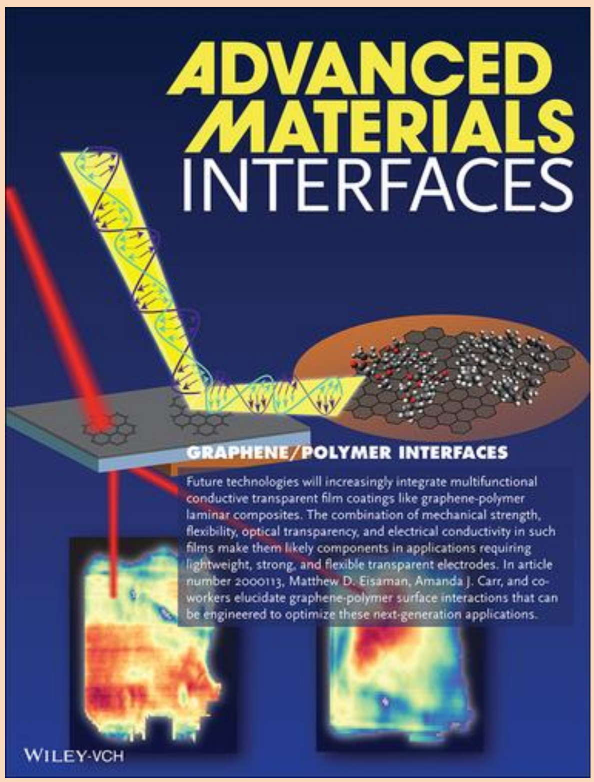
Stony Brook University
College of Engineering and Applied Sciences

September 2024
Undergraduate Guide
To
Electrical Engineering



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Department of Electrical & Computer Engineering
Stony Brook University
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CONTENTS

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

Fall 2024

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 Circuits and VLSI; Communications, Signal Processing, and Networking; Nanoelectronics and Photonics; and Power and Energy Systems. 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, 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 b 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, Northrop Grumman, Omnicon Group, GE Energy, Boeing, Motorola, 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
1) **Demonstrate Versatility**:**	
WRT: Write Effectively in English	WRT 102*
QPS: Master Quantitative Problem Solving	AMS151
HUM: Address Problems using Critical Analysis and the Methods of the Humanities	ANY
SNW: Study the Natural World	PHY131
TECH: Understanding Technology	ESE123 or ESE 118
SBS: Understand, Observe, and Analyze Human Behavior and the Structure and Functioning of Society	ANY
ARTS: Explore and Understand the Fine and Performing Arts	ANY
USA: Understand the Political, Social, and Cultural History of the United States	ANY
GLO: Engage Global Issues	ANY
2) **Explore Interconnectedness:**	
STAS: Science or Technology and the Arts, Humanities, or Social Sciences	ESE 301
3) **Pursue Deeper Understanding**	ESE 440
4) **Prepare for Life-Long Learning**	ESE 441

* 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

** One of the SBC courses should also have **DIV** designation.

2.3 Recommended Course Sequence For Electrical Engineering Major

	Fall		cr	Spring		cr
Freshman	**AMS 151[1]**	**Calculus I (QPS)**	3	**AMS 161[1]**	**Calculus II**	3
	PHY 131/ 133[2]	**Physics I/Lab (SNW)**	4	**PHY 132/ 134[2]**	**Physics II/Lab**	4
	ESE 123	Intro. to ECE (TECH)	4	AMS 210	Linear Algebra	3
	WRT 102	**Eng. Comp. (WRT)**	3	**ESE 118**	**Digital Logic Design**	4
		First Year Seminar 101	1		First Year Seminar 102	1
Total			**15**			**15**
Sophomore	ESE 124	Prog. Fund.	4	AMS 261	Calculus III	4
	ESE 280	Emb. Microcontroller Sys. Design I	4	**ESE 272**	**Electronics**	4
	ESE 271	**Circuit Analysis**	3	**ESE 273**	**Microelectronic Circuits**	3
	ESE 305	**Det. Sig. Sys.**	**3**	ESE 224	Advanced Prog. & Data Structures	4
	AMS 361	Calculus IV	4	ESE 306	Rand. Sig. Sys.	3
Total			**18**			**18**
Junior	**ESE 331**	**Semiconductor Dev.**	**3**	ESE 324	Advanced Electronics Lab	3
	ESE 323	**Prototyping**	**3**	**ESE XXX[4]**	**Specialization Course**	3
	ESE 342	**Comm. Sys.**	3	**ESE 300**	**Tech. Comm. For ECE**	2
	ESE 319	E&M	3	**ESE 301**	**Eng. Ethics (STAS)**	2
	ESE	**Elective[5]**	3	**ESE 315**	**Control System Design**	3
				ESE	**Elective[5]**	3
Total			**15**			**16**
Senior	**ESE 440**	**Eng. Design I**	3	**ESE 441**	**Eng. Design II**	3
	ESE XXX[4]	**Specialization Course**	3	SBS	Soc. and Beh. Sci.	3
		Math or Science Elec[3].	4	ESE	Elective[5]	3
	ARTS	Arts	3	USA	American History	3
	HUM	Humanities	3	GLO	Global	3
Total			**16**			**15**

All courses in **boldface** must be passed with a minimum grade of C.
A course may not satisfy more than one category.

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 One course from: CHE 131, CHE 152 , BIO 202 , BIO 203 , ESG 198, PHY 251, AMS 301 or ESE 122

4 Students must select one of the four specializations listed below by the end of the sophomore year and two courses from the corresponding list:

a. **Circuits and VSLI**: ESE 330, ESE 355, ESE 411, ESE 414
b. **Communications, Signal Processing, and Networking**: ESE 337, ESE 346, ESE 442
c. **Nanoelectronics and Photonics**: ESE 332, ESE 412, ESE 413, ESE 334
d. **Power and Energy Systems**: ESE 350, ESE 352, ESE 435, ESE 451, ESE 452

5 Three technical ESE electives. Any upper division (300 or 400 level) **ESE** course that is not required except ESE 494. The three technical electives may not be satisfied by any of the required courses within the specialization.

2.3.a Checklist For Major Requirements In Circuits and VLSI Specialization

AMS 151[1] ______________	**PHY 131 [2]** ____________		**(PHY 125______& 133_____)**
(or MAT 131)	**PHY 133** _____________		**(PHY127_______&134______)**
	PHY 132[2] _____________	**OR**	**(PHY126 _____________)**
AMS 161[1] ______________	**PHY 134** ____________		
(or MAT 132)			

AMS 210 _____________ (or MAT 211)	AMS 261 _______________ (or MAT 203)	AMS 361) _______________ (or MAT 303)

ESE 118 ____________	ESE 123 ___________	ESE 124 _____________
ESE 305 _____________	ESE 306 _____________	ESE 224 ____________
ESE 271 ____________	**ESE 272** ____________	**ESE 273** ____________
ESE 280 _____________	**ESE 300** _____________	**ESE 301** _____________
ESE 315 _____________	ESE 319 _____________	**ESE 323** _____________
ESE 324 _____________	**ESE XXX[5]** _____________	**ESE 331** _____________
ESE 342 _____________	**ESE XXX[5]** _____________	**ESE 440** _____________
ESE 441 _____________		

Three technical ESE electives[3] (2 with **C** or better) ____________________

______________________ ______________________

Math or science elective[4] ________________________

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- Three technical ESE electives. Any upper division (300 or 400 level) **ESE** course that is not required except ESE 494. The three technical electives may not be satisfied by any of the required courses within the specialization.

4 - Math or Science elective: One course from: CHE 131, CHE 152 , BIO 202 , BIO 203 , ESG 198, PHY 251, AMS 301 or ESE 122

5- Two courses selected from ESE 330, ESE 355, ESE 411, ESE 414

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

2.3.b Checklist For Major Requirements In Communications, Signal Processing, and Networking Specialization

AMS 151[1] ______________ **(or MAT 131)**	**PHY 131 [2]** ____________		**(PHY 125**______**& 133**_____**)**
	PHY 133 _____________		**(PHY127**_______**&134**______**)**
	PHY 132[2] _____________	**OR**	**(PHY126** _____________**)**
AMS 161[1] ______________ **(or MAT 132)**	**PHY 134** ____________		

AMS 210 _____________ (or MAT 211)	AMS 261 _______________ (or MAT 203)	AMS 361) _______________ (or MAT 303)
ESE 118 ____________	ESE 123 ____________	ESE 124 _____________
ESE 305 _____________	ESE 306 _____________	ESE 224 ____________
ESE 271 ____________	**ESE 272** ____________	**ESE 273** ____________
ESE 280 _____________	**ESE 300** _____________	**ESE 301** _____________
ESE 315 _____________	ESE 319 _____________	**ESE 323** _____________
ESE 324 _____________	**ESE 331** _____________	**ESE XXX[5]** _____________
ESE 342 _____________	**ESE 440** _____________	**ESE 441** _____________
ESE XXX[5] _____________		

Three technical ESE electives[3] (**2 with C** or better) ____________________

______________________ ______________________

Math or science elective[4] _______________________

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- Three technical ESE electives. Any upper division (300 or 400 level) **ESE** course that is not required except ESE 494. The three technical electives may not be satisfied by any of the required courses within the specialization.

4 - Math or Science elective: One course from: CHE 131, CHE 152 , BIO 202 , BIO 203 , ESG 198, PHY 251, AMS 301 or ESE 122

5- Two courses selected from ESE 337, ESE 346, ESE 442

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

2.3.c Checklist For Major Requirements In Nanoelectronics and Photonics Specialization

AMS 151[1]______________
(or MAT 131)

AMS 161[1] ______________
(or MAT 132)

PHY 131 [2] ____________
PHY 133 _____________
PHY 132[2] _____________
PHY 134 ____________

OR

(PHY 125______& 133_____)
(PHY127_______&134______)
(PHY126 _____________)

AMS 210 _____________
(or MAT 211)

AMS 261 _______________
(or MAT 203)

AMS 361) _______________
(or MAT 303)

ESE 118 ____________	ESE 123 ____________	ESE 124 _____________
ESE 305 _____________	ESE 306 _____________	ESE 224 ____________
ESE 271 ____________	**ESE 272** ____________	**ESE 273** ____________
ESE 280 _____________	**ESE 300** _____________	**ESE 301** _____________
ESE 315 _____________	ESE 319 _____________	**ESE 323** _____________
ESE 324 _____________	**ESE 331** _____________	**ESE XXX[5]**____________
ESE 342 _____________	**ESE XXX[5]**_____________	
ESE 440 _____________	**ESE 441** _____________	

Three technical ESE electives[3] (**2 with C** or better) ____________________

______________________ ______________________

Math or science elective[4] ________________________

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- Three technical ESE electives. Any upper division (300 or 400 level) **ESE** course that is not required except ESE 494. The three technical electives may not be satisfied by any of the required courses within the specialization.

4 - Math or Science elective: One course from: CHE 131, CHE 152 , BIO 202 , BIO 203 , ESG 198, PHY 251, AMS 301 or ESE 122

5- Two courses selected from ESE 332, ESE 334, ESE 412, ESE 413

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

2.3.d Checklist For Major Requirements In Power and Energy Systems Specialization

AMS 151[1] ______ **(or MAT 131)**	**PHY 131 [2]** ______		**(PHY 125____ & 133____)**
	PHY 133 ______		**(PHY127____&134____)**
	PHY 132[2] ______	**OR**	**(PHY126 ______)**
AMS 161[1] ______ **(or MAT 132)**	**PHY 134** ______		

AMS 210 ______ (or MAT 211)	AMS 261 ______ (or MAT 203)	AMS 361) ______ (or MAT 303)

ESE 118 ______	ESE 123 ______	ESE 124 ______
ESE 305 ______	ESE 306 ______	ESE 224 ______
ESE 271 ______	**ESE 272** ______	**ESE 273** ______
ESE 280 ______	**ESE 300** ______	**ESE 301** ______
ESE 315 ______	ESE 319 ______	**ESE 323** ______
ESE 324 ______	**ESE 331** ______	**ESE XXX[5]** ______
ESE 342 ______	**ESE 440** ______	**ESE 441** ______
ESE XXX[5] ______		

Three technical ESE electives[3] (**2 with C** or better) ______________

______________ ______________

Math or science elective[4] ______________

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- Three technical ESE electives. Any upper division (300 or 400 level) **ESE** course that is not required except ESE 494. The three technical electives may not be satisfied by any of the required courses within the specialization.

4 - Math or Science elective: One course from: CHE 131, CHE 152 , BIO 202 , BIO 203 , ESG 198, PHY 251, AMS 301 or ESE 122

5- Two courses selected from ESE 350, ESE 352, ESE 435, ESE 451, ESE 452

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

2.4 Academic Advising

The Department has an undergraduate committee that consists of the Undergraduate Program Director and nine 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.

2.5 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 280. 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.

2.6 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 request for evaluation using this form. A record of previous transfer equivalencies is available for reference at:
https://www.stonybrook.edu/commcms/advising/_transferinfo/equivalencies/

2.7 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 taken for the major must be taken for a letter grade. A grade of C or higher is required in the following courses:

> ESE 118, ESE 271, ESE 272, ESE 273, ESE 300, ESE 301, ESE 305, ESE 315, ESE 323, ESE 331, ESE 342, ESE 440, ESE 441, Two ESE Technical Electives, ESE Specialization Courses, AMS 151, AMS 161 (or MAT 131, MAT 132), PHY 131, PHY 132, PHY 133, PHY 134

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 300, ESE 301, 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) or ESE 495 (Honors) 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 D 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 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 the permission of the Electrical & Computer Engineering Department.
ESE 475 and ESE 476 may be used as Technical ESE Electives.

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

Course Descriptions

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. An introduction to the C programming language will be provided along with the basics of embedded electronics and the Internet of Things.

SBC: TECH

ESE 118: Digital Logic Design (4)

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. May not be taken for credit in addition to EEO 218/219.

Fall, Spring

Prerequisite: ESE 123

SBC: TECH

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

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)

Introduces basic electrical and computer engineering concepts in a dual approach that includes: laboratories for hands-on wired and computer simulation experiments in analog and logic circuits, and lectures providing concepts and theory relevant to the laboratories. Emphasizes physical insight and applications rather than theory. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information. Fall and Spring

Pre- or Corequisites: AMS 151 or MAT 125 or 131

SBC: TECH

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. May not be taken for credit in addition to EEO 124.

Fall, Spring

Prerequisite: Declared Area of Interest or Major in Electrical or Computer Engineering.

ESE 188: Understanding Machine Learning (3)

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. The course does not require any prerequisites in engineering or computer science.

SBC: TECH

ESE 224: Advanced Programming and Data Structures (4)

The course presents fundamental data structures and algorithms frequently used in engineering applications. Object oriented programming in C++ is used to teach the concepts. Discussed topics include: programming and applications of data structures; stacks, queues, lists, heaps, priority queues, and introduction to binary trees. Recursive programming is heavily utilized. Fundamental sorting algorithms are examined along with informal efficiency analysis. May not be taken for credit in addition to EEO 224.

Fall, Spring

Prerequisite: ESE 124

ESE 271: Electrical Circuit Analysis (3)

The course covers the following topics: passive circuit elements: resistors, capacitors, inductors. Elements of circuit topology. Kirchhoff's and Ohm's law. Nodal and mesh analysis. Equivalent circuits. Steady-state AC circuits. Phasors. Transient analysis. Laplace transforms. Fundamentals of AC power, coupled inductors (transformers). Not for credit in addition to EEO 271. Fall, Spring

Prerequisite: MAT 127 or 132 or 142 or 171 or AMS 161

Pre/co-requisite: PHY 127/134 or 132/134 or 142

ESE 272: Electronics (4)

This is the first non-linear electronics class that introduces the students to the fundamentals of the circuit design through the architecture of a modern electronics system at the interface with sensors and actuators. Modeling of the non-linear devices, diode and MOS transistors, is presented, along with basic properties of MOS transistors for analog (amplification) and digital (switching) IC circuit design. Operational amplifier ideal and non-ideal models are explored along with the concepts of the feedback and stability. Signal conditioning circuits (fixed-gain, difference and instrumentation amplifiers, active filters), signal shaping circuits (rectifier, clipper, peak detector) and oscillators are presented. Basics of sample and hold circuit, data converters, digital signal processing platforms and radios are presented. spring

Prerequisite: ESE 271

ESE 273: Microelectronic Circuits (3)

This is the first integrated circuits class that introduces the students to the fundamentals of the non-linear devices and design of IC amplifiers. The course starts with the introduction to the device physics, operation and modeling of a diode. Operation of MOS transistor, derivation of the large-signal transistor current as a function of the terminal voltages in different regions of operation is then presented, along with the small-signal model. Single-stage amplifier structures are explored, along with the introduction of the implementation of current source and current mirror. Frequency-response of common-source amplifier is presented. The concepts of multi-stage amplification and differential pair are introduced. Operation modeling of bipolar transistors are presented, along with the common-emitter amplifier. Comparison of MOS and BJT transistor and performance of common-source and common-emitter is presented. Not for credit in addition to EEO 315. Spring

Prerequisite: ESE 271

ESE 280: Embedded Microcontroller Systems Design I (4)

Fundamental design of microcontroller-based electronic systems. Topics include system level architecture, microcontrollers, memory, configurable ports, peripheral ICs, interrupts, sensors, and actuators, serial data protocols, assembly language programming, debugging, and table driven FSMs. Hardware/software trade-offs in implementing system functions. Hardware and software design are equally emphasized. Laboratory work involves design, implementation, and verification of microcontroller systems. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information. Fall

Prerequisite: ESE or ECE major; ESE 118 or permission of instructor.

ESE 290: Transitional Study (1-3)

A vehicle used for 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.

Prerequisite: Permission of department

ESE 300: Technical Communication for Electrical and Computer Engineers (2)

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 are the writing of resumes and cover letters. May not be taken for credit in addition to EEO 300. Spring

Prerequisite: WRT 102; ESE or ECE major, U3 standing; ESE 280

ESE 301: Engineering Ethics and Societal Impact (2)

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. Introduction to patents, copyright, trademarks and infringement using case studies. May not be taken for credit in addition to EEO 302. Fall, Spring

Prerequisite: U3 or U4 standing; one D.E.C. E or SNW course

SBC: STAS

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.

Prerequisite: ESE 273 or 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. Not for credit in addition to EEO 301. Fall, Spring

Pre- or Corequisite: ESE 271

ESE 306: Random Signals and Systems (3)

Random experiments and events; random variables and random vectors, probability distribution functions, random processes; Binomial, Bernoulli, Poisson, and Gaussian processes; Markov chains; significance testing, detection of signals, estimation of signal parameters; properties and application of auto-correlation and cross-correlation functions; power spectral density; response of linear systems to random inputs. May not be taken for credit in addition to EEO 306. Spring

Prerequisite: ESE 305

ESE 315: Control System Design (3)

The course aims to introduce students to basic concepts of classical control theory, such as closed-loop systems, root-locus analysis, Bode diagrams and Nyquist Criterion, and their applications in electrical, mechanical, and electromechanical systems. The students are expected to master the methods for control systems design including basic feedback control and PID control, which have a major application in the design of process control systems for industry. Spring

Prerequisite: ESE 305

ESE 319: Electromagnetics and Transmission Line Theory (3)

Properties of generic uniform plane waves including phase and group velocities. Uniform plane electromagnetic waves (UPEMWs) consisting of an electric field wave and a magnetic field wave, both moving synchronously in space and time; mutual right-handed orthogonality between the electric and magnetic field vectors and the direction of propagation; Poynting vector. Transmission lines (TLs): voltage and current behaving as waves on TLs, voltage reflection coefficient, impedance transformation law, VSWR, Smith Chart, impedance matching. Maxwell equations, EM wave equation, boundary conditions. Scattering of UPEMWs incident normally or obliquely at the interface plane between two dielectric media. Waveguides: TE and TM modes of a rectangular waveguide, cut-off frequencies, dominant mode, power flow. Not for credit in addition to EEO 319. Fall

Prerequisites: ESE 271; AMS 261 or MAT 203 or MAT 307; AMS 361 or MAT 303 or MAT 308

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 272 and ESE 280

ESE 324: Advanced Electronics Laboratory (3)

The objective of this advanced electronics lab course is to provide hands-on design experience for students. The students will have the opportunity to leverage theoretical knowledge acquired during ESE 272 and ESE 273 to design and test more complex and highly popular electronic circuits such as multi-stage amplifier, voltage regulator, and DC-DC boost and buck converters, data converters, and phase-locked loop. The initial several experiments will be based on the fundamental single stage amplifiers. The rest of the experiments will be more design centric where students will have the responsibility to determine either topology or the values of the circuit elements in each experiment in order to satisfy specific design objectives. The lectures will cover the theoretical principles as well as related design tradeoffs. Different topologies and analysis techniques will be presented for each circuit, guiding students during the design process. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information. Spring

Prerequisites: ESE 272 and ESE 273

ESE 325: Modern Sensors (3)

The course focuses on the underlying physics principles, design, and practical implementation 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

Prerequisite: ESE 273

ESE 326: Fundamental Algorithms for Automated Electronic Design (3)

Upon completion of the course, students will know to design and implement the fundamental algorithms for automated electronic design, such as system and circuit design. The discussed core algorithms include greedy algorithms, divide-and-conquer, quicksort, dynamic programming, graph algorithms, and string matching. Analysis of algorithms is also discussed. These algorithms are exemplified for basic electronic design tasks, like circuit partitioning, floorplanning, module placement, signal routing, task scheduling, resource allocation, and technology mapping. The course work involves programming exercises and one course project. Spring

Prerequisites: ESE 224

ESE 327: Fundamental Algorithms for Machine Learning Systems (3)

The course presents the fundamental methods used in Machine Learning for engineering applications. The course discusses representation models for learning, extraction of frequent patterns, classification, clustering, and application of these techniques for different engineering applications. Supervised and unsupervised learning methods are discussed. The course includes two projects that involve devising and implementing the studied techniques and their evaluation using standard benchmark data. Fall

Prerequisites: ESE 224

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. Spring

Prerequisite: ESE 273

ESE 331: Semiconductor Devices (3)

The course covers physical principles of operation of semiconductor devices. Energy bands and energy band diagram, carrier densities, transport properties, generation recombination phenomena in bulk semiconductors, and the continuity equation are covered first. Equipped with an understanding of the character of physical phenomena in semiconductors, students learn the principles of operation, current-voltage characteristics, and nonidealities of p-n junction diodes, metal-semiconductor contacts, bipolar junction transistors, and field effect transistors. Not for credit in addition to EEO 331. Fall

Prerequisites: AMS 361 or MAT 303; PHY 127/134 or PHY 132/134 or PHY 142

ESE 332: Quantum Mechanics for Engineers (3)

Introductory undergraduate level first course in quantum mechanics geared towards engineers and applied physicists. Comprehensive introduction to quantum mechanics and its application to real-world problems. Fall

Prerequisites: PHY 122/124 or PHY 126 and 127 and 134 or PHY 132/134 or PHY 142/134; MAT 127 or 132 or 142 or 171 or AMS 161

Advisory Corequisite: AMS 261 or MAT 203 or 205 or 307

ESE 333: Real-Time Operating Systems (3)

Introduces basic concepts and principles of real-time operating systems. Topics include 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. Fall

Prerequisites: ESE 224 or CSE 214; ESE 280

ESE 334: Introduction to Nanoelectronic Devices (3)

The major goals and objectives are to provide undergraduate students with initial knowledge and understanding of nanoelectronic devices. The course will cover physical properties of low-dimensional structures (quantum wells, quantum wires, quantum dots, and superlattices) that create a basis for operation of nanoelectronic devices as well as nanostructure fabrication, characterization and applications in nanoelectronics. Additionally, the course will cover applications of nanotechnology in biology and medicine. Fall

Prerequisite: ESE 331

ESE 337: Digital Signal Processing: Theory (3)

Introduces digital signal processing theory, discrete time sequences and systems, linear time-invariant (LTI) systems, convolution sum, Discrete Time Fourier Transform (DTFT), Z-transform, Discrete Fourier Series (DFS), sampling DTFT, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), sampling and reconstruction of continuous and discrete time signals, design of FIR and IIR filters, difference equations. May not be taken for credit in addition to EEO 303. Fall

Prerequisite: ESE 305

ESE 342: Communication Systems (3)

Basic concepts in both analog and digital data communications; signals, spectra, and linear networks; Sampling and pulse modulation; Pulse modulation schemes; Principles of digital transmission; Behavior of analog and digital systems in noise; Channel capacity and channel coding schemes. Fall

Prerequisite: ESE 306

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 everyday living. Spring

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

ESE 344: Software Techniques for Engineers (3)

This course covers software techniques for solving electrical and computer engineering problems in the C++ programming language. Design, implementation, and application to engineering problems of non-linear data structures and related advanced algorithms are covered. This includes binary trees, trees, graphs, and networks. OOP features such as Polymorphism, templates, Exception handling, File I/O operations, as well as Standard Template Library are used in the programming projects. Spring

Prerequisites: ESE 224

ESE 345: Computer Architecture (3)

This course focuses on the fundamental techniques of designing and evaluating modern computer architectures and tradeoffs present at the hardware/software boundary. The emphasis is on instruction set design, processor design, memory and parallel processing. Students will get an understanding of the design process in the context of a complex computer system. Students will undertake a VHDL/Verilog design project using modern CAD tools. Fall, Spring

Prerequisites: ESE 280 and ESE 382

ESE 346: Computer Communications (3)

Basic theory and technology of computer communications. Introduction to performance evaluation, error codes and routing algorithms. Introduction to queueing theory, machine learning for networking and network planning. Other topics include Ethernet, wireless networks including LTE, 5G and 6G, fiber optic networking, software defined networking, networking on chips, space networks, data centers, grids and clouds. Not for credit in addition to CSE 310 or ISE 316 or ISE 317 or EEO 306. Fall

Pre- or corequisite: ESE 306

ESE 350: Electric 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 operating electric power facilities (when available). Topics included are: Three Phase AC systems, phasor and function of time analysis, per unit representation, transmission line parameters, delta-wye transformers, power flow, transient stability, renewable energy integration, and basics of power system protection. Spring

Prerequisite: ESE 271

ESE 352: Electromechanical Energy Converters (3)

An introduction to the conversion of mechanical power to electric power (generators) and the conversion of electric power to mechanical power (motors). Analysis of the interaction of magnetic fields with electric current and moving conductors to produce electromagnetic force and induced voltage. Energy converters studied include three phase AC synchronous generators and motors, AC induction motors, DC linear and rotating machines, and single phase AC motors. An introduction to inverter-based renewable energy generations in power systems. Fall

Prerequisite: ESE 273

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 laboratory experiments and hands-on use of CAD tools.

Prerequisite: ESE 118

ESE 356: Digital System Specification and Modeling (3)

A comprehensive introduction to the field of system level design. This course introduces basic concepts of complex hybrid (software/hardware) system modeling and simulation methodologies. Topics include top-down and bottom-up design methodology, system complexity refinement, SystemC specification language syntax and semantics, behavioral and system-level modeling, channel and interface modeling and implementation, and IP core development. Included are three projects on modeling and simulation.

Prerequisites: ESE 224 and ESE 280

ESE 358: Computer Vision (3)

Introduces fundamental concepts, algorithms, computational techniques, and applications in visual information processing. Covers image formation models and image filtering, binary image analysis, feature detection, contours, image segmentation, 3D image capture and analysis through stereo, motion, structured-light, and LIDAR, medical images, pattern classification, machine learning, and 3D object recognition. Fall

Prerequisites: ESE 305; ESE 224

ESE 360: Network Security Engineering (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. Not for credit in addition to CSE 408. Spring

Pre- or corequisite: ESE 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: implementation of functionality; realizing new interfacing capabilities; and improving performance through programming the embedded microcontroller and customizing the reconfigurable analog and digital hardware of SoC.

Prerequisites: ESE 280 and ESE 273; ESE 224 or CSE 230

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. Spring

Prerequisites: ESE 280 and ESE 305

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

Prerequisites: 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, testbenches, subprograms, packages, and libraries. Architecture and characteristics of PLDs and FPGAs are studied. Laboratory work involves writing the VHDL descriptions and testbenches for designs, compiling, and functionally stimulating 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 or ECE major; ESE 118 or permission of instructor

ESE 388: Foundations of Machine Learning

This course provides an introduction to the fundamental concepts of machine learning. Statistical learning framework is utilized for clustering, classification, and prediction tasks. Concepts are reinforced through theoretical and programming assignments, with applications in computer vision, natural language processing and bioinformatics. Fall

Prerequisites: ESE 224 and ESE 306

3 credits

ESE 411: Analog Integrated Circuits (3)

Single-stage amplifiers biased and loaded with current mirrors. Frequency response. Two-stage operational amplifiers designed by conventional and computer-aided techniques. Negative feedback, stability and compensation. Spring

Prerequisite: ESE 273

ESE 412: 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 is involved. It discusses design and operation of optical modulators, quantum well lasers, light emitting diodes, and photodetectors. Spring

Prerequisite: ESE 331

ESE 413: Introduction 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 331

ESE 414: Fundamentals of Low Noise Electronics for Sensors

Introduction to sensor model, electronic noise, signal-to-noise analysis in frequency and time domains, low-noise charge amplification, low-noise amplifier design, filter design, analog and digital signal processing for sensors.

Prerequisite: ESE 411

ESE 435: Power System Analysis (3)

The course focuses on fundamental analytics of power systems. The course will help students understand major problems in power system static, dynamic, and stability analysis, as well as fundamental optimization issues in power system operation. The course covers power system steady-state modeling with emphasis on admittance and impedance matrix, power system dynamics modeling with emphasis on the functional state-space model, and power system analytics with emphasis on power flow analysis, eigenvalue analysis, and time-domain transient simulation. Advanced topics such as power system optimization exemplified by optimal power flow and unit commitment, as well as power system control will also be introduced. Emphasis is on using applied mathematics to analyze power system problems. Spring

Prerequisite(s): AMS 210 (Linear Algebra), ESE 271 (Electrical Circuit Analysis) or equivalent, U3 or U4 status

ESE 440: Senior Design I (3)

The senior design sequence (ESE 440 and ESE 441) 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. The final grade will be assigned at the end of the two course sequence ESE 440-441. Not counted as a technical elective. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information. Fall

Prerequisites: ESE or ECE major, U4 standing; ESE 300; For ESE majors: two ESE electives or for ECE majors: two ECE electives.

Partially fulfills: CER, ESI, EXP+, SBS+, SPK, STEM+, WRTD

ESE 441: Senior Design II (3)

The senior design sequence (ESE 440 and ESE 441) 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. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information. Spring

Prerequisite: ESE 440

Partially fulfills: CER, ESI, EXP+, SBS+, SPK, STEM+, WRTD

ESE 442: Recent Advances in Communications and Wireless Networks (3)

This course covers major wireless network protocols and recent advances on selected topics of communications and networks. Students are expected to survey the current literature on the subject area of the course and complete a project. Spring

Prerequisite: ESE 342 or ESE 346 or CSE 310

ESE 451: Power Electronics (3)

An introduction to the design and characterization of high-efficiency switch-mode power converters. Fundamental dc-dc converter topologies will be introduced and analyzed in the steady state and dynamically. The application of semiconductor devices in power applications including MOSFET, BJT, IGBT, and thyristors will be studied. Non-idealities in circuit components and the design of magnetic components will be discussed. Students will build and characterize circuits of their own design. Fall

Prerequisite: ESE 273

ESE 452: Advanced Power Electronics (3)

A continued study of switching power converters after ESE 451. Topics include power factor and AC power line current harmonics, analysis of discontinuous circuit operation, resonant converters, and soft-switching. The advantages of wide band gap semiconductors in high power applications will be discussed. Students will build and characterize their designs. Spring

Prerequisite: ESE 451

ESE 457: Fundamentals of Digital Image Processing (3)

This course covers fundamentals of digital image processing. Basic principles, computational algorithms, and applications are covered. Topics include image formation and sensing, sampling and quantization, image enhancement and histogram analysis, geometric transformations, filtering in the spatial and Fourier domains, edge and feature detection, color image processing, image deblurring, and medical images and computed tomography. Spring

ESE 462: AI Driven Smart Grids (3)

The course focuses on Artificial Intelligence (AI) applications to power system modeling, analysis, and operation. Topics include basics of AI and smart grid, AI-driven modeling such as load/renewable energy prediction and dynamic model discovery, AI-driven power system analysis such as dynamic simulation, and stability and security assessment, and AI-based operation such as optimal dispatch and emergency control. Emerging topics, including generative AI, quantum machine learning, and trustworthy AI, will also be discussed. Students enrolled in the course are expected to possess a foundational capability in using Matlab or Python for developing basic programs.

Prerequisites: ESE 350 or ESE 435; AMS 210 or MAT 211

Prerequisites: ESE 305; ESE 224

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 repeated once but only three credits may be counted as an ESE elective. Fall, Spring, Summer

Prerequisites: U4 standing; a minimum g.p.a. of 3.00 in all Stony Brook courses, and a grade of B or better in the course in which the student is to assist; permission of department.

SBC: EXP+

ESE 476: Instructional Laboratory Development Practicum (3)

Students work closely with a 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 as a technical elective for electrical and computer engineering majors. May be repeated as an open elective.

Prerequisites: U4 standing; minimum cumulative g.p.a. of 3.0 and minimum grade of A- in the course for which the students will develop material; permission of department and instructor

SBC: EXP+

ESE 481: Design of Secure IoT Embedded Systems (4)

This course focuses on the design, development, and implementation of secure IoT systems using microcontrollers, radio modules, sensors, and actuators. Topics include security and access management. installation of security credentials on a microcontroller. Microcontrollers with radio modules. Pre-provisioned radio modules. AWS serverless IoT. ExpressLink and AT commands. Permissions, policies and rules. IoT payloads and JSON. Message brokers. Publish and subscribe principle. MQTT broker and verification tools. IoT centric cloud services and their use. Operating a microcontroller in low power modes. The laboratory portion of the course will provide hands-on experience in designing and implementing IoT embedded systems. Fall

Prerequisites: ESE 381

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

An independent off-campus engineering project with faculty supervision. May be repeated but only three credits may be counted as an ESE elective.

Prerequisites: ECE or ESE major; U3 or U4 standing; 3.00 g.p.a. minimum in all engineering courses; permission of department

SBC: EXP+

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.

Prerequisite: Acceptance into the ECE or ESE Honors programs or permission of instructor.

ESE 495: Honors 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

Prerequisites: ESE 494, permission of department and acceptance into the ECE or ESE Honors programs

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

An independent research project with faculty supervision. Permission to register requires a 3.00 g.p.a. in all engineering courses and the agreement of a faculty member to supervise the research. May be repeated but only three credits may be counted as an ESE elective. Fall, Spring, Summer

Requirements: U4 standing, 3.00 GPA minimum in all engineering courses, permission of department

APPENDIX B: ECE FACULTY

FACULTY	RESEARCH INTERESTS
Choi, Hyeongrak	Quantum Information Science, Quantum Computing, Quantum Photonics, Quantum Networks
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
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.
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 sysems, social networks, epidemic networks, and power networks.
Luo, Fang	High power-density converter design, high-density EMI filter design and integration, and power module packaging/integration for wide band-gap devices.
Milder, Peter	Domain-specific hardware generation tools for FPGA and ASIC
Mendez-Mendez, Jorge	Lifelong machine learning, sequential decision making, robot learning, reinforcement learning.
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.

Zhang, Peng	Power system, programmable microgrids, networked microgrids, software-defined distribution network, cyber-resilient power grid, formal methods, reachability analysis, power system stability and control.
Zhao, Yue	Smart energy systems, renewable energy integration, electricity market, infrastructure security, sensing and signal processing, optimization theory, information theory, communication networks.
Zhou, Yifan	Power system dynamics and stability, inverter-based resources, renewable energy, verifiable smart grids, machine learning in smart grids, quantum computing.

APPENDIX C
TEACHING LABORATORIES

Analog Laboratory

Contact Person: Daniel Vuoso
Location: Room 283, Light Engineering
Usage: ESE 123, ESE 272, and ESE 324

This lab serves the ESE 123, ESE 272, 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 7080 Personal Computer with ATE connectivity,
- Keysight Model DSO-X3012A 100 MHz Two Channel Digital Storage Oscilloscope,
- Agilent Model E36312A Triple Output Power Supply with a variable +6 VDC and +/- 25 VDC outputs,
- Agilent Model 34450A 5½ Digit Precision Digital Multimeter,
- Agilent Model 34461A 6½ Digit Precision Digital Multimeter,
- Keysight Model 33210A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 10 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, and
- A GW Instek LCR-8505 Automatic RLC meter is available for general use.

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: Daniel Vuoso
Location: Room 235, Heavy Engineering
Usage: ESE 118

This laboratory serves ESE 118 (Digital Logic Design). The laboratory contains sixteen workstations, each consisting of a Keysight MSO-X3012A 100MHz Dual Trace Oscilloscope/16 Bit Digital Logic Analyzer, a PB 505 Digital Design Workstation, a Keysight 33210A function/arbitrary waveform generator and a Dell Optiplex 7080 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), and
- 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:	Bryant Gonzaga, 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, and system design projects involving advanced digital systems. The digital systems may employ embedded microcomputers, or alternately, programmable logic devices (PDLs) and a hardware description language (HDL), such as VHDL. 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 (Digital Design Using VHDL and PLDs). The lab room provides a number of student design stations, with each station supporting a design team of up to two students. Each design station has a networked personal computer (PC) and a 43” monitor. Once logged in, students have access to a number of sophisticated software design packages, including ActiveHDL by Aldec, Synplify Pro by Synopsys, ispLEVER by Lattice Semiconductor, Vivado by Xilinx, 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.

Several student project design verification stations are also available in the DSRPL. The design verification stations are updated each week, based on the actual lab assignment for that week, as well as the actual project being designed that semester. Importantly, the design verification stations enable full testing and evaluation of the student design solutions, in the real-world, and in real-time. A variety of test and debugging equipment, as needed for a respective week/project, are also provided by each design verification station. These include 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.

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 wheelchair accessible student workstations available in the DSRPL.

Electrical & Computer Engineering Computer Aided Design Laboratory

Contact Person:	Jenny Chen
Location:	Room 281, Light Engineering
Usage:	ESE 123, ESE 124, ESE 118, ESE 271, ESE 272 ESE 273, ESE 280, ESE 300, ESE 305, ESE 306, ESE 315, ESE 324, ESE 326, ESE 327, ESE 337, ESE 345, ESE 346, ESE 357, ESE 358, ESE 381, ESE 382, ESE 440, ESE 441, ESE 475, ESE 476, ESE 481, 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 42 Windows based Dell PC's, 1 Mac Mini, 2 Linux based machines (Ubuntu, Rocket), that are networked via switched ethernet to a Dell file server. There is one network laser printer available for students to print their results.

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

- Cadence LDV (VHDL and Verilog),
- Matlab with three toolboxes - The Mathworks Inc.,
- Aldec Active HDL – Aldec,
- Synplicity Pro – Synopsis,
- Embedded Workbench for Atmel AVR – IAR,
- ISP Lever – Lattice,
- Microsoft Visual Studio IDE C, C++ - Microsoft,
- Dev C++ IDE – Embarcadero Technologies,
- XCode (Mac Mini) – Apple,
- Microsoft Office – Microsoft,
- Pspice Capture, Pspice A/D – Cadence,
- Image Tool – University of Texas Health Science Center,
- SynaptiCAD – SynaptiCAD, and
- Texas Instruments TMS329 family development tools.

Embedded Systems Design Laboratory

Contact Individuals:	Bryant Gonzaga, Prof. Ken Short
Location: Room:	230 Light Engineering
Usage:	ESE 280, ESE 381, ESE 440, ESE 441, ESE 475, ESE 476, ESE 481, 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 the adjacent room 228.

The ESDL facility is used primarily to support the laboratory portions of two undergraduate courses: ESE 280 (Embedded Microprocessor Systems Design I) and ESE 381 (Embedded Microprocessor Systems Design II). As such, the main portion of the lab contains 18 identical student stations, each supporting a design team of up to two students. Each student station is equipped with a networked personal computer (PC), a 43" monitor, a full function state-of-the-art solderless breadboarding system, a dual-display digital multimeter, a full function Digital Storage Oscilloscope (DSO), and a function generator. Each station also has available a custom lab-pack, which includes a number of tools, a 16-channel logic analyzer module, a hand-held DVM, oscilloscope probes, and a variety of test cables. In addition, any of a large number of specialty and custom designed items may be provided at each of the student design stations, based on that semester's actual design project.

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 are several wheelchair accessible student stations 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.

Senior Design and Prototyping Laboratory

Contact Person: Daniel Vuoso
Location: Rooms 283A and B, Light Engineering
Usage: ESE 323 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 10 general workstations 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 34450A/34401A Precision Digital Multimeter,
- Agilent Model 33120A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 15 MHz. and
- Agilent Model 33220A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 20 MHz.

Some workstations also contain:

- Keysight EL34143A DC electronic load,
- Array 3721A DC electronic load, and
- Saleae Logic Pro 16 protocol-aware logic analyzer.

Two RF workstations 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, and
- BWD-45 Shortwave Dipole and RF Systems Wideband DX500 Active antennae for reception of radio signals.

The 6 workstations consist of Dell Optiplex 7050 PC's that contain several engineering software packages. All PC's are connected to a HP M402 LaserJet Network Printer through a Ubiquiti 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 board and the following equipment:

- Three Ultimaker 2+ Connect and two MakerBot Replicator+ 3D printers,
- One Manncorp. MC301 SMT Reflow oven,
- Two Manual SMT Pick and Place machines with solder dispenser,

- Two Manncorp. Precision Solder Paste dispensers,

- Three Omano digital inspection camera systems,
- Three Dino-Lite USB microscope cameras, and
- One optical microscope with electronic image capture.

The remaining 8 workstations contain:

- Keysight DSO-X3012A Two-channel digital storage oscilloscopes,
- Agilent/Keysight 34401A/34450A 6 ½ digit precision digital multimeter
- Weller SMT Soldering Systems, and
- Dell Optiplex 7090 PCs running various CAD and engineering software.

APPENDIX D

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 mobile and Bayesian signal processing, sensor signal processing, positioning and navigation, signal detection and estimation, signal modeling, wireless networks, 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: ESE440, ESE441 and ESE499 Research:
Research emphasis is on the development and fabrication of novel fiber optic systems for very diverse applications ranging from aerospace to biomedical. Projects involve development of new techniques and algorithms. 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.

Equipment: Equipment includes a fiber optic fusion splicer, fiber polisher, diamond saw, optical microscope, optical spectral analyzer with a sub-nanometer resolution, 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. Electronic test equipment includes logic analyzers and development platforms for USB2.0, Bluetooth and FPGA embedded systems.

Usage in UG Curriculum: The laboratory is used by undergraduate students taking ESE363, ESE440, ESE441 and ESE499. Primarily, these courses are senior level independent research/design courses. Students under the supervision of Prof. Dhadwal have full access to the laboratory and equipment discussed.

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

Integrated Microsystems Lab

Contact Person: Prof. Milutin Stanaćević
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.

Automatic Hardware Generation and Optimization (AHGO) Laboratory

Contact Person: Prof. Peter Milder
Location: Room 357, CEWIT Bldg
This lab is dedicated to the design and optimization of digital systems, with a focus on field-programmable gate arrays. The lab is equipped with numerous FPGA development systems from Xilinx and Intel, and with desktop PCs and servers with FPGA and ASIC CAD tools from Synopsys, Mentor Graphics, Cadence, Xilinx, and Intel.

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.

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 are 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 are equipped with commercial CAD tools and FPGA prototyping capability. There are PCs with wireless network testing capability for network hardware platform design.

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 wafersare 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 equipment for networking and system research.

Mixed-Domain Embedded Systems Laboratory

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

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.

Electric Power and Energy Systems Laboratory

Contact Person: Prof. Peng Zhang
Location: Room 118, 124, Suffolk Hall

The lab is dedicated to enabling innovations for different layers of grid infrastructures that will transform today's power grids into tomorrow's autonomic networks and flexible services towards self-configuration, self-healing, self-optimization, and self-protection against grid changes, renewable power injections, faults, disastrous events and cyber-attacks. Our lab conducts cutting edge research in Smart Programmable Microgrids (SPM), networked microgrids with a focus on AI-enabled control and stability, formal methods and reachability analysis, software-defined smart grid, cyber-physical resilience of power grid, power system stability and control, Quantum Grid (QGrid), and real-time electromagnetic transient analysis.

The main equipment in the Power Lab is a large real-time cyber-physical testbed consists of the following main components: 1) two RTDS NovaCor Cubicles including two NovaCor Chassis, GT- NETx2 cards, GTSYNC cards, and real-time simulation package; 2) Four Pica8 high performance 10G/40G Ethernet switches and other SDN switches for building a software-defined network for power grids; 3) Twelve Dell Edge R470 servers; 4) Hardware microgrid converter control toolboxes; 5) Dozens of Schweitzer protection and control devices including Schweitzer's most up-to-date distribution relays, PMUs, SDN switches, and microgrid controllers; 6) Ten Dell workstations and monitors for RTDS model development, test and experiments. Power Lab has developed a series of in-house software packages such as reliability and resilience evaluation tools for microgrids, large distribution systems, substations and bulk power systems, harmonic/interharmonic analysis toolbox, unbalanced power flow analysis, automated reconfiguration, source location for power quality disturbances, etc. The Lab's risk analysis software packages have been used for grid hardening and microgrid planning by major power utilities in the US. In addition, the Lab owns grid simulators such as PSS/E, DSAT, RT-LAB, RTCAD and PSCAD/EMTDC.

Opto-Electronics Laboratory

Contact Person: Prof. G Belenky
Location: Room 181, 208 Light Eng and 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.