **2.6 Academic Advising**

The Department has an undergraduate committee that consists of the Undergraduate Program Director and eight faculty members. In addition to curriculum issues, the members of the undergraduate committee also serve as advisors. Each advisor is required to have at least four hours each week for walk-in advising. During these office hours students need not make an appointment to see an advisor. Additionally, the department mandates that all freshmen students in their second semester and transfer students in their first semester see an academic advisor during the pre-registration period. All the other students are divided into two groups. One group is required to see an advisor in the fall semester whereas the other group in the spring semester. This compulsory advising is enforced through a registration block, which is removed only after the student's course plan is approved by an advisor.

## **2.7 Communication Skills**

The importance of reporting results through written and oral communication is stressed throughout the four years. Technical report writing is an essential component of all laboratory courses. The skills are honed and fine tuned in a required junior level technical communication course. Students must register for the technical communication course ESE 300 concurrently with or after completion of ESE 314, 324, 280, or 382. The senior design project is a final platform for students with an opportunity to present their results in two written reports and an oral presentation.

## **2.8 Transfer Credit Equivalency**

The Department of Electrical & Computer Engineering considers transfer credits for equivalency to ESE courses at any time. The student must provide a detailed course outline, textbook used, and any other pertinent course material for proper evaluation. The process is initiated by the student submitting a completed transfer credit equivalency form, together with additional attachments, to the College of Engineering and Applied Sciences undergraduate office. A record of previous transfer equivalency is available for reference.

## **2.9 Honors Program in Electrical Engineering**

The Honors Program in Electrical Engineering provides high achieving students an opportunity to receive validation for a meaningful research experience and for a distinguished academic career. A student interested in becoming a candidate for the Honors Program in Electrical Engineering may apply to the program at the end of the sophomore year.

To be admitted to the Honors Program, students need a minimum **cumulative grade point average of 3.50 and a B or better in all major required courses** (including math and physics). Transfer students who enter Stony Brook University in the junior year need a minimum cumulative grade point average of 3.5 and a B or better in all required major courses (including math and physics) in their first semester at Stony Brook University.

Graduation with departmental honors in Electrical Engineering requires the following:

1. A cumulative grade point average of 3.50 or higher and a B or better in all major required courses (including math and physics) upon graduation.
2. Completion of ESE 494, a 1 credit seminar on research techniques, with a B or better during the junior year.
3. Completion of ESE 495, a 3-credit honors research project, with a B or better.
4. Presentation of an honors thesis (written in the format of an engineering technical paper) under the supervision of an ESE faculty member. The thesis must be presented to and approved by a committee of two faculty members including the student's advisor.

For students who qualify, this honor is indicated on their diploma and on their permanent academic record.

### 3. ACADEMIC GUIDELINES

#### a) Grading Requirements

All courses required for the major must be taken for a letter grade (A through D) A grade of "C" or higher is required in each of the following courses:

**ALL SPECIALIZATIONS:** ESE 211, ESE 118, ESE 231, ESE 271, ESE 300, ESE301, ESE 337, ESE 372, ESE440, ESE441, MAT 131, MAT 132 (or AMS 151, AMS 161), PHY 131/133, PHY 132/134.

**MICROELECTRONICS SPECIALIZATION:** ESE 311, ESE 330; two ESE electives, and one technical elective

**TELECOMMUNICATIONS SPECIALIZATION:** ESE 340, ESE 342; two ESE electives, and one technical elective

**GENERAL SPECIALIZATION:** 4 ESE Electives and one technical elective

#### b) Pass/No Credit Option

There is **NO GPNC** option. All courses required for the major must be taken for a letter grade (A through D).

#### c) Residency Requirements

In addition to the University requirements, the following courses must be completed at Stony Brook:

1. **ESE 440 and ESE 441** with a faculty advisor from the Electrical & Computer Engineering Department.
2. **ESE 300.**
3. A minimum of 7 Engineering courses. At least 5 of the 7 courses must be ESE courses passed with a grade of "C" or higher. The following courses cannot be used to meet this requirement:

ESE 211, ESE 300, ESE 314, ESE 324, ESE 440 and ESE 441.

d) College Time Limits for the Bachelor of Engineering Degree All requirements for the Bachelor of Engineering degree must be met in eleven semesters by those students with full-time status. Full-time transfer students must meet all degree requirements in the number of semesters remaining after the number of transferred degree related credits are divided by 12 (the semester equivalency) and the result is subtracted from 11 (semesters).

#### e) Graduate Courses

Graduate level courses may be taken by undergraduates with a superior academic record (technical G.P.A. of 3.3 or greater) to satisfy either open elective or non-ESE technical elective requirements with approval. Approval must be obtained from the Department of Electrical & Computer Engineering, the course instructor, and the College of Engineering and Applied Science.

#### f) Undergraduate Research

Students with a superior academic record may use ESE 499 (0-3 credits) to do an independent research study under the guidance of an Electrical & Computer Engineering faculty. Additional details may be found in the course description. The department has several research laboratories; Appendix F gives a brief description of each laboratory. This course must be taken at Stony Brook.

g) Undergraduate Teaching

Students with a superior academic record may use ESE 475 (3 credits of open elective) or ESE 476 to assist faculty in teaching by conducting recitation, laboratory sections and developing new laboratory experiments. These courses must be taken at Stony Brook, with permission of the Electrical & Computer Engineering Department. ESE 476 may be used as a Technical Elective.

h) Undergraduate Internship in Electrical Engineering

An independent off-campus engineering project with faculty supervision. Permission to register requires a **B** average in all engineering courses and the agreement of a faculty member to supervise the project. May be repeated but only three credits of internship electives may be counted toward the non-ESE technical elective requirements.

i) University Graduation Requirements

In addition to the above requirements a student should check that he or she has met all additional requirements set forth by the University, and The College of Engineering and Applied Science.

**STUDENTS SHOULD CONSULT THE UNDERGRADUATE BULLETIN FOR  
ADDITIONAL INFORMATION ON ACADEMIC GUIDELINES.**

# APPENDIX A

## TECHNICAL ELECTIVE LIST

Course #	Course Title	Course #	Course Title
AMS 301	Finite Mathematical Struc.	Any upper division (300 or 400 level)	
AMS 303	Graph Theory	<b>ESE</b> course that is not required except ESE494.	
AMS 315	Data Analysis	A course may not be used to satisfy	
AMS 318	Financial Math.	<b>both ESE</b> electives and technical electives	
AMS 321	Computer Projects in Appl. Math.		
AMS 326	Numerical Analysis		
AMS 333	Mathematical Biology		
AMS 341	Operations Research I	ESG 281	An Engineering Intro to the Solid State
AMS 342	Operations Research II	ESG 302	Thermodynamics of Materials
AMS 412	Mathematical Statistics	ESG 332	Materials Science I
AMS 487	Research in Applied Mathematics	ESG 333	Materials Science II
AMS 492	Topics in Applied Mathematics	ESG 339	Thin Film Processing of Advanced Materials

BME/BUS/MGT 300 level with permission of ECE Undergraduate Director

CSE 216	Computer Science III		
CSE 303	Intro to Theory of Computation		
CSE 304	Compiler Design	ESM 325	Diffraction Tech. and Structure of Solids
CSE 305	Principles of Database Systems	ESM 335	Strength of Materials
CSE 306	Operating Systems	ESM 336	Electronic Materials
CSE 308	Software Engineering	ESM 353	Biomaterials: Manufacture, Prop & Appl
CSE 328	Fund. of Computer Graphics	ESM 369	Polymer Engineering
CSE 332	Intro. to Scientific Visualization	ESM 499	Research in Materials Science
CSE 373	Analysis of Algorithms		
CSE 376	Adv. Sys. Prog. in Unix/C		
CSE 377	Intro. to Medical Imaging		
CSE 487	Research in Computer Science		
MEC 301	Thermodynamics	EST 364	How to Build a Startup
MEC 305	Heat and Mass Transfer	EST 371	Data Science Management
MEC 310	Intro. to Machine Design	EST 391	Technology Assessment
MEC 320	Numerical methods	EST 392	Eng. & Managerial Economics
MEC 363	Mechanics of Solids	EST 393	Project Management
MEC 393	Engineering Fluid Mechanics	EST 499	Research in Technology & Society
MEC 402	Mechanical Vibrations		
MEC 410	Design of Machine Elements	PHY 251	Modern Physics
MEC 411	Control Sys. Analysis	PHY 300	Optics & Waves
MEC 422	Thermal System Design	PHY 308	Quantum Physics
MEC 499	Research in Mechanical Eng.	PHY 452	Lasers

## APPENDIX B

### DESCRIPTION OF ESE COURSES

#### **ESE 111 Making with Arduino: Hardware and Programming (3)**

Create a working electronic project using low-cost and easy to program Arduino development boards. Example projects may include wearable electronics, robots, and electronic displays. Along the way we will learn elements of the C programming language and the basics of embedded electronics and the Internet of Things. Summer. Can be taken by ECE majors **BUT** does not satisfy any major or minor requirement. (SBC TECH)

#### **ESE 118 Digital Logic Design (4) (TECH)**

Develops methods of analysis and design of both combinational and sequential systems regarding digital circuits as functional blocks. Utilizes demonstrations and laboratory projects consisting of building hardware on breadboards and simulation of design using CAD tools. Topics include: number systems and codes; switching algebra and switching functions; standard combinational modules and arithmetic circuits; realization of switching functions; latches and flip-flops; standard sequential modules; memory, combinational, and sequential PLDs and their applications; design of system controllers. Fall and Spring.

*Prerequisite:* ESE 123

#### **ESE 121 Introduction to Audio Systems (3)**

Analog and digital audio systems, musical instrument amplifiers and effects, audio instrumentation, samplers, synthesizers, and audio transducers will be studied. Signal and system concepts will be demonstrated using audible examples to develop intuitive and non-mathematical insights. Audio system specifications will be explained and their effects demonstrated. (SBC TECH). Fall and Spring.

Can be taken by ECE majors **BUT** does not satisfy any major or minor requirement.

#### **ESE 122 Discrete Mathematics for Engineers (3)**

Introduction to topics in computational mathematics, such as number systems, Boolean algebra, mathematical induction, combinatorics and probability, recursion and graph theory. Algorithm aspects of the topics discussed will be emphasized. Fall.

*Corequisite:* ESE 123

#### **ESE 123 Introduction to Electrical and Computer Engineering (4) (TECH)**

This course introduces basic electrical simulation experiments in analog and logic circuits; and supporting lectures providing concepts and theory relevant to the labs, with each experiment discussed one week earlier in lectures. The primary emphasis is on physical insight and applications rather than on mathematical rigor, and the intention is to stimulate the interest and computer engineering concepts through a two-pronged approach; hands-on wired and computer of students rather than overwhelm them with theory. PNC grading allowed for non-majors. Fall and Spring.

*Prerequisites or corequisites:* MAT 125 or 131 or 141 or AMS 151; PHY 125 with Lab 133 or PHY 131 with Lab 133 or PHY141

#### **ESE 124 Programming Fundamentals (4)**

The course presents fundamental and more advanced C programming concepts. Lectures discuss the C language constructs and exemplify their using in relevant programming applications. The course also introduces fundamental concepts in electrical and computer engineering, such as bitwise operations, text file scanning, stack-based computation, table-based finite state machine implementation, hash tables, and linked lists. Scheduled lab activities focus on devising, implementing, debugging, and validating C programs for the concepts discussed in class. A course project focuses on developing a more extensive C program that comprehensively utilizes the programming concepts discussed during the semester. *Prerequisite:* ESE or ECE major or AOI

### **ESE 188 Understanding Machine Learning (3) (TECH)**

This is a course on the basics of machine learning. Students develop an intuitive understanding of the core concepts of machine learning including supervised and unsupervised learning, classification and prediction. The course provides a number of practical examples from a wide range of disciplines including biomedicine, social sciences, and engineering. (SBC TECH)

### **ESE 201 Engineering and Technology Entrepreneurship (3)**

The purpose of this course is to bridge the gap between technical competence and entrepreneurial proficiency. Students are not expected to have any formal business background, but have some background in a technical field. These fields can range from the engineering disciplines to computer science, and from biology and chemistry to medicine. Accordingly, the course will provide the necessary exposure to the fundamentals of business, while minimizing the use of business school jargon. Entrepreneurship is considered as a manageable process built around innovativeness, risk-taking and proactiveness. The course focuses on ventures where the business concept is built around either a significant technical advance in an operational process, or in the application of technology to create a new product or service.

*Prerequisites for engineering majors:* any core engineering course from one of the engineering majors.

*Prerequisites for non-engineering majors:* any two combinations of the following: EST 192, EST 194, EST 202.

### **ESE 211 Electronics Laboratory A (2)**

Introduction to the measurement of electrical quantities; instrumentation; basic circuits, their operation and applications; electronic devices; amplifiers, oscillators, power supplies, wave-shaping circuits, and basic switching circuits. Fall and Spring.

*Prerequisite:* ESE 271

*Corequisite:* ESE 372

### **ESE 224 Computer Techniques for Electronic Design II (3)**

This course is an introduction of C++ programming language for problem solving in electrical and computer engineering. Topics covered include: C++ structures, classes, abstract data types and code reuse. Basic Object-oriented programming concepts as well as fundamental topics of discrete mathematics and algorithms are introduced to solve problems in many areas in electrical and computer engineering.

Fall and Spring.

*Prerequisite:* ESE 124

### **ESE 231 Introduction To Semiconductor Devices (3)**

This course covers the principles of semiconductor devices. Energy bands, transport properties and generation recombination phenomena in bulk semiconductors are covered first. Junctions between semiconductors and metal-semiconductor will then be studied. Equipped with an understanding of the character of physical phenomena in semiconductors, students learn the principles of operation of diodes, transistors, light detectors and light emitting devices. Spring

*Prerequisites:* AMS 361 or MAT 303 and PHY 127 with Lab 134 or 132 with Lab134 or PHY 142

### **ESE 271 Electrical Circuit Analysis I (3)**

Electrical circuit analysis. Kirchoff's Laws, Ohm's Law, nodal and mesh analysis for electric circuits, capacitors, inductors, and steady-state AC; transient analysis using Laplace Transform. Fundamentals of AC power, coupled inductors, and two-ports. Fall and Spring.

*Prerequisite(s):* MAT 127 or 132 or 142 or 171 or AMS 161

*Co/pre-requisite(s):* PHY 127/134 or 132/134 or 142

### **ESE 280 Embedded Microprocessor Systems Design I (4)**

Fundamental concepts and techniques for designing electronic systems that contain a microprocessor or microcontroller as a key component. Topics include system level architecture, microprocessors, ROM, RAM, I/O subsystems, address decoding, PLDs and programmable peripheral ICs, assembly language programming and debugging. Hardware-software trade-offs in implementation of functions are considered. Hardware and software design are emphasized equally. Laboratory work involves design, implementation, and testing of microprocessor controlled circuits. Fall.

*Prerequisite:* ESE, ECE majors, ESE 118, or permission of the instructor and the department.

### **ESE 290 Transitional Study (1-3)**

A vehicle used to transfer students to remedy discrepancies between a Stony Brook course and a course taken at another institution. For example, it allows the student to take the laboratory portion of a course for which he or she has had the theoretical portion elsewhere. Open elective credit only. Fall and Spring.

*Prerequisite:* permission of the instructor and the department.

### **ESE 300 Technical Communications for Electrical/Computer Engineering (3)**

Topics include how technical writing differs from other forms of writing, the components of technical writing, technical style, report writing, technical definitions, proposal writing, writing by group or team, instructions and manuals, transmittal letters, memoranda, abstracts and summaries, proper methods of documentation, presentations and briefings, and analysis of published engineering writing. Also covered is the writing of resumes and cover letters. Spring.

*Prerequisite:* ESE, ECE majors, junior standing; WRT 102;

*Prerequisite or corequisite:* ESE 314 or 324 or 280 or 382

### **ESE 301 Engineering Ethics and Societal Impact (3) (SBC STAS and D.E.C H)**

The study of ethical issues facing engineers and engineering related organizations, and the societal impact of technology. Decisions involving moral conduct, character, ideals and relationships of people and organizations involved in technology. The interaction of engineers, their technology, the society and the environment is examined using case studies. *This course requires a "C" or better grade.* Fall and Spring

*Prerequisites:* U3 or U4 standing, one D.E.C. category E or SNW course.

### **ESE 304 Applications of Operational Amplifiers (3)**

Design of electronic instrumentation: structure of basic measurement systems, transducers, analysis and characteristics of operational amplifiers, analog signal conditioning with operational amplifiers, sampling, multiplexing, A/D and D/A conversion; digital signal conditioning, data input and display, and automated measurement systems. Application of measurement systems to pollution and to biomedical and industrial monitoring is considered. Spring.

*Prerequisite:* ESE 372

### **ESE 305 Deterministic Signals and Systems (3)**

Introduction to signals and systems. Manipulation of simple analog and digital signals. Relationship between frequencies of analog signals and their sampled sequences. Sampling theorem. Concepts of linearity, time-invariance, causality in systems. Convolution integral and summation; FIR and IIR digital filters. Differential and difference equations. Laplace transform, z-transform, Fourier series and Fourier transform. Stability, frequency response and filtering. Provides general background for subsequent courses in control, communication, electronics and digital signal processing. Fall and Spring *Prerequisite or corequisite:* ESE 271

**ESE 306 Random Signals and Systems (4)**

Random experiments and events; random variables, probability distribution and density functions, continuous and discrete random processes; Binomial, Bernoulli, Poisson, and Gaussian processes; system reliability; Markov chains; elements of queuing theory; detection of signals in noise; estimation of signal parameters; properties and application of auto-correlation and cross-correlation functions; power spectral density; response of linear systems to random inputs. Spring.

*Prerequisite or corequisite:* ESE 305

**ESE 311 Analog Integrated Circuits (3)**

Engineering permission of the instructor and the department design concepts applied to electronic circuits. Basic network concepts, computational analysis and design techniques: models of electronic devices; biasing and compensation methods; amplifiers and filters designed by conventional and computer-aided techniques. Spring.

*Prerequisite:* ESE 372

**ESE 312 Lightwave Devices (3)**

Introduction to optical semiconductor devices and their applications in telecommunications, optoelectronics, and consumer electronics-areas where signal processing or the transmission of signals across free space or fiber optic cables involved. It discusses design and operation of optical modulators, quantum well lasers, light emitting diodes, and photodetectors.

*Prerequisites:* ESE 231

**ESE 313 Intro to Photovoltaics (3)**

Introduction to the basic concepts of photovoltaic solar energy conversion, including: 1. The solar resource in the context of global energy demand; 2. The operating principles and theoretical limits of photovoltaic devices; 3. Device fabrication, architecture, and primary challenges and practical limitations for the major technologies and materials used for photovoltaic devices. Students will gain knowledge of: the device physics of solar cells, the operating principles of the major commercial photovoltaic technologies, the current challenges and primary areas of research within the field of photovoltaics, and a basic understanding of the role of photovoltaics in the context of the global energy system. Spring

*Prerequisite:* ESE 231 or ESG 281 or permission of the instructor and the department

**ESE 314 Electronics Laboratory B (3)**

Laboratory course on design and operation of basic building blocks of electronics. The course is coordinated with, and illustrates and expands upon, concepts presented in ESE 372. Emphasis is given to design solutions more relevant to integrated rather than to discrete element electronics. Field effect transistors are given special attention due to their importance in contemporary analog and digital IC. Frequency responses of the basic amplifiers and active filters are analyzed. Internal structure and fundamental performance limitations of digital inverter and other gates are studied. Fall

*Prerequisite:* ESE, ECE majors, ESE 211 & ESE 372, or permission of the instructor and the department

**ESE 315: Control System Design**

Analysis and design of linear control systems. Control components, development of block diagrams. Computer simulation of control systems and op-amp circuit implementation of compensators. Physical constraints in the design. Pole-placement and model matching design using linear algebraic method. Selection of models using computer simulation and quadratic optimal method. Root-locus method and Bode plot method. Use of PID controllers in practice.

*Prerequisite:* ESE 271

**ESE 319 Electromagnetics and Transmission Line Theory (3)**

Fundamental aspects of electromagnetic wave propagation and radiation, with application to the design of high speed digital circuits and communication systems. Topics include: solutions of Maxwell's equations for characterization of EM wave propagation in unbounded and lossy media; radiation of EM energy; guided wave propagation with emphasis on transmission lines theory. Fall

*Prerequisite:* ESE 271

**ESE 323 Modern Circuit Board Design and Prototyping (3)**

Design, fabricate, and test a prototype device using a custom made circuit board, surface mount components, and a 3D printed enclosure. Topics include printed circuit design, active and passive component selection, design for testability, solid modeling, and 3D printing. Fall *Prerequisite:* ESE 211 and ESE 280. Fall

**ESE 324 Electronics Laboratory C (2)**

Illustrates and expands upon advanced concepts presented in ESE 372. Experiments include analog circuits such as oscillators, voltage regulators; mixed-signal circuits such as data converters, phase-locked loops, and several experiments emphasizing the analog design issues in digital circuits. Laboratory fee required. Spring.

*Prerequisites:* ESE 211, 372; ESE, ECE majors; U3 standing

**ESE 325 Modern Sensors (3)**

The course focuses on the underlying physics principles, design, and practical implementations of sensors and transducers including piezoelectric, acoustic, inertial, pressure, position, flow, capacitive, magnetic, optical and bioelectric sensors. Established as well as novel sensor technologies as well as problems of interfacing various sensors with electronics are discussed. Fall

*Prerequisites:* ESE 372

**ESE 330 Integrated Electronics (3)**

An overview of the design and fabrication of integrated circuits. Topics include gate-level and transistor-level design; fabrication material and processes; layout of circuits; automated design tools. This material is directly applicable to industrial IC design and provides a strong background for more advanced courses. Fall.

*Prerequisite:* ESE 372

**ESE 333 Real-Time Operating Systems (3)**

Intro to basic concepts and principles of real-time operating systems. The topics to be covered include operating system concepts and structure, multiple processes, interprocess communication, real-time process scheduling, memory management, virtual memory, file system design, security, protection, and programming environments for real-time systems. Spring

*Prerequisite:* ESE 124, CSE 214 and ESE 280 or CSE 220

**ESE 337 Digital Signal Processing Theory (3)**

An introduction to Digital Signal Processing Theory, Sequences, Discrete-Time Convolution, and Difference Equations, Sampling and Reconstruction of Signals, One- and Two-Sided Z-Transforms, Transfer Functions and Frequency Response. Design of FIR and IIR Filters. Discrete and Fast Fourier Transforms and Applications. Fall

*Prerequisite:* ESE 305

**ESE 340 Basic Communication Theory (3)**

Basic concepts in both analog and digital data communications; signals, spectra, and linear networks; Fourier transforms, energy and power spectra, and filtering; AM, FM, and PM; time and frequency multiplexing; discussion of problems encountered in practice; noise and bandwidth considerations; pulse modulation schemes. Fall.  
*Prerequisites:* ESE 305 and 306

**ESE 342 Digital Communications Systems (3)**

Pulse modulation and sampling. All-digital networks. Pulse code modulation. Digital modulation techniques. Time-division multiplexing. Baseband signaling. Intersymbol interference. Equalization. Basic error control coding. Exchange of reliability for rate. ARQ schemes. Message and circuit switching. Spring  
*Prerequisite:* ESE 340

**ESE 343 Mobile Cloud Computing (3)**

Introduction to the basic concepts of mobile cloud computing, including: 1. The mobile computing technology used in modern smart phones; 2. The cloud computing technology used in existing data centers; 3. The synergy of mobile and cloud computing and its applications; 4. Programming on smart phone utilizing data center services. Students will gain knowledge of: the fundamental principles of mobile cloud computing, the major technologies that support mobile cloud computing, the current challenges and primary areas of research within the field of mobile cloud computing, and a basic understanding of the role of mobile cloud computing in the context of the everyday living. Spring

*Prerequisite:* ESE 224, CSE 214, CSE 230 or ISE 208

**ESE 344 Software Techniques for Engineers (3)**

Trains students to use computer systems to solve engineering problems. It covers C/C++ programming language, UNIX programming environment, basic data structures and algorithms, and object oriented programming. Spring.  
*Prerequisites:* ESE 118 or (discontinued ESE 218) and ESE 224 or CSE 230

**ESE 345 Computer Architecture (3)**

Starts with functional components at the level of registers, buses, arithmetic, and memory chips, and then uses a register transfer language to manipulate these in the design of hardware systems up to the level of complete computers. Specific topics also included are microprogrammed control, user-level instruction sets, I/O systems and device interfaces, control of memory hierarchies, and parallel processing organizations. Fall.

*Prerequisites for ESE, ECE majors:* ESE 280 and ESE382

*Prerequisites for CSE majors:* CSE 220 and ESE 118

**ESE 346 Computer Communications (3)**

Basic theory and technology of computer communications. Introduction to performance evaluation, error codes and routing algorithms. Other topics include Ethernet, wireless networks including LTE and 5G, fiber optic networking, software defined networking, networking on chips, space networks, data centers, grids and clouds, and network security. Not for credit in addition to CSE 310 or ISE 316. This course is offered as both CSE 346 and ESE 346.

*Pre- or corequisite for ESE and ECE majors:* ESE 306

*Pre- or corequisite for CSE majors:* AMS 310 or 311 *Prerequisite for CSE majors:* CSE 220 *Pre- or corequisite for ISE majors:* ISE 218 and AMS 310 or AMS 311

**ESE 347 Digital Signal Processing: Implementation (4)**

Fundamental techniques for implementing standard signal processing algorithms on dedicated digital signal processing chips. Topics include a review of discrete-time systems, sampling and reconstruction, FIR and IIR filter

design, FFT, architecture and assembly language of a basic signal processing chip, and an introduction to adaptive filtering. Spring.

*Prerequisite:* ESE 337 or ESE 305 and ESE 280

### **ESE 350 Electrical Power Systems (3)**

Fundamental engineering theory for the design and operation of a modern electric power system. Modern aspects of generation, transmission, and distribution are considered with appropriate inspection trips to examine examples of these facilities. The relationship between the facilities and their influence on our environment are reviewed. Topics included are power system fundamentals, characteristics of transmission lines, generalized circuit constants, transformers, control of power flow and of voltage, per unit system of computation, system stability, and extra-high voltage AC and DC transmission. Spring.

*Prerequisite:* ESE 271

### **ESE 352 Electromechanical Energy Converters (3)**

Basic principles of energy conversion; DC, induction, and synchronous rotary converters; the three-phase system and symmetrical components; the relationships between voltage, current, flux, and m.m.f.; equivalent circuits and operating characteristics of rotary converters; and analysis of saturation effects. Fall.

*Prerequisite:* ESE 372

### **ESE 355 VLSI System Design (4)**

Introduces techniques and tools for scalable VLSI design and analysis. Emphasis is on physical design and on performance analysis. Includes extensive lab experiments and hands-on usage of CAD tools. Fall

*Prerequisite:* ESE 118

### **ESE 356 Digital System Specification and Modeling (3)**

Introduces concepts of specification and modeling for design at various level of abstraction. High Level specification language is used for executable models creation, representing possible architecture implementations. Topics include design space exploration through fast simulation and reuse of models and implementation. Fall

*Prerequisites:* ESE 280 and ESE 124

### **ESE 358 Computer Vision (3)**

Introduces fundamental concepts, algorithms, and computational techniques in visual information processing. Covers image formation, image sensing, binary image analysis, image segmentation, Fourier image analysis, edge detection, reflectance map, photometric stereo, basic photogrammetry, stereo, pattern classification, extended Gaussian images, and the study of the human visual system from an information processing point of view. Fall.

*Prerequisites for ESE, ECE majors:* ESE 305; ESE 224 or CSE 230

*Prerequisites for CSE majors:* CSE 214 and CSE 220

### **ESE 360 Network Security (3)**

An introduction to computer network and telecommunication network security engineering. Special emphasis on building security into hardware and hardware working with software. Topics include encryption, public key cryptography, authentication, intrusion detection, digital rights management, firewalls, trusted computing, encrypted computing, intruders and viruses. Spring

*Pre or corequisite:* ESE/CSE 346 or CSE/ISE 310

### **ESE 366 Design using Programmable Mixed-Signal Systems-on-Chip (4)**

This course focuses on development of mixed-signal embedded applications that utilize systems on chip (SoC) technology. The course discusses design issues, such as (i) implementing functionality, (ii) realizing new interfacing capabilities, and (iii) improving performance through programming the embedded microcontroller and

customizing the reconfigurable analog and digital hardware of SoC. Fall *Prerequisite:* ESE 372, ESE 280 and ESE 224 or CSE 230

### **ESE 372 Electronics (4)**

The pertinent elements of solid-state physics and circuit theory are reviewed and applied to the study of electronic devices and circuits, including junction diodes, transistors, and gate and electronic switches; large- and small-signal analysis of amplifiers; amplifier frequency response; and rectifiers and wave-shaping circuits. Fall and Spring.

*Prerequisite:* ESE 271

*Corequisite:* ESE 211 for ESE/ECE majors only

### **ESE 375 Architectures for Digital Signal Processing (3)**

This course covers various aspects of architectures in digital signal processing and multimedia data processing. The topics include iteration bound analysis, retiming the circuits, unfolding and folding the architectures, algorithmic and numerical strength reduction for low power and low complexity design, introduction to array processor architectures and CORDIC implementation.

*Prerequisites:* ESE 305 and ESE 280

### **ESE 381 Embedded Microprocessor Systems Design II (4)**

A continuation of ESE 280. The entire system design cycle, including requirements definition and system specifications, is covered. Topics include real-time requirements, timing, interrupt driven systems, analog data conversion, multi-module and multi-language systems. The interface between high-level language and assembly language is covered. A complete system is designed and prototyped in the laboratory. Spring.

*Prerequisite:* ESE 271 and 280

### **ESE 382 Digital Design Using VHDL and PLDs (4)**

Digital system design using the hardware description language VHDL and system implementation using complex programmable logic devices (CPLDs) and field programmable gate arrays (FPGAs). Topics include design methodology, VHDL syntax, entities, architectures, test benches, subprograms, packages, and libraries. Behavioral and structural coding styles for the synthesis of combinational and sequential circuits are covered. Architectures and characteristics of PLDs and FPGAs are studied. Laboratory work involves writing the VHDL descriptions and test benches for designs, compiling and functionally simulating the designs, fitting and timing simulation of the fitted designs, and programming the designs into a CPLD or FPGA and bench testing. Spring.

*Prerequisite:* ESE, ECE majors, ESE 118, or permission of the instructor and the department.

### **ESE 440 Senior Design I (3)**

The senior design sequence (ESE440 and ESE441) is a two-semester, team based and capstone with deliverables. The primary objective of the senior design course sequence is to provide a vehicle for students to transition from an academic environment to that of a commercial/professional engineering environment. Students learn to work in teams to complete a project from concept, practical design based on multiple constraints, to creating a deliverable product meeting the design specifications. Students present written, oral and poster presentations of the project. While most of the project work is done outside the classroom, guest speakers provide insight into other related topics from resume preparation, to program management, to team dynamics and to design methodologies used in industry. The project incorporates appropriate engineering standards and multiple realistic constraints. Not counted as a technical elective. Laboratory fee required.

*Prerequisite(s):* Senior standing in the major, ESE300, and for EE majors: ESE324 and two ESE electives; for CE majors: two CE electives

**ESE 441 Engineering Design II (3)**

The senior design sequence (ESE440 and ESE441) is a two-semester, team based and independent capstone project with deliverables. The primary objective of the senior design course sequence is to provide a vehicle for students to transition from an academic environment to that of a commercial/professional engineering environment. Students learn to work in teams to complete a project from concept, practical design based on multiple constraints, to creating a deliverable product meeting the design specifications. Students present written, oral and poster presentations of the project. While most of the project work is done outside the classroom, guest speakers provide insight into other related topics from resume preparation, to program management, to team dynamics and to design methodologies used in industry. The project incorporates appropriate engineering standards and multiple realistic constraints. Not counted as a technical elective. Laboratory fee required.

*Prerequisite:* ESE 440

**ESE 475 Undergraduate Teaching Practicum (3)**

Students assist the faculty in teaching by conducting recitation or laboratory sections that supplement a lecture course. The student receives regularly scheduled supervision from the faculty instructor. May be used for Electrical Engineering or Computer Engineering to satisfy one technical elective and repeated once. All semesters.

*Prerequisites:* U4 standing, a minimum grade point average of 3.0 in all Stony Brook courses, and a grade of B in the course in which the student is to assist; permission of the department.

**ESE 476 Instructional Laboratory Development Practicum (3)**

Students work closely with faculty advisor and staff in developing new laboratory experiments for scheduled laboratory courses in electrical and computer engineering. A comprehensive technical report and the instructional materials developed must be submitted at the end of the course. May be used once as a technical elective for electrical or computer engineering major. May be repeated once but only 3 credits may be used as technical elective for either Electrical or Computer Engineering. Fall and Spring

*Prerequisite(s):* U4 standing, a minimum grade point average of 3.0 in all Stony Brook courses, and a minimum grade of A- in the course for which the student will develop instruction material; permission of the instructor and the department.

**ESE 488 Internship in Electrical/Computer Engineering (3)**

An independent off-campus engineering project with faculty supervision. May be repeated but only three credits of internship electives may be counted toward the technical elective requirement for Electrical Engineering or Computer Engineering. All semesters.

*Prerequisites:* ESE, ECE major; U3 or U4 standing; 3.0 grade point average in all engineering courses; permission of the instructor and the department.

**ESE 494 Honors Seminar On Research (1)**

An introduction to the worldwide research enterprise with special emphasis on research in the United States. Topics include research funding, publications, patents, career options, theory versus experiment, entrepreneurship and presentation skills. Fall

*Prerequisite(s):* Acceptance into ECE Honors program or permission of the instructor and the department.

**ESE 495 Honor Research Project (3)**

A research project, for students in the honors program, conducted under the supervision of an electrical and computer engineering faculty member. Fall, Spring, Summer

*Prerequisite(s):* ECE Honors program, ESE 494 and permission of the instructor and the department.

**ESE 499 Research in Electrical Sciences (0-3)**

An independent research project with faculty supervision. Permission to register requires a 3.0 average in all engineering courses and the agreement of a faculty member to supervise the research. May be repeated but only three credits of research electives (AMS 487, CSE 487, MEC 499, ESM 499, EST 499, ISE 487) may be counted toward technical elective requirements for Electrical Engineering. All semesters.

*Requirements:* U4 standing, 3.00 grade point average minimum in all engineering courses, permission of the instructor and the department.

## APPENDIX C: ECE FACULTY

### FACULTY

### RESEARCH INTERESTS

Dhadwal, Harbans S.	Integrated fiber optics, Fiber optic biosensors; optical signal processing; photon correlation spectroscopy
Djuric, Petar M.	Signal analysis, modeling, and processing; Monte Carlo methods; wireless communications and sensor networks
Doboli, Alexa	VLSI CAD with emphasis on hardware/software co-design & mixed-signal synthesis
Donetski, Dmitri	Design of long-wavelength detectors, photovoltaic cells and high power laser diode arrays
Dorojevets, Mikhail N.	Parallel computer architecture; high-performance systems design; superconductor processors
Eisaman, Matthew	Exploring technologies for improving the efficiency of solar cells, including light management and the connection between structure and performance at the nanoscale.
Fernandez-Bugallo, Monica	Statistical signal processing, with emphasis on Monte Carlo methods and their application to high-dimensional systems including target tracking and biological systems.
Gindi, Gene	Medical Image Processing and Analysis with an emphasis on statistical methods
Gorfinkel, Vera	Semiconductor devices, including microwave and optoelectronics.
Hong, Sangjin	Low-power VLSI design of multimedia wireless communications and digital signal processing systems, including SOC design methodology and optimization
Kamoua, Ridha	High frequency semiconductor devices; microwave devices; terahertz sources.
Lin, Shan	Cyber physical systems, networked information systems, and smart sensor systems, with an emphasis on feedback control based designs.
Liu, Ji	Distributed control and computation, multi-agent systems, social networks, epidemic networks, and power networks.
Luryi, Serge	Sensor systems, semiconductor devices and technologies, Optoelectronics
Milder, Peter	Domain-specific hardware generation tools for FPGA and ASIC
Parekh, Jayant P.	Microwave acoustics; microwave magnetics; microwave electronics; microcomputer applications.
Robertazzi, Thomas G.	Computer networks; parallel processing, performance evaluation and e-commerce tech.
Salman, Emre	Nanoscale integrated circuit design; digital and mixed signal circuits
Shamash, Yacov	Control systems and robotics.
Shterengas, Leon	High power and high speed light emitters, carrier dynamics in nanostructures, molecular beam epitaxy
Short, Kenneth L.	Digital system design; embedded microprocessor systems; instrumentation.
Suchalkin, Sergey	Design and Development of optoelectronic devices. Far- and Mid-infrared spectroscopy of solids. Physics of semiconductors and nanostructures.
Stanacevic, Milutin	Analog and Digital VLSI Circuits
Subbarao, Murali	Computer vision; image processing
Tang, K. Wendy	Parallel and distributed processing; massively parallel systems; computer architecture, neural networks.
Wang, Xin	Mobile Computing and Wireless Networking
Westerfeld, David	Design and characterization of high-performance mid-infrared semiconductor light sources (LEDs and lasers).
Yang, Yuanyuan	Parallel and distributed computing and systems, high speed networks, optical networks, high performance computer architecture, and fault-tolerant computing
Ye, Fan	Mobile computing/sensing systems and applications, Indoor localization and floor plan reconstruction, Internet-of-Things and sensor networks.
Zhao, Yue	Smart energy systems, renewable energy integration, electricity market, infrastructure security, sensing and signal processing, optimization theory, information theory, communication networks.

## APPENDIX D

### TEACHING LABORATORIES

#### **Analog Laboratory**

Contact Person: Anthony Olivo  
Location: Room 283, Light Engineering  
Usage: ESE 123, ESE 211, ESE 314, and ESE 324

This lab serves the ESE 123, ESE 211, ESE 314, and ESE 324 engineering courses. It contains eighteen workstations equipped for testing simple to complex analog circuits, from DC to 20 MHz Each workstation consists of the following test equipment:

- Dell Optiplex 990 Personal Computer with ATE connectivity.
- Keysight Model DSO3012A 100 MHz Two Channel Digital Storage Oscilloscope.
- Agilent Model E3631A Triple Output Power Supply with a variable +6 VDC and +/- 25 VDC outputs.
- Agilent Model 34450A 5½ Digit Precision Digital Multimeter.
- Agilent Model 34401A 6½ Digit Precision Digital Multimeter.
- Agilent Model 33120A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 15 MHz
- Agilent Model 33220A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 20 MHz
- Three section Solderless Breadboard for the construction and testing of circuits designed in the laboratory.
- A Philips Model 6303A Automatic RLC meter is available for general use.
- The workstations are networked through a HP Procurve 1800 24 port Gigabit switch to a HP P3015 LaserJet Network Printer.

This laboratory includes 8 Soldering Stations for the assembly of printed circuit boards.

The CAD laboratory is used in conjunction with this laboratory for the design, modeling, and simulation of all Analog and Digital circuits built and tested for laboratory experiments. This laboratory is in use every weekday and most nights during each semester. In addition to normal lab hours, students use this lab on an irregular basis to do additional work beyond the limit of the formal lab sessions.

#### **Digital Systems Design Laboratory**

Contact Person: Anthony Olivo  
Location: Room 235, Heavy Engineering  
Usage: ESE 118

This laboratory serves ESE-118 (Digital Systems Design). The laboratory contains fourteen workstations, each consisting of a Keysight MSO3012A 100MHz Dual Trace Oscilloscope/16 Bit Digital Logic Analyzer, a PB 505 Digital Design Workstation and a Dell Optiplex 990 Personal Computer. The Digital Logic Analyzer can capture and display up to 16 channels of digital data via a flexible dual 8-channel cable. Data acquisition is accomplished by normal, time base, channel activity, or glitch triggering.

The PB 505 Digital Design Workstation is a multi-function breadboard system, which consists of the following:

- A three section Solderless Breadboard for the construction and testing of circuits,
- A function generator, which outputs sine waves, triangle waves, square waves, and TTL square waves from 0.1 Hz to 100 kHz.

- Three internal power supplies with a fixed +5VDC, a +1.3 to +15 VDC variable output, and a -1.3 to -15 VDC variable output.
- 16 LED logic indicators (8 logic HIGH and 8 Logic LOW)
- 8 Logic switches, two debounced switches, and an 8 ohm speaker

The CAD laboratory is used in conjunction with this laboratory for the design, modeling, and simulation of all Digital circuits built and tested for laboratory experiments.

## **Digital Systems Rapid Prototyping Laboratory**

Contact Individuals:	Scott Tierno, Prof. Ken Short
Location: Room:	230, Light Engineering
Usage:	ESE 382, ESE 440, ESE 441, ESE 475, ESE 476, ESE 499

The Digital Systems Rapid Prototyping Laboratory (DSRPL) is devoted to teaching, research, and system design projects involving advanced digital systems employing embedded microprocessor based systems and VHDL based digital systems. The laboratory is located adjacent to the Embedded Systems Design Laboratory (ESDL), in room 228 on the second floor of the Light Engineering building.

The DSRPL facility is structured to support advanced digital design projects, as well as the laboratory portion of an upper division undergraduate VHDL digital design course, ESE-382. The lab room is configured with design stations equipped with computer workstations that are networked to the laboratory's RAID 1 compliant Windows 2003 server. Each workstation includes a dual-display design interface, and provides access to a number of sophisticated software design packages, including ActiveHDL by Aldec, Synplify Pro by Synopsys, ispLEVER by Lattice Semiconductor, and other related software packages. All software packages utilize floating licensing, and are available on virtually all computers in the DSRPL, as well as the ESDL (see above).

The project design verification stations may also be configured with a variety of test and debugging equipment, as needed for a respective design project. Available are JTAG based (on-chip) in-circuit emulators, logic analyzers, spectrum analyzers, digital storage oscilloscopes, arbitrary function/waveform generators, frequency counters, and a variety of other standard and custom lab test equipment. Further available in this room is a device programming station that supports a large number of programmable logic devices including EPROMs, microcontrollers, standard and complex PLDs, and FPGAs. Currently this lab supports digital system design projects utilizing a large variety of configurable devices such as CPLDs, cross-over PLDs, and FPGAs from Lattice, Xilinx, and Altera.

The DSRPL meets all requirements of the *Americans with Disabilities Act* (ADA), and other mandated safety requirements of the Federal and New York State governments. There are several wheel-chair accessible student workstations available in the DSRPL.

## **Electrical & Computer Engineering Computer Aided Design Laboratory**

Contact Person: Scott Campbell, Prof. John Murray-Director  
Location: Room 281, Light Engineering  
Usage: ESE 123, ESE 124, ESE 211, ESE 118, ESE 271,  
ESE 300, ESE 305, ESE 306, ESE 314, ESE 315,  
ESE 316, ESE 324, ESE 337, ESE 345, ESE 346,  
ESE 347, ESE 349, ESE 357, ESE 358, ESE 372,  
ESE 280, ESE 381, ESE 382, ESE 440, ESE 441,  
ESE 475, ESE 476, ESE 499

The Electrical & Computer Engineering Computer Aided Design Laboratory is the primary computing resource for all undergraduate courses taught in the department. The ECE CAD Lab offers undergraduate students access to CAD software tools used to analyze, model, simulate, and better understand engineering concepts. The lab supports every undergraduate course in the department.

The lab has a total of 40 Dell PC's, that are networked via switched Ethernet to a Dell file server. There are two network laser printers available for students to print their results.

The following software packages are available to the users on the network:

Aldec Active HDL – Aldec  
Atmel AVR Studio - Atmel  
Cadence toolset including Capture, Pspice A/D - Cadence Design Systems  
Embedded Workbench for Atmel AVR - IAR  
Image Tool – University of Texas Health Science Center  
ISE Webpack - Xilinx  
ISP Lever - Lattice  
Matlab - The Mathworks Inc.  
Microsoft Visual Studio - Microsoft  
Microsoft Office - Microsoft  
Modelsim - Mentor Graphics  
Synplify Pro – Synopsys

## **Embedded Systems Design Laboratory**

Contact Individuals: Scott Tierno, Prof. Ken Short  
Location: Room: 230, Light Engineering  
Usage: ESE 280, ESE 381, ESE 440, ESE 441, ESE 475, ESE 476, ESE 499

The Embedded Systems Design Laboratory (ESDL) is devoted to teaching and system design projects involving embedded microprocessor and microcomputer based systems. The primary portion of the laboratory is located in the Light Engineering building, on the second floor, in room 230. A project related area is located in a portion of an adjacent room, room 228.

The ESDL facility is used primarily to support the laboratory portions of two undergraduate courses: ESE-280 and ESE-381, Embedded Microprocessor Systems Design I and II. The main portion of the lab contains 13 student stations, each of which supports a group of 2 students. Each student station is equipped with a networked personal computer (PC), a full function state-of-the-art solderless breadboarding system, a Fluke model 45 dual display digital multimeter, an HP 54603B Digital Storage Oscilloscope, and a variety of other test equipment. Each station also has available a number of specialized microcomputer daughter boards and accessories, along with several industry standard JTAG-ICE debugging units, which collectively provide support for a large number of microcomputer devices and system design projects. Finally, a variety of specialty and custom designed items are available at each of the student stations, based on that semester's student design project.

The ESDL facility also has available a device programming station that is used in by students enrolled in ESE280, ESE381, ESE475, ESE476, ESE499, and ESE440/441. The programming station enables the programming of SPLDs, CPLDs, EPROMS, microcontrollers, and a large number of other classic and state-of-the-art programmable devices.

Each personal computer of each lab station is networked via a gigabit Ethernet local area network (LAN), providing connectivity to the lab's Xeon-based Dell PowerEdge server. This server is RAID 1 compliant and has eight high capacity high speed SCSI hard drives. At the present time the server is running the Windows Server network operating system. The laboratory LAN is connected by a dedicated firewall to the campus switched Ethernet network and the Internet. This provides high speed access to a variety of on and off campus computer systems and Websites. This server also supports the Digital Systems Rapid Prototyping Lab (DSRPL) facility, which is described below.

The ESDL meets all requirements of the *Americans with Disabilities Act* (ADA), and other mandated safety requirements of the Federal and New York State governments. There is also one wheel-chair accessible student station in the ESDL.

## **IEEE Student Laboratory**

Contact Person: President, IEEE Student Branch  
Location: Room 175, Light Engineering

This laboratory is run, independently, by the student chapter of the Institute of Electrical and Electronic Engineers. This lab contains 16 networked computers and various test equipment. It also has 4 dedicated computers with access to Engineering CAD programs utilized in the curriculum. Seniors find the laboratory particularly useful in testing their senior design projects.

## **Digital Signal Processing Laboratory (DSP)**

Contact Person: Scott Campbell  
Location: Room 179, Light Engineering  
Usage: ESE 347, 440, 441

The Digital Signal Processing Laboratory has a HP Spectrum Analyzer, in-circuit emulator and the capability for Real-time DSP implementation. The laboratory has ten workstations, each of which contains a Dell personal computer, a 60 MHz 2-channel digital oscilloscope, function generator, Texas Instruments Peripheral Explorer Board with TMS320F28335 processor, and Texas Instruments TMS320C6701 Evaluation Module. All of the stations have a full set of development tools (Texas Instruments Code Composer Studio, C compiler, assembler,

linker, and simulator) for the TMS320C67xx and TMS320F2833x families; this software, with the simulator target, is also available in the CAD lab, providing students with access outside laboratory hours.

This facility supports ESE 347 (Digital Signal Processing: Implementation), ESE 440 (Engineering Design I), and ESE441 (Engineering Design II). ESE347 has a regularly scheduled laboratory (3 hours/week). The experiments performed include:

- design and implementation of simple FIR filters;
- design and implementation of high-order FIR filters, including low-pass, broadband differentiators, and Hilbert transformers;
- design and implementation of simple IIR filters, with effects of overflow and saturation;
- design and implementation of higher-order IIR filters, with special emphasis on bilinear transform designs;
- design of digital oscillators.
- AM and SSB modulation/demodulation

### **Senior Design and Prototyping Laboratory**

Contact Person: Anthony Olivo  
Location: Rooms 283A and B, Light Engineering  
Usage: ESE 323, ESE 363, ESE 373 and ESE 440/441

This laboratory is used for the design, construction, and testing of Senior Design Projects and Surface Mount Technology printed circuit board design, assembly, reflow and manufacturing.

Room 283B contains ten general work stations consisting primarily of:

- Dell Optiplex Personal Computers
- Keysight DSO3012A 100MHz Dual Trace Oscilloscope.
- Keysight MSO3012A 100MHz Dual Trace Oscilloscope/16 Bit Digital Logic Analyzer.
- Agilent Model MSO7012A 100 MHz Two Channel Mixed Signal Storage Oscilloscope with 16 bit digital inputs.
- Agilent Model DSO7012B 100 MHz Two Channel Digital Storage.
- Agilent Model 34410A Precision Digital Multimeter.
- Agilent Model 33120A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 15 MHz.
- Agilent Model 33220A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 20 MHz.

Two RF work stations consisting of the following Agilent equipment:

- 54642A 500 MHz Two Channel Digital Storage Oscilloscope.
- 1142 Active Probe Station
- E4401B Spectrum Analyzer with tracking generator.
- 8648A Synthesized Signal Generator, 0.01 to 1000 MHz.
- 4285A Precision LCR Meter, 75 kHz to 30 MHz.
- E5100A Network Analyzer, 100 kHz to 180 MHz.
- 4395A Network/Spectrum/Impedance Analyzer, 10 Hz to 500 MHz, with 87511A S-Parameter Test Set.
- BWD-45 Shortwave Dipole and RF Systems Wideband DX500 Active antennae for reception of radio signals.

The six work stations consist of Dell Optiplex 990 PC's that contain several engineering software packages. All PC's are connected to a HP P3015 LaserJet Network Printer through a HP Procurve 1800 24 port Gigabit switch and to the internet through a Smoothwall 3 Firewall.

Room 283A houses 10 workstations of prototyping and manufacturing equipment for SMT (Surface Mount Technology) printed circuit boards.

- Two MakerBot Replicator 3D printers connected to Dell Optiplex 990 PC's running AutoDesk Inventor Pro CAD software system.
- One Manncorp. MC301 SMT Reflow oven
- Two Manual SMT Pick and Place machines with solder dispenser
- Two Manncorp. Precision Solder Paste dispensers

The remaining 8 workstations contain

- National Instruments ELVIS breadboard system and PXI Test Chassis
- Weller SMT Soldering Systems
- Dell Optiplex 990 PC's running Labview and AutoDesk engineering packages

### **Wireless and Intelligent Systems (WIS) Laboratory**

Contact Person: Wendy Tang, Ridha Kamoua, Directors

Location: Room 150, Light Engineering

The WIS laboratory, directed by Dr. Wendy Tang and Ridha Kamoua, focuses on various sensors with integrated communication capabilities for intelligent systems. The laboratory is equipped with state-of-art computing equipment's, novel sensors, wireless sensor motes and interfaces by Crossbow Technology Inc. Current projects include wireless health monitoring systems and novel network topologies for wireless sensor networks.

## APPENDIX E RESEARCH LABORATORIES

All research laboratories are used by students working toward either their Masters or Ph.D. degree. In addition, undergraduate students may also use these facilities for independent work study (ESE 499).

### **Computer Vision Laboratory**

Contact Person: Prof. Murali Subbarao  
Location: Room 248, Light Engineering

This laboratory has a network of Personal Computers, digital imaging hardware, and custom built Computer Vision Systems for experimental research in 3D vision and digital image processing.

### **COSINE Laboratory**

Contact Person: Prof. Petar M. Djurić  
Location: Room 202,204, 256, Light Engineering

The COSINE Laboratory supports the research efforts of faculty members and graduate and undergraduate students of the Department of Electrical and Computer Engineering whose work is in the areas of signal processing, communications, and networking. Current and recent research projects involve Monte Carlo-based signal processing, signal and information processing over networks, machine learning, wireless sensor networks, Bayesian signal processing, positioning and navigation, signal detection and estimation, signal modeling, radio-frequency identification, computer networking, biocomputing, data transmission using coded modulation, multiple-access systems, scheduling, network performance evaluation, grid computing, information theory, and image processing.

### **Wireless Sensing and AUTO ID Laboratory (WSAID)**

Contact Person: Prof. Petar M. Djurić  
Location: Room 286 CEWITT

WSAID is located in room 286 of the CEWIT building at the Research and Development Park. The research at the laboratory focuses on Radio Frequency Identification (RFID), wireless sensor networks, and indoor localization. The lab contains facilities and equipment to carry out cutting edge research and small-scale prototyping and evaluation of technologies in real world scenarios. Current projects at the laboratory include development of a novel UHF RFID system for enhanced performance, development of indoor localization systems based on technologies such as RFID, WiFi and Zigbee, and development of customized RFID systems for use in healthcare settings.

### **Fiber Optics Sensors Laboratory (FOSL)**

Contact Person: Prof. Harbans Dhadwal  
Location: Room 136, Light Engineering  
Usage: ESE363, ESE440, ESE441 and ESE499

Research emphasis is on the development and fabrication of novel fiber optic systems for very diverse applications ranging from aerospace to biomedical. Research work has been supported by NSF, NASA, NIH and various state and industrial partners. Some of the current research projects include development of capillary waveguide based biosensors for detection of pathogens in a marine environment, laser debridement, cavity sensors for flight control surfaces, and photonic power conversion for mobile platforms.

The laboratory is equipped with various capabilities for optical and electronic diagnosis. These include a fiber optic fusion splicer, fiber polisher, diamond saw, optical microscope, optical spectral analyzer, single photon-counting systems, a high speed digital autocorrelator and various laser sources. Additionally, the laboratory has the facilities for designing and fabricating printed circuit boards and fabricating optical and electronic sub-systems.

### **Microwave Characterization Laboratory (MCL)**

Contact Person: Prof. Harbans Dhadwal  
Location: Room 210, Light Engineering

The facility includes an anechoic chamber for characterizing microwave systems radiating at frequencies above 10 GHz. An automated measurement system permits polarization and azimuth scans. Current projects include development of microwave sensors for measurement of attitude angles. Test equipment includes oscillators, spectrum analyzers and power meters for use in the 10 GHz frequency range.

### **Fluorescence Detection Lab**

Contact Person: Prof. Vera Gorfinkel  
Location: Rooms 551-559, Chemistry Building

This lab is involved in design, development, implementation, and testing of various instruments for Life Sciences. Research areas include laser induced fluorescence detection, single photon counting techniques, fast data acquisition and transfer, design and development of analog and digital integrated circuits, signal processing, capillary electrophoresis phenomena, DNA sequencing, microfluidics.

### **Nanoscale Circuits and Systems (NanoCAS) Laboratory**

Contact Person: Prof. Emre Salman  
Location: Room 228, Light Engineering

This research laboratory focuses on developing design methodologies for high performance as well as energy efficient integrated circuits with application to future processors and embedded computing. Located at 228 Heavy Engineering Building, the NanoCAS Lab is equipped with a high performance processing and storage server, workstations, and all necessary EDA tools for modeling, design, and analysis. For updated information, please visit:

[nanocas.ece.stonybrook.edu](http://nanocas.ece.stonybrook.edu)

### **Medical Image Processing Lab**

Contact Person: Prof. Gene Gindi (4-2539)  
Location: Room 060 T-8 HSC

We apply signal processing techniques to medical images to evaluate the quality of reconstructed images in terms of performance metrics on medically relevant detection and estimation performance figures. This allows one to optimize the imaging system hardware or the reconstruction algorithm. Most of our work involves nuclear medical image (PET and SPECT) and X-ray imaging, though some of our work is of a more fundamental nature and applies to areas beyond medical imaging. We also conduct human psychophysical performance testing on detection tasks to validate our theoretical predictions.

We are well equipped with 8 Linux and Wintel work stations, and much of our computationally intensive work is carried out on a high performance 16 node dual core Unix cluster devoted exclusively to the lab.

## **Integrated Microsystems Lab**

Contact Person: Prof. Milutin Stanačević  
Location: Room 258, Light Engineering

Our research efforts are focused on advancing the performance of CMOS integrated circuits at analog sensor interfaces. We investigate design of miniature, low-power, highly accurate sensing microsystems, that have a significant and pervasive impact on a large number of applications, ranging from new generation of biomedical devices for personal health monitors, hearing aids or implantable neural prostheses to communication devices and radiation detectors. The lab is fully equipped for the design, testing and characterization of analog and mixed-signal integrated circuits.

## **Automatic Hardware Generation and Optimization (AHGO) Laboratory**

Contact Person: Prof. Peter Milder  
Location: Room 350, CEWIT Building

The AHGO laboratory focuses on research of new computer-based techniques to improve design and optimization of FPGA and VLSI digital systems, emphasizing applications in signal processing, computer vision, cloud computing, and communications. The lab is equipped with Intel workstations, Xilinx and Altera FPGA development boards and environments, and commercial CAD tools.

## **Mobile Systems Design Laboratory**

Contact Person: Prof. Sangjin Hong  
Location: Room 254 Light Engineering

Mobile Systems Design Laboratory is equipped to conduct research in the broad area of VLSI systems design for signal processing and communications. The laboratory has several SUN workstations for design and simulation of complex hardware and software systems. These machines equipped with commercial CAD tools and FPGA prototyping capability. There are PCs with wireless network testing capability for network hardware platform design.

## **Mobile Systems Design Laboratory**

Contact Person: Prof. Sangjin Hong  
Location: Room 266, CEWIT Building

Mobile Systems Design Laboratory is equipped to conduct research in the broad area of collaborative systems for heterogeneous mobile sensors.

The laboratory has several workstations for design and simulation of complex hardware and software systems. These machines equipped with commercial CAD tools and FPGA prototyping capability. There are PCs with wireless network testing capability for network hardware platform design.

## **High-Performance Computing and Networking Research Laboratory**

Contact Person: Prof. Yuanyuan Yang  
Location: Room 243, Heavy Engineering

Here is the description for High Performance Computing and Networking Research Laboratory. Please also use this version to update the department website.

This laboratory is equipped to conduct experimental research in the broad areas of networking and parallel and distributed systems. The lab has

- 1 Dell PowerEdge 1800 computing server,
- 8 Dell OptiPlex GX620 MT workstations,
- 1 Sun Ultra 60 Workstation with dual processors,
- 4 Sun Ultra 10 Workstations,
- 8 Dell Latitude D610 laptops,
- 4 Lenovo ThinkPad X41 tablets/laptops,
- 8 Dell 520 MHZ Axim X51v PDAs,
- 1 Agilent 1683A standalone logic analyzer,
- 1 Agilent 54622A 2 channel 100-MHz MegaZoom oscilloscope,
- 1 M1 HF RFID development kit,
- 1 DKM8 UHF RFID development kit, and
- 1 CC2420DK development kit.

### **Opto-Electronics Laboratory**

Contact Person: Prof. Gregory Belenky  
Locations: Room 181, 208 Light Eng.  
Room 231, 233 Heavy Eng.

The laboratory specializes in growth, fabrication and advanced characterization of optoelectronic devices including semiconductor lasers. The laboratory equipment park includes everything which is necessary to complete production process of an optoelectronic device – from design to packaging. Powerful computer simulation packages such as BeamProp, COMSOL and PADRE are used for device structure design.

The designed structures are grown by Molecular Beam Epitaxy (MBE) in VEECO Gen 930 reactor including materials of III and V groups. Immediately after growth epitaxial materials are characterized with high-resolution X-ray diffractometry and photoluminescence and carrier lifetime measurements with time resolution from 200 femtoseconds to microseconds providing rapid feedback for optimization of growth. Powerful optical Namarsky microscopes with magnification of 1500 times and Veeco Dimension atomic force microscope are used to monitor surface morphology of the grown wafers. The wafers are further processed in a Class 100 clean room. The typical procedures include oxygen plasma cleaning, e-beam metal and optical quality dielectric deposition, plasma etching, substrate lapping polishing and cleaving. Unpackaged devices are tested with probe stations operating from liquid helium to room temperatures and above. The good devices are mounted with chip bonding machine and electrically connected to the mount's terminals using ball and wedge wire bonding machines.

Next characterization cycle includes measurements of various device operation parameters. High-sensitivity and high-resolution spectral measurements are performed with Fourier transform and grating spectrometers. Optical characteristics light emitting diodes with output power ~ 1mW and of diode lasers and diode laser arrays with output powers exceeding 100 W are measured with a variety of quantum and thermal detectors. Mid-IR cameras and reflection optics are used for the device imaging. Transient characteristics of the devices are studied in a frequency range up to 20 GHz.

### **Ultra High Speed Computing Laboratory**

Contact Person: Prof. Mikhail Dorojevets  
Location: Room 244, Light Engineering  
Room 170, CEWITT

The Ultra High Speed Computing Laboratory is focused on designing 50-100 GHz processors with novel logic and memory superconductor technologies. This research facility is equipped with SUN and Dell high-performance workstations, several PCs, and a 36-processor computing cluster. All computers are connected by 10 Gbit/sec Ethernet LAN.

### **Wireless and Networking Systems Laboratory**

Contact Person: Prof. Xin Wang  
Location: Room 141, Heavy Engineering

This lab conducts research in the wireless networking and mobile computing area. The current research topics of the lab can be found from the group website. This lab has about 550 square feet space in the recently renovated Heavy Engineering building. The lab has eight Pentium Dell workstations, a set of crossbow sensors, professional sensor test bed development kit, and other equipments for networking and system researches.

### **Mixed-Domain Embedded Systems Laboratory**

Contact Person: Prof. Alex Doboli  
Location: Rm 270, CEWITT Building

The lab is equipped for research in the broad area of electronic system design and design automation. The lab contains 2 SUN workstations, 6 PCs, a programmable network of 50 embedded processors, and several microcontroller and FPGA based boards. Various IC design software tools, including Cadence and Synopsys tools, are installed. The lab has its own library of more than 200 books, 50 Ph.D. thesis, as well as the most relevant research papers published over the last five years. Current research projects involve design automation for mixed analog-digital systems and embedded systems for multimedia, sensor network applications and emerging technologies.