STONY BROOK

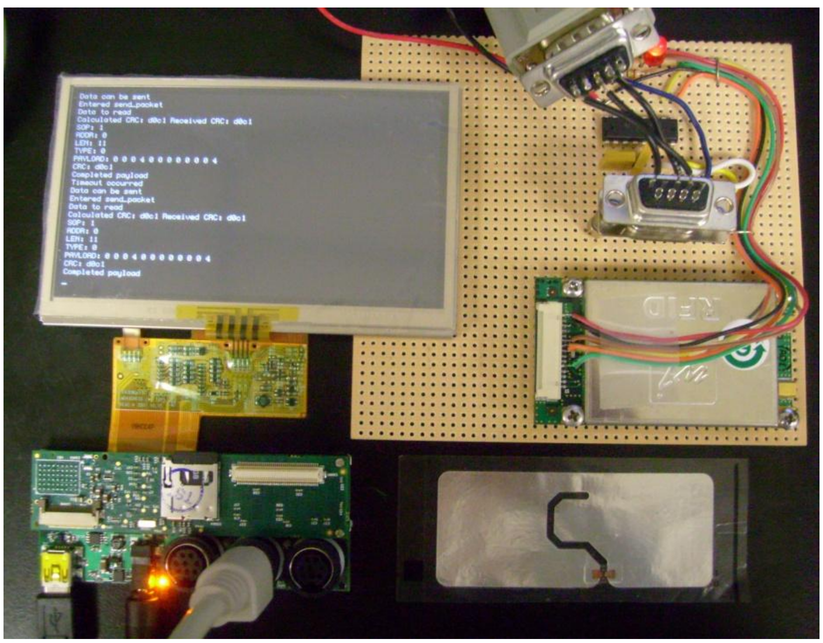
STATE UNIVERSITY OF NEW YORK

September 2009

Undergraduate Guide

To

Computer Engineering



Accredited ABET Engineering Accreditation Commission

Department of Electrical & Computer Engineering

Stony Brook University

Stony Brook, NY 11794-2350

CONTENTS

This guide is to be used as an aid for students planning course sequences within the Computer 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

September 2009

1. INTRODUCTION

Electrical engineering has been a professional field since 1884, and offers the greatest diversity of career choices; from communications to engineering in medicine and biology, from computers to oceanic engineering. Electrical engineering is the historical name for what is now called electrical, electronics, and **computer engineering.**

Since the advent of the computer and later the microprocessor, the field of digital electronics and computers has seen explosive growth and is now a major area of electrical engineering. The Computer Engineering Major allows student at Stony Brook to prepare for a career in this area. The program provides balanced preparation in both hardware and software needed for a computer engineering career.

Mission of the Electrical and Computer Engineering Department:

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 the 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 engineering. The first teaches the 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 engineering through choices of technical electives taken during the junior and senior year.

Objectives:

The program educational objectives for Computer Engineering are as follows:

PEO 1. Our graduates should excel in engineering positions in industry and other organizations that emphasize design and implementation of engineering systems and devices;

PEO 2. Our graduates should excel in best graduate schools, reaching advanced degrees in engineering and related disciplines;

PEO 3. Within several years from graduation our alumni should have established a successful career in an engineering-related multidisciplinary field, possibly leading or participating effectively in interdisciplinary engineering projects, as well as continuously adapting to changing technologies;

PEO 4. We expect our graduates to continue personal development through professional study and self-learning;

PEO 5. We expect our graduates to be good citizens and cultured human beings, as well as appreciate the importance of professional, ethical and societal responsibilities.

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

a) an ability to apply knowledge of mathematics, science, and engineering;

b) an ability to design and conduct experiments, as well as to analyze and interpret data;

c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;

d) an ability to function on multi-disciplinary teams;

e) an ability to identify, formulate, and solve engineering problems;

f) an understanding of professional and ethical responsibility;

g) an ability to communicate effectively;

h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;

i) a recognition of the need for ability to engage in life-long learning;

j) a knowledge of contemporary issues, and

k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

More details about program educational objectives and outcomes can be found at http://www.ece.sunysb.edu/peos

2. DEGREE REQUIREMENTS FOR COMPUTER ENGINEERING MAJOR

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 Computer Engineering Major of the B.E. degree program is periodically evaluated by the national Accreditation Board for Engineering and Technology (A.B.E.T.). This board, comprising various professional engineering organizations, ensures a consistent engineering curriculum throughout the United States. The B.E. program in computer engineering is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 - telephone: (410) 347-7700.

2.1 A.B.E.T. Requirements for Computer Engineering

A.B.E.T. 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 Electronic Design. This course, taught by a team of faculty, 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 Diversified Education Curriculum (D.E.C.)

The general education requirements of the university, described in the Diversified Education Bulletin, summarized in Table 1, must be satisfied by all students. D.E.C. requirements are divided into three categories of University Skills, Disciplinary Diversity, and Expanding Perspectives and Cultural Awareness. Additionally, each category is subdivided and assigned a letter from A through J. Courses satisfying each letter category may be taken at any time, except for D.E.C. A, which must be taken in the Freshman year. No D.E.C. course may be used to satisfy two categories simultaneously, however, it may also be used to satisfy the major requirements. For example, PHY 131 satisfies D.E.C. category E as well as the major requirement. In selecting courses for the I and J categories, students must select one with a humanities designator and the other with a social sciences designator (this ensures necessary depth). Students should use Table 1 in planning their D.E.C. course assignments.

Table 1: Diversified Education Curriculum (D.E.C.)
Requirements for Computer Engineering Majors

LEVEL	COURSES (number)	GRADE (min)	EXAMPLE
University Skills:			
A - English Composition	1	C	WRT 102*
B – Interpreting Texts in the Humanities	1	D	ANY
C - Mathematical and Statistical Reasoning	1	C[1]	AMS 151
Disciplinary Diversity:			
E – Natural Sciences	2	C[1]	PHY 131,133 PHY 132,134
F – Social and Behavioral Sciences	1	D	ANY
G – Humanities	1	D	ANY
Expanding Perspectives and Cultural Awareness:			
H – Implications of Science and Technology	1	D	ESE 301
I – European Traditions	1	D	see above
J – The World Beyond European Traditions	1	D	see above

* 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.

[1] A grade of "C" is a major requirement

2.3 Recommended Course Sequence For Computer Engineering Major

Year	FALL ..	Credits	SPRING	Credits
	AMS 151[1] Calculus I(or **MAT 131**)	3-4	**AMS 161**[2] Calculus II (or **MAT 132**)	3-4
	PHY 131[1] Classical Physics I[2]	3	**PHY 132**[2] Classical Physics II	3
	PHY 133[1] Classical Physics Lab. I[2]	1	**PHY 134**[2] Classical Physics Lab. II	1
Freshman	**D.E.C. A** English Comp	3	CHE 131 Gen Chem or ESG 198	4
	ESE 123 Introduction to ECE	4	First Year Seminar 102	1
	First Year Seminar 101	1	ESE 124 Com. Tech. for Elect. Design	3
		15-16		15-16
	D.E.C Course	3	AMS 210 Applied Lin Algebra (or MAT 211)	3
	AMS 361 Appl Cal IV (or MAT 303)	4	D.E.C. Course	3
	ESE 218 Digital Sys Design	4	**ESE 211** Electronics Lab. A	2
Sophomore	**ESE 271** Circuit Analysis	4	**ESE 372** Electronics	4
	CSE 230 Int. Prog.in C and C++	3	**CSE 114** Computer Science I	4
	or ESE 224	18		16
	CSE 214 Computer Science II	3	CSE 219 Computer Science III	3
	AMS 301 Finite Math. Struc. I	3	**ESE 300** Writing in Elect. Eng.	3
Junior	ESE 305 Deterministic Signals & Sys.	3	D.E.C. H: ESE 301 Eng.Ethics & Soc. Imp.	3
	ESE 314 Electronics Lab. B	3	ESE 306 Random Signals & Systems	4
	ESE 380 Embedded Sys.Dsgn.I	4	**ESE 382** Digital Design using VHDL	4
		16		17
	ESE 440 Elec Engineering Dsgn.I[4]	3	ESE 441 Electrical Eng. Design II[4]	3
	ESE XXX[3]	3	**ESE XXX**[3]	4
Senior	**ESE 345** Computer Architecture	3	**ESE XXX**[3]	3
	ESE 333 Real-time Oper. Systems/**OR** CSE 306 Operating Systems	3	D.E.C. Course	3
			D.E.C. Course	3
	ESE XXX[3]	3		
	D.E.C. Course	3		
		18		16

Total credits = 131- 133

All courses in **Boldface** 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 & 171, or MAT 125, MAT 126 and MAT 127 or MAT 141 and 142, or MAT 141 & 171

2 - PHY 131 and PHY 132 can be replaced by (PHY 125, PHY 126 and PHY 127), 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 - 4 ESE electives must be selected from ESE 311, 319, 330, 337, 344, 346, 347, 349, 355, 356, 357, 358, 360, 366, 381, 476, CSE 376

4 - Senior Design Project must be one that has been pre-approved as appropriate for the Computer Engineering Major

STUDENTS _CANNOT_ PNC COURSES

2.4 Checklist For Requirements In Computer Engineering

AMS 151[1] ____________ (**or MAT 131**)

PHY 131[2] ____________

PHY 133 ____________

CHE131 ____________ (or ESG 198)

AMS 161 ____________ (**or MAT 132**)

PHY 132 ____________

PHY 134 ____________

AMS 210 (or MAT 211) ____________

AMS 301 ____________

AMS 361 (or MAT 303) ____________

CSE 114 ____________

CSE 214 ____________

CSE 219 ____________

CSE 230 (or ESE 224) ____________

ESE 301 ______________________ (D.E.C. H)

ESE 123[1] ____________

ESE 124 ____________

ESE 211 ____________

ESE 271 ____________

ESE 300 ____________

ESE 305 ____________

ESE 306 ____________

ESE 314 ____________

ESE 218 ____________

ESE 333 ____________ (Or CSE 306)

ESE 345 ____________

ESE 372 ____________

ESE 380 ____________

ESE 382 ____________

ESE 440 ____________

ESE 441 ____________

4 ESE electives must be selected from ESE 311, 319, 330, 337, 344, 346, 347, 349, 355, 356, 357, 358, 360, 366, 381, 476, CSE 376

ESE ____________

ESE ____________

ESE ____________

ESE ____________

Courses in **Boldface** must be completed with a **"C"** or better.

1 - Transfer students who have Transfer Credits for the freshman Mathematics (Calc I & II) and Physics (I and II) may apply for a waiver of ESE 123. Written applications must be submitted to the Director of Undergraduate Studies in Electrical & Computer Engineering.

STUDENTS *CANNOT* PNC COURSES

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2.5 Academic Advising

The Department of Electrical & Computer Engineering is committed to providing excellent advising to all of its students. Undergraduate advisors are available for consultation during pre-assigned office hours. 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. This compulsory advising is enforced through a registration block, which is removed only after the student has seen an advisor.

2.6 Communication Skills

The importance of reporting results through written and oral communication is stressed throughout the four years. Technical report writing is an essential component of all laboratory courses. The skills are honed and fine tuned in a required junior level technical communication course. Students must register for the technical communication course ESE 300 concurrently with or after completion of ESE 314, 324, 380, or 382. The senior design project is a final platform for students with an opportunity to present their results in two written reports and an oral presentation.

2.7 Transfer Credit Equivalency

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

3. ACADEMIC GUIDELINES

a) Grading Requirements

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

1) ESE 211, ESE 271, ESE 218, ESE 300, ESE 345, ESE 372, ESE 380, ESE 382, AMS 151 or MAT 131 , AMS 161 or MAT 132, PHY 131/133, PHY 132/134, CSE 114, CSE 214, CSE 230

2) 4 ESE Technical Electives.

b) Pass/No Credit Option

There is **NO PNC** option.

c) Residency Requirements

The following courses must be completed at Stony Brook:

1. Four ESE technical electives and ESE 345, ESE 380, and ESE 382, all with a grade of "C" or higher
2. ESE 440 and ESE 441 with a faculty advisor from the Electrical & Computer Engineering Department. The senior design project must be one that has been pre-approved as appropriate for the Computer Engineering Major.
3. ESE 300

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 elective requirements with approval. Approval must be obtained from the Department of Electrical & Computer Engineering, the course instructor, and the College of Engineering and Applied Science.

f) Undergraduate Research

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

g) Undergraduate Teaching

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

h) University Graduate 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 Sciences.

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

APPENDIX A
DESCRIPTION OF ESE COURSES

ESE 120 Projects in Electrical Engineering (3)
This course allows students to work with faculty and graduate students on an independent project in electrical engineering. This course is intended for high school students who are taking the Principles of Engineering course. Spring.
Prerequisite: Permission of Department.

ESE 123 Introduction to Electrical and Computer Engineering (4)
This course introduces basic electrical and computer engineering concepts through a two-pronged approach; hands-on wired and computer simulation experiments in analog and logic circuits; and supporting lectures providing concepts and theory relevant to the labs, with each experiment discussed one week earlier in lectures. The primary emphasis is on physical insight and applications rather than on mathematical rigor, and the intention is to stimulate the interest of students rather than overwhelm them with theory. PNC grading allowed for non majors. Fall and Spring.
Prerequisites or Corequisites: MAT 125 or 131 or 141 or AMS 151; PHY 125 or 131/133 or 141

ESE 124 Computer Techniques For Electronic Design I (3)
An extensive introduction to problem solving in electrical engineering using the ANSI C language. Topics covered include data types, operations, control flow, functions, data files, numerical techniques, pointers, structures, and bit operations. Students gain experience in applying the C language to the solution of a variety of electrical engineering problems, based on concepts developed in ESE 123. Knowledge of C at the level presented in this course is expected of all electrical engineering students in subsequent courses in the major. Spring and Fall.
Prerequisite or Corequisite: MAT 125 or 131 or 141 or AMS 151; ESE 123 or equivalent

ESE 211 Electronics Laboratory A (2)
Introduction to the measurement of electrical quantities; instrumentation; basic circuits, their operation and applications; electronic devices; amplifiers, oscillators, power supplies, wave-shaping circuits, and basic switching circuits. Fall and Spring.
Prerequisite: ESE 271
Corequisite: ESE 372 for ECE/ESE majors only

ESE 218 Digital Systems 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. Fall and Spring.
Prerequisite for engineering majors: PHY 127 or 132/134 or 142 or ESE 124
Prerequisite for CSE majors: CSE 220

ESE 224 Computer Techniques for Electronic Design II (3)
This course is an introduction of C++ programming language for problem solving in electrical and computer engineering. Topics covered include: C++ structures, classes, abstract data types and code reuse. Basic Object-oriented programming concepts as well as fundamental topics of discrete mathematics

and algorithms are introduced to solve problems in many areas in electrical and computer engineering. Fall. *Prerequisite:* ESE 124

ESE 231 Introduction To Semiconductor Devices (3)
This course covers the principles of semiconductor devices. Energy bands, transport properties and generation recombination phenomena in bulk semiconductors are covered first. Junctions between semiconductors and metal-semiconductor will then be studied. Equipped with an understanding of the character of physical phenomena in semiconductors, students learn the principles of operation of diodes, transistors, light detectors and light emitting devices. This course will provide general background for subsequent courses in electronics. Spring
Prerequisites: AMS 361 or MAT 303 and PHY 127 or 132/134 or 142

ESE 271 Electrical Circuit Analysis I (4)
Electrical circuit analysis. Kirchoff's Laws, Ohm's Law, nodal and mesh analysis for electric circuits, capacitors, inductors, and steady-state AC; transient analysis using Laplace Transform. Fundamentals of AC power, coupled inductors, and two-ports. Fall and Spring.
Prerequisites: MAT 127 or 132 or 142 or 171 or AMS 161; PHY 127 or 132/134 or 142

ESE 290 Transitional Study (1-3)
A vehicle used to transfer students to remedy discrepancies between a Stony Brook course and a course taken at another institution. For example, it allows the student to take the laboratory portion of a course for which he or she has had the theoretical portion elsewhere. Open elective credit only. Fall and Spring.
Prerequisite: Permission of department

ESE 300 Technical Communications for Electrical/Computer Engineering (3)
Topics include how technical writing differs from other forms of writing, the components of technical writing, technical style, report writing, technical definitions, proposal writing, writing by group or team, instructions and manuals, transmittal letters, memoranda, abstracts and summaries, proper methods of documentation, presentations and briefings, and analysis of published engineering writing. Also covered is the writing of resumes and cover letters. Spring.
Prerequisite: ESE, ECE majors, junior standing; WRT 102;
Prerequisite/ Corequisite: ESE 314 or 324 or 380 or 382

ESE 301 (D.E.C. H) **Engineering Ethics and Societal Impact (3)**
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.
Prerequisites: U3 or U4 standing, one D.E.C. category E course.

ESE 304 Applications of Operational Amplifiers (3)
Design of electronic instrumentation: structure of basic measurement systems, transducers, analysis and characteristics of operational amplifiers, analog signal conditioning with operational amplifiers, sampling, multiplexing, A/D and D/A conversion; digital signal conditioning, data input and display, and automated measurement systems. Application of measurement systems to pollution and to biomedical and industrial monitoring is considered. Spring.
Prerequisite: ESE 372

ESE 305 Deterministic Signals and Systems (3)
Introduction to signals and systems. Manipulation of simple analog and digital signals. Relationship between frequencies of analog signals and their sampled sequences. Sampling theorem. Concepts of linearity, time-invariance, causality in systems. Convolution integral and summation; FIR and IIR digital filters. Differential and difference equations. Laplace transform, z-transform, Fourier series and Fourier transform. Stability, frequency response and filtering. Provides general background for subsequent courses in control, communication, electronics and digital signal processing. Fall and Spring
Pre- or corequisite: ESE 271

ESE 306 Random Signals and Systems (4)
Random experiments and events; random variables, probability distribution and density functions, continuous and discrete random processes; Binomial, Bernoulli, Poisson, and Gaussian processes; system reliability; Markov chains; elements of queuing theory; detection of signals in noise; estimation of signal parameters; properties and application of auto-correlation and cross-correlation functions; power spectral density; response of linear systems to random inputs. Spring.
Prerequisite or Corequisite: ESE 305

ESE 307 Analog Filter Design (3)
Introduces basic concepts of analog filter theory and implementation. Topics include: filter types, transfer functions, Bode plots, implementation of first- and second order filters using op amps, maximally flat and equal-ripple filters, frequency transformations, LC ladders, transconductance-C realizations, switched capacitor circuits and filter sensitivity. Spring
Prerequisite: ESE 372 and ESE 305

ESE 310 Electrical Circuit Analysis II (3)
A continuation of ESE 271. Topics include network elements, graph theory, linear network analysis: fundamental loops and cutsets, matrix solutions, nonlinear network analysis; state variables, small and large signal analysis, numerical methods. Spring
Prerequisite: ESE 271

ESE 311 Analog Integrated Circuits (3)
Engineering design concepts applied to electronic circuits. Basic network concepts, computational analysis and design techniques: models of electronic devices; biasing and compensation methods; amplifiers and filters designed by conventional and computer-aided techniques. Spring.
Prerequisite: ESE 372

ESE 314 Electronics Laboratory B (3)
Coordinated with, and illustrates and expands upon, concepts presented in ESE 372. Experiments include diode circuits, class A BJT, FET and differential amplifiers as well as analog signal processing. Laboratory fee required. Fall
Prerequisite: ESE 211 & ESE 372

ESE 315 Control System Design (3)
Analysis and design of linear control systems. Control components, development of block diagrams. Computer simulation of control systems and op-amp circuit implementation of compensators. Physical constraints in the design. Pole-placement and model matching design using linear algebraic method. Selection of models using computer simulation and quadratic optimal method. Root-locus method and Bode plot method. Use of PID controllers in practice. Spring.
Prerequisite: ESE 271

ESE 319 Electromagnetics and Transmission Line Theory (3)
Fundamental aspects of electromagnetic wave propagation and radiation, with application to the design of high speed digital circuits and communication systems. Topics include: solutions of Maxwell's equations for characterization of EM wave propagation in unbounded and lossy media; radiation of EM energy; guided wave propagation with emphasis on transmission lines theory.
Prerequisite: ESE 271

ESE 321 Electromagnetic Waves and Wireless Communication (3)
Following topics are covered in this course; the wireless radio signal environment, electromagnetic wave propagation in free space and in other media, effects of reflection, scattering, diffraction, and multi-path interference on the characteristics and quality of the received signal., cellular wireless network planning, efficient use and reuse of assigned radio frequency spectrum, effects of transmitting and receiving antenna design, introduction of basic wireless communication techniques to achieve reliable communication. Spring.
Prerequisite: ESE 319

ESE 322 Intro to Auto ID Technologies (3)
This course covers the analysis and design of bar code symbologies and scanning technologies for automatic identification. Included are symbology code structures and pattern recognition; basic scanner design using both laser and imaging light sources; analysis of competing technologies and reasons for selection; printing technologies; bar code quality and specifications required for successful scanner design. Fall.
Prerequisite(s): ESE 372, ESE 218, ESE 305
Corequisite(s): ESE 319

ESE 323 RFID Technology for Automatic Identification (3)
This course covers the analysis and design of RFID technologies for automatic identification. Included are the theory of operation, analysis of RFID system components, passive and active tags, frequencies used, air interfaces, coding structures, antenna design and regulatory compliance. Spring.
Prerequisite: ESE 319

ESE 324 Electronics Laboratory C (2)
Illustrates and expands upon advanced concepts presented in ESE 372. Experiments include multistage amplifiers, class B and class C power amplifiers, speech processing, active RC and switched-capacitor filters, oscillators, and switching power supplies. Laboratory fee required. Spring.
Prerequisites: ESE 211, 372; ESE, ECE majors; junior standing

ESE 325 Modern Sensors (3)
The course focuses on the underlying physics principles, design, and practical implementations of senors 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. Spring
Prerequisites: ESE 372

ESE 330 Integrated Electronics (3)
An overview of the design and fabrication of integrated circuits. Topics include gate-level and transistor-level design; fabrication material and processes; layout of circuits; automated design tools. This

material is directly applicable to industrial IC design and provides a strong background for more advanced courses. Fall. *Prerequisite*: ESE 372

ESE 332 Semiconductor Device Characterization (3)
Basic experimental experience in characterization of microelectronic and optoelectronic semiconductor devices including diodes, transistors, light emitting diodes, lasers, and photodetectors. Measurement of I-V and L-I (light-current) device characteristics; practice in the techniques of determining various device parameters; analysis of aggregate experimental data to determine the relationships between device and output characteristics, device band diagrams, and device designs. Includes study of modern methods of silicon and compound semiconductor devices and systems technologies. Spring.
Prerequisite: ESE 372

ESE 333 Real-Time Operating Systems (3)
Intro to basic concepts and principles of real-time operating systems. The topics to be covered include operating system concepts and structure, multiple processes, interprocess communication, real-time process scheduling, memory management, virtual memory, file system design, security, protection, and programming environments for real-time systems. Fall
Prerequisite: ESE 124, CSE 214 and ESE 380 or CSE 220

ESE 337 Digital Signal Processing Theory (3)
An introduction to Digital Signal Processing Theory, Sequences, Discrete-Time Convolution, and Difference Equations, Sampling and Reconstruction of Signals, One- and Two-Sided Z-Transforms, Transfer Functions and Frequency Response. Design of FIR and IIR Filters. Discrete and Fast Fourier Transforms and Applications. Fall
Prerequisite: ESE 305

ESE 340 Basic Communication Theory (3)
Basic concepts in both analog and digital data communications; signals, spectra, and linear networks; Fourier transforms, energy and power spectra, and filtering; AM, FM, and PM; time and frequency multiplexing; discussion of problems encountered in practice; noise and bandwidth considerations; pulse modulation schemes. Fall.
Prerequisites: ESE 305 and 306

ESE 341 Intro to Wireless & Cellular Communication (3)
Basic concepts of wireless cellular communications, radio frequency spectrum reuse, radio channel characterization, path loss and fading, multiple access techniques, spread spectrum systems, channel coding, specific examples of cellular communication systems.
Prerequisite or Corequisite: ESE 340
Corequisite: ESE 305

ESE 342 Digital Communications Systems (3)
Pulse modulation and sampling. All-digital networks. Pulse code modulation. Digital modulation techniques. Time-division multiplexing. Baseband signaling. Intersymbol interference. Equalization. Basic error control coding. Exchange of reliability for rate.ARQ schemes. Message and circuit switching. Spring
Prerequisite : ESE 340

ESE 344 Software Techniques for Engineers (3)
Trains students to use computer systems to solve engineering problems. It covers C/C++ programming language, UNIX programming environment, basic data structures and algorithms, and object oriented programming. Spring.

Prerequisites: ESE 218 or (discontinued ESE 318) and ESE 224 or CSE 230

ESE 345 Computer Architecture (3)
Starts with funcitonal components at the level of registers, buses, arithmetic, and memory chips, and then uses a register transfer language to manipulate these in the design of hardware systems up to the level of complete computers. Specific topics also included are microprogrammed control, user-level instruction sets, I/O systems and device interfaces, control of memory hierarchies, and parallel processing organizations. Fall.
Prerequisites for ESE, ECE majors: ESE 380
Prerequisites for CSE majors: CSE 220 and ESE 218

ESE 346 Computer Communications (3)
Basic principles of computer communications. Introduction to performance evaluation of protocols. Protocols covered include those for local, metropolitan and wide area networks. Introduction to routing, high speed packet switching, circuit switching and optical data transport. Other topics include TCP/IP, Internet, web server design, network security and grid computing. Crosslisted with CSE 346. Spring.
Prerequisite or corequisite for ESE, ECE majors: ESE 306
Prerequisite for CSE majors: CSE 220; *Prerequisite or corequisite:* AMS 310 or 311

ESE 347 Digital Signal Processing: Implementation (4)
Fundamental techniques for implementing standard signal processing algorithms on dedicated digital signal processing chips. Topics include a review of discrete-time systems, sampling and reconstruction, FIR and IIR filter design, FFT, architecture and assembly language of a basic signal processing chip, and an introduction to adaptive filtering. Spring.
Prerequisite: ESE 337 or ESE 305 and ESE 380

ESE 350 Electrical Power Systems (3)
Fundamental engineering theory for the design and operation of a modern electric power system. Modern aspects of generation, transmission, and distribution are considered with appropriate inspection trips to examine examples of these facilities. The relationship between the facilities and their influence on our environment are reviewed. Topics included are power system fundamentals, characteristics of transmission lines, generalized circuit constants, transformers, control of power flow and of voltage, per unit system of computation, system stability, and extra-high voltage AC and DC transmission. Spring.
Prerequisite: ESE 271

ESE 352 Electromechanical Energy Converters (3)
Basic principles of energy conversion; DC, induction, and synchronous rotary converters; the three-phase system and symmetrical components; the relationships between voltage, current, flux, and m.m.f.; equivalent circuits and operating characteristics of rotary converters; and analysis of saturation effects. Fall.
Prerequisite: ESE 372

ESE 355 VLSI System Design (4)
Introduces techniques and tools for scalable VLSI design and analysis. Emphasis is on physical design and on performance analysis. Includes extensive lab experiments and hands-on usage of CAD tools.
Spring
Prerequisite: ESE 218

ESE 356 Digital System Specification and Modeling(3)
Introduces concepts of specification and modeling for design at various level of abstraction. High Level specification language is used for executable models creation, representing possible architecture implementations. Topics include design space exploration through fast simulation and reuse of models and implementation.   Spring
Prerequsiites: ESE 380 and ESE 124

ESE 357 Digital Image Processing (3)
Covers digital fundamentals, image transforms, image enhancement, image restoration, image compression, image segmentation, representation and description, recognition and interpretation. Fall.
Prerequisites for ESE, ECE majors: ESE 305; ESE 224 or CSE 230
Prerequisites for CSE majors: CSE 214 and CSE 220

ESE 358 Computer Vision (3)
Introduces fundamental concepts, algorithms, and computational techniques in visual information processing. Covers image formation, image sensing, binary image analysis, image segmentation, Fourier image analysis, edge detection, reflectance map, photometric stereo, basic photogrammetry, stereo, pattern classification, extended Gaussian images, and the study of the human visual system from an information processing point of view. Fall.
Prerequisites for ESE, ECE majors: ESE 305; ESE 224 or CSE 230
Prerequisites for CSE majors: CSE 214 and CSE 220

ESE 360 Network Security (3)
An introduction to computer network and telecommunication network security engineering. Special emphasis on building security into hardware and hardware working with software.   Topics include encryption, public key cryptography, authentication, intrusion detection, digital rights management, firewalls, trusted computing, encrypted computing, intruders and viruses. Fall
Prerequisite: ESE/CSE 346

ESE 363 Fiber Optic Communications (4)
Design of single and multi-wavelength fiber optic communication systems. Topics include: analysis of optical fibers; optical transmitter and receiver design; optical link design, single-wavelength fiber optic networks with analysis of FDDI and SONET/SDH; wavelength division multiplexing. Spring.
Prerequisites: ESE 372

ESE 366 Design using Programmable Mixed-Signal Systems-on-Chip (4)
This course focuses on development of mixed-signal embedded applications that utilize systems on chip (SoC) technology. The course discusses design issues, such as (i) implementing functionality, (ii) realizing new interfacing capabilities, and (iii) improving performance through programming the embedded microcontroller and customizing the reconfigurable analog and digital hardware of SoC.
*Prerequisite***:** ESE 372, ESE 380 and ESE 224 **or** CSE230   Spring.

ESE 372 Electronics (4)
The pertinent elements of solid-state physics and circuit theory are reviewed and applied to the study of electronic devices and circuits, including junction diodes, transistors, and gate and electronic switches; large- and small-signal analysis of amplifiers; amplifier frequency response; and rectifiers and wave-shaping circuits. Fall and Spring.
Prerequisite: ESE 271
Corequisite: ESE 211 for ESE/ECE majors only

ESE 373 RF Electronics for Wireless Communications (3)
The course provides an introduction to the basic concepts and key circuits of radio-frequency systems. Taught within the context of the design and construction of a transceiver for wireless communications, the course covers fundamental principles which apply to all radio devices, from transceivers-on-a-chip to high-power broadcast transmitters. The essential theoretical background is presented at each stage, with additional emphasis placed on practical implementation using commercially-available integrated circuits for double-balanced mixers, oscillators, and audio power amplifiers. The topics begin with a thorough description of basic components and circuits, and continue with key elements of radio electronics, including filters, matching networks, amplifiers, oscillators, mixers, modulators, detectors, and antennas. Computer simulation via PSpice and Puff is emphasized as an integral part of the design process. Fall
Prerequisite(s): ESE 372

ESE 380 Embedded Microprocessor Systems Design I (4)
Fundamental concepts and techniques for designing electronic systems that contain a microprocessor or microcontroller as a key component. Topics include system level architecture, microprocessors, ROM, RAM, I/O subsystems, address decoding, PLDs and programmable peripheral ICs, assembly language programming and debugging. Hardware-software trade-offs in implementation of functions are considered. Hardware and software design are emphasized equally. Laboratory work involves design, implementation, and testing of microprocessor controlled circuits. Fall.
Prerequisite: ESE 218

ESE 381 Embedded Microprocessor Systems Design II (4)
A continuation of ESE 380. The entire system design cycle, including requirements definition and system specifications, is covered. Topics include real-time requirements, timing, interrupt driven systems, analog data conversion, multi-module and multi-language systems. The interface between high-level language and assembly language is covered. A complete system is designed and prototyped in the laboratory. Spring.
Prerequisite:ESE 271 and 380

ESE 382 Digital Design Using VHDL and PLDs (4)
Digital system design using the hardware description language VHDL and system implementation using complex programmable logic devices (CPLDs) and field programmable gate arrays (FPGAs). Topics include design methodology, VHDL syntax, entities, architectures, test benches, subprograms, packages, and libraries. Behavioral and structural coding styles for the synthesis of combinational and sequential circuits are covered. Architectures and characteristics of PLDs and FPGAs are studied. Laboratory work involves writing the VHDL descriptions and test benches for designs, compiling and functionally simulating the designs, fitting and timing simulation of the fitted designs, and programming the designs into a CPLD or FPGA and bench testing. Spring.
Prerequisite: ESE 318 or ESE 218

ESE 440 Engineering Design I (3)
Lectures by faculty and visitors on typical design problems encountered in engineering practice. During this semester each student chooses a senior design project for Engineering Design II. A preliminary design report is required. Not counted as a technical elective. Laboratory fee required. Individual project prerequisites. Fall.
Prerequisites: ESE or ECE major, senior standing; Two ESE technical electives (excluding ESE 390 and ESE 499); project dependent ; ESE 300

ESE 441 Engineering Design II (3)
Student groups carry out the detailed design of the senior projects chosen during the first semester. A comprehensive technical report of the project and an oral presentation are required. Not counted as a technical elective. Laboratory fee required. Spring and Fall.
Prerequisite: ESE 440

ESE 475 Undergraduate Teaching Practicum (3)
Students assist the faculty in teaching by conducting recitation or laboratory sections that supplement a lecture course. The student receives regularly scheduled supervision from the faculty instructor. May be used as a non-ESE technical elective only and repeated once. All semesters.
Prerequisites: Senior standing, a minimum grade point average of 3.0 in all Stony Brook courses, and a grade of B in the course in which the student is to assist; permis of dept.

ESE 476 Instructional Laboratory Development Practicum (3)
Students work closely with faculty advisor and staff in developing new laboratory experiments for scheduled laboratory courses in electrical and computer engineering. A comprehensive technical report and the instructional materials developed must be submitted at the end of the course. May be used once as a technical elective for electrical or computer engineering major. May be repeated once but only 3 credits may be used as technical elective for either Electrical or Computer Engineering. Fall and Spring
Prerequisite(s): U4 standing, a minimum grade point average of 3.0 in all Stony Brook courses, and a minimum grade of A- in the course for which the student will develop instruction material; permission of the department and the instructor.

ESE 488 Internship in Electrical/Computer Engineering (3)
An independent off-campus engineering project with faculty supervision. May be repeated but only three credits of internship electives may be counted toward the non-ESE technical elective requirement. All semesters.
Prerequisites: ESE, ECE major; junior standing; 3.0 grade point average in all engineering courses; permission of department

ESE 499 Research in Electrical Sciences (0-3)
An independent research project with faculty supervision. Permission to register requires a 3.0 average in all engineering courses and the agreement of a faculty member to supervise the research. May be repeated but only three credits of research electives (AMS 487, CSE 487, MEC 499, ESM 499, EST 499, ISE 487) may be counted toward non-ESE technical elective requirements. All semesters.

APPENDIX B

CSE COURSE DESCRIPTION

CSE 114 Computer Science I (4)
An introduction to procedural and object-oriented programming methodology. Topics include program structure, conditional and iterative programming, procedures, arrays and records, object classes, encapsulation, information hiding, inheritance, polymorphism, file I/O, and exceptions. Software debugging and testing techniques are emphasized including an introduction to formal verification methods. Includes required laboratory.
Prerequisites: C or higher in CSE 113

CSE 214 Computer Science II (3)
An extension of programming methodology to data storage and manipulation on complex data sets. Topics include: programming and applications of major data structures; stacks, queues, lists, binary trees, heaps, priority queues, balanced trees and graphs. Recursive programming is heavily utilized. Fundamental sorting and searching algorithms are examined along with informal efficiency comparisons.
Prerequisite: Grade of C or higher in CSE 114 or passing the proficiency examination for CSE 114.

CSE 219 Computer Science III (3)
Development of the basic concepts and techniques learned in CSE 114 Computer Science I and CSE 214 Computer Science II into practical programming skills that include a systematic approach to program design, coding, testing, and debugging. Application of these skills to the construction of robust programs of 1,000 to 2,000 lines of source code. Use of programming environments and tools to aid in the software development process.
Prerequisite: CSE 214

CSE 230 Intermediate Programming in C and C++ (3)
An intermediate introduction to the C and C++ programming languages. Topics include basic control structures and data types, functions and program structures, pointers and arrays, input and output system calls, classes and types, inheritance and object-oriented programming, exceptions and templates.
Prerequsities: CSE 130 or ESE 124 or MEC 112 or ESG 111

CSE 376 Advanced Systems Programming in UNIX/C (3)
Focuses on several aspects of producing commercial-grade system software; reliability, portability, security, and survivability. Uses Unix and C, heavily used in industry when developing systems and embedded systems code. Emphasizes techniques and tools to produce reliable, secure, and highly portable code. Requires substantial programming as well as a course project.
Prerequisite: CSE 214 or 230

APPENDIX C:
DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING FACULTY

FACULTY	RESEARCH INTERESTS
Belenky, Gregory L.	Optoelectronic device and systems. Semiconductor devices, physics and technology.
Chen, Chi-Tsong	Systems and control theory; digital signal processing.
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 and 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 in the topics of Bayesian analysis, sequential Monte Carlo methods, adaptive filtering, stochastic optimization and their applications to multiuser communications, smart antenna systems, target tracking and vehicle positioning and navigation.
Gindi, Gene	Medical Image Processing and Analysis with an emphasis on statistical methods
Gorfinkel, Vera	Semiconductor devices, including microwave and optoelectronics.
Hong, Sangjin	Low-power VLSI design of multimedia wireless communications and digital signal processing systems, including SOC design methodology and optimization
Kamoua, Ridha	Solid-state devices and circuits; microwave devices; integrated circuits.
Luryi, Serge	Sensor systems, semiconductor devices and technologies,optoelectronics
Murray, John	Signal processing; power switching electronics; systems theory.
Parekh, Jayant P.	Microwave acoustics; microwave magnetics; microwave electronics; microcomputer applications.
Robertazzi, Thomas G.	Computer networks; parallel processing, performance evaluation and e-commerce technology.
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.
Stanacevic, Milutin	Analog and Digital VLSI Circuits
Subbarao, Murali	Computer vision; image processing.
Sussman-Fort, Stephen E.	Microwave circuits, analog electronics, computer-aided design, and network theory.
Tang, K. Wendy,	Parallel and distributed processing; massively parallel systems; computer architecture; neural networks.
Tuan, Hang-Sheng	Electromagnetic theory; integrated optics; microwave acoustics.
Wang, Xin	Mobile Computing and Wireless Networking
Yang, Yuanyuan	Parallel and distributed computing and systems, high speed networks, optical networks, high performance computer architecture, and fault-tolerant computing

Zemanian, Armen — Network theory; VLSI modeling.

APPENDIX G
TEACHING LABORATORIES

Analog Laboratory

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

This laboratory contains eighteen work stations consisting of equipment for testing simple to complex analog circuits, from DC to 20 MHz. Each work station consists of the following test equipment:

1) Dell Optiplex Personal Computer with ATE connectivity and HPVee software.
2) Agilent Model 54621A 60 MHz Two Channel Digital Storage Oscilloscope.
3) Agilent Model E3631A Triple Output Power Supply with a variable +6 VDC and +/- 25 VDC outputs.
4) Agilent Model 34401A 6 ½ Digit Digital Multimeter
5) Fluke Model 45 High Resolution Digital Multimeter with Frequency Counter and Dual Display for simultaneous measurements.
6) Agilent Model 33120A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 15 MHz.
7) Agilent Model 33220A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 20 MHz.
8) E&L Cadet Digital Designer for digital designs.
9) Three section Solderless Breadboard for the construction and testing of circuits designed in the laboratory.

A Tektronix Model 571 Transistor Curve Tracer and a Philips Model 6303A Automatic RLC meter are available for general use. The workstations are networked through a 3Com SuperStacker 1100 24 port switch to a HP 4200TN LaserJet Network Printer.

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

CEWIT Wireless Sensing and Auto ID Networks Lab

Contact Person: Prof. J. Sharony
Location: CEWIT building, Room 286
Usage: ESE 3xxx, ESE 5xxx

The purpose of the lab is to conduct research and development in wireless sensor networks, RFID systems, M2M communications, and Real Time Location Systems (RTLS). We also develop mobile and wireless solutions based on these technologies that can be commercialized.

The current equipment that we have include:

Wireless sensors, embedded systems mobile development platforms, RFID readers and tags; RFID tag printer; Barcode scanners (laser scanning and imaging); ZigBee based wireless nodes; Spectrum analyzers; Oscilloscopes

Digital Signal Processing Laboratory (DSP)

Contact Individuals:	Scott Campbell, Prof. John Murray
Location: Room:	179, Light Engineering
Usage:	ESE 347, ESE 440, ESE 441

The Digital Signal Processing Laboratory has ten workstations, each with a Dell Dimension PC, a 60 MHz 2-channel digital oscilloscope, function generator, Texas Instruments TMS320C6713 DSP Starter Kit, and Texas Instruments TMS320C6701 Evaluation Module. Each station is capable of real-time DSP implementation, with full analog input and output.

All of the stations have a full set of development tools (Texas Instruments Code Composer Studio,C compiler, assembler, linker, and simulator) for the TMS320C67xx family; this software, with the simulator target, is also available in the CAD lab, providing students with access outside laboratory hours.

All of the stations are networked to the CAD Lab, so that the code developed in the CAD Lab is available to the students for their labs.

The lab also contains a HP Spectrum Analyzer, and a FlexDSP in-circuit emulator.

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

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

Digital Systems Design Laboratory

Contact Person:	Anthony Olivo
Location:	Room 283A, Light Engineering
Usage:	ESE 218

This laboratory contains fourteen workstations, each consisting of an Agilent Model 54603B 60 MHz Two Channel Digital Storage Oscilloscope, a Hewlett Packard Model 54620A Digital Logic Analyzer and an E&L Ruggedized CADET II Digital Designer.

The HP 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 E&L Instruments Ruggedized CADET II is a multi-function breadboard system, which consists of the following:

1) A three section Solderless Breadboard for the construction and testing of circuits,
2) A function generator, which outputs sine waves, triangle waves, square waves, and TTL square

waves from 0.1 Hz to 100 kHz.
3) 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
4) 16 LED logic indicators (8 logic HIGH and 8 Logic LOW)
5) 8 Logic switches, two debounced switches, and a 8 ohm speaker

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

Digital Systems Rapid Prototyping Laboratory

Contact Individuals:	Scott Tierno, Prof. Ken Short
Location: Room:	228, Light Engineering
Usage:	ESE 382, ESE 440, ESE 441, ESE 475, ESE 499

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

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

The project design stations may also be configured with a variety of test and debugging equipment, as needed for a respective design project. Available are POD based (CPU replacement) and JTAG based (on-chip) in-circuit emulators, logic analyzers, spectrum analyzers, digital storage oscilloscopes, function/waveform generators, frequency counters, and a variety of other standard lab test equipment. Further available in this room is a device programming station that supports a large number of programmable logic devices including EPROMs, microcontrollers, standard and complex PLDs, and FPGAs. Currently this lab supports embedded system designs based on the Atmel AVR family, as well as several industry standard single chip microcontrollers. Digital system designs using VHDL, and CPLDs and FPGAs from Lattice, Xilinx, and Altera are currently supported.

Electrical & Computer Engineering Computer Aided Design Laboratory

Contact Person:	Scott Campbell, Prof. John Murray -Director
Location:	Room 281, Light Engineering
Usage:	ESE 123, ESE 124, ESE 211, ESE 218, ESE 271, ESE 300, ESE 305, ESE 306, ESE 314, ESE 315, ESE 316, ESE 324, ESE 337, ESE 345, ESE 346, ESE 347,ESE 349, ESE 357, ESE 358, ESE 372, ESE 380, ESE 381,ESE 382, ESE 440, ESE 441, ESE 475, ESE 476, ESE 499

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

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

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

- Cadence LDV (VHDL and Verilog)
- Visio Technical
- Matlab - The Mathworks Inc.
- Maple - Waterloo Maple Inc.
- Aldec Active HDL – Aldec
- Synplicity Pro – Synplicity ISP Lever - Lattice
- Electronics Workbench - Interactive Image Technologies Inc.
- Microsoft Visual Studio C, C++, J++ - Microsoft
- Microsoft Office - Microsoft
- Pspice Capture, Pspice A/D - Cadence
- Texas Instruments TMS329 family development tools
- More packages are being added each year

Embedded Systems Design Laboratory

Contact Individuals:	Scott Tierno, Prof. Ken Short
Location: Room:	230, Light Engineering
Usage:	ESE 380, ESE 381, ESE 440, ESE 441, ESE 475, ESE 499

The Embedded Systems Design Laboratory (ESDL) is devoted to teaching and system design projects involving embedded microprocessor based systems. The laboratory is located in the Light Engineering building, on the second floor, in room 230.

The facility is used primarily to support the laboratory portions of two undergraduate courses: ESE 380 and ESE 381, Embedded Microprocessor Systems Design I and II. This lab facility contains 10 student stations, each of which supports a group of 2 students. Each student station is equipped with a personal computer (PC), a full function state-of-the-art solderless breadboarding system, a Fluke model 45 dual display digital multimeter, an HP 54603B Digital Storage Oscilloscope, and a variety of other test equipment. Each station also has available a configurable Atmel AVR microcomputer board, and an Atmel JTAG-ICE unit, which provides support for a variety of AVR devices. Finally, a variety of specialty and custom designed items are available at the student stations, based on that semesters student design project.

The ESDL facility also has available a device programming station that is used in by students enrolled in ESE-380, ESE-381, ESE-499, and ESE-440/441. The programming station enables the programming of SPLDs, CPLDs, EPROMS, and a large number of other classic and state-of-the-art programmable devices.

Each lab station personal computer is further networked via a gigabit Base-T Ethernet LAN to a Windows Xeon-based network server. The server is RAID 1 compliant and has six high capacity high speed SCSI hard drives. At present the server is running the Windows 2003 Server network operating system. The laboratory LAN is connected by a dedicated hardware firewall to the campus switched

Ethernet network. This provides high speed access to a variety of on and off campus computer systems and Websites. This server also supports the DSRPL facility (see below).

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 2 dedicated computers with access to Engineering CAD programs utilized in the curriculum. Seniors find the laboratory particularly useful in testing their senior design projects.

Microelectronics and Photonics Prototyping Laboratory

Contact Person**:** Prof. R. Kamoua and Prof. D. Donetski
Location: Room 235, Heavy Engineering
Usage: ESE 366, ESE 440, ESE 441, ESE 476, ESE 499

This lab is used to support undergraduate students, not restricted to seniors, in carrying out projects in microelectronics and optoelectronics. This facility supports senior design projects (ESE440/ESE441), independent projects, Laboratory development projects (ESE476), undergraduate research projects (ESE499), as well as ESE 366 (Design using Programmable Mixed-Signal Systems-on-Chip). The laboratory is equipped with: ten workstations: OptiPlex Pentium 4 Personal Computers with National Instruments data acquisition cards and interfaces operating under Labview, five ELVIS stations, five PXI-based measurement and automation systems each consisting of a high-precision DAQ, a 2 channel 100 MHz digitizer, a 100 MHz Frequency/clock generator, a 1M gate FPGA-based I/O device, a 6 ½ digit DMM and LCR meter, a camera with video acquisition card, a programmable power supply. general purpose testing equipment: 500-MHz Network/Spectrum/Impedance analyzer 4395A from Agilent, 1-GHz scope TDS5104B from Tektronics, digital delay/pulse generator DG535 and lock-in-amp SR810 form Stanford Research, a variety of precision voltage and current sources/meters from Keithley including semiconductor parameter analyzer 4200 and CV meter 590. equipment for optical measurements including high-resolution spectrometers OceanOptics HR4000 and Thermonicolet Nexus 670 covering the wavelength range from 200 nm to 10 m, microscope Ziess Stemi-2000 with a color camera, a precision motorized stage, accessories for laser diode pumping, optical beam collimation and fiber optics

Senior Design Laboratory

Contact Person: Anthony Olivo, Instructional Support Associate
Location: Room 283B, Light Engineering

This laboratory is used for the design, construction, and testing of the Senior Design Projects. It contains ten general work stations consisting primarily of:

1) Dell Dimension Personal Computer
2) Agilent Model 54603B, 54621A, or 54622D Digital Storage Oscilloscope.
3) Agilent Model E3631A Triple Output Power Supply with a variable +6 VDC and +/- 25 VDC outputs.
4) Agilent Model 34410A Precision Digital Multimeter
5) Agilent Model 33120A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 15 MHz.
6) Agilent Model 33220A Arbitrary Waveform Generator that produces various signals from 0.1 Hz to 20 MHz.

One RF work station consists of:
1) Agilent Model E4401B Spectrum Analyzer with tracking generator, 9 kHz to 1.5 GHz
2) Agilent Model 8648A Synthesized Signal Generator, 0.01 to 1000 MHz
3) Agilent Model 4285A Precision LCR Meter, 75 kHz to 30 MHz
4) Agilent Model E5100A Network Analyzer, 10 kHz to 180 MHz
5) Agilent Model 54642A 500 MHz Digital Storage Oscilloscope.
6) Agilent Model 4395A Network/Spectrum/Impedence Analyzer, 10 Hz to 500 MHz

The remaining six work stations consist of one SunBlade 150 and five Dell Dimension Personal Computers that contain several engineering software packages. All PC's are connected to a HP 4100TN LaserJet Network Printer through a 3Com SuperStacker 3300 24 port switch and to the internet through a 3Com OfficeConnect Firewall.

Wireless and Intelligent Systems (WIS) Laboratory

Contact Person: Wendy Tang, Ridha Kamoua, Directors
Location: Room 150, Light Engineering

The WIS laboratory, directed by Dr. Wendy Tang and Ridha Kamoua, focuses on various sensors with integrated communication capabilities for intelligent systems. The laboratory is equipped with state-of-art computing equipments, novel sensors, wireless sensor motes and interfaces by Crossbow Technology Inc. Current projects include wireless health monitoring systems, sensor balls for homeland security, and integrated sensors for neural recording.

APPENDIX H
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).

1. Computer Vision Laboratory

Contact Person: Prof. M. 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.

2. Vision and Image Processing Laboratory

Contact Person: Prof. M. Subbarao
Location: Room 209, CEWIT Bldg.

This laboratory has a multi-stereo camera system, Depth-from-Defocus Vision system, and 3D microscope vision system, and a network of Personal Computers. Software available includes 3D imaging and Image Processing algorithms for experimental research.

COSINE Laboratory

Contact Person: Prof. Petar M. Djuric
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 communications, signal processing, and networking. Current and recent research projects involve mobile and wireless networks, radio-frequency identification, computer networking, Bayesian signal processing,, sensor signal processing, positioning and navigation, signal detection and estimation, signal modeling, high energy cosmic ray detection, 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. Djuric
Location: CEWITT, room 286

WSAID is located in room 286 of the CEWIT building at the Research and Development Park. The research at the laboratory focuses on the fields of Radio Frequency Identification (RFID), wireless sensor networks and indoor localization. The lab contains facilities and equipment to not only carry out cutting edge research but also 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.

Digital Signal Processing Laboratory

Contact Person: Prof. John Murray
Location: Room 116, Light Engineering

The digital signal processing laboratory has PC-based signal processing equipment, and a complement of basic test equipment. The PC-based equipment includes systems with Texas Instruments fixed- and floating-point processors (TMS320C24X, TMS32C28XX, TMS320C3X, TMS320C6211, and TMS320C6711) with full analog-in to analog-out capabilities, and in-circuit emulation. In addition, there are full sets of development tools (assemblers, linkers, simulators, debuggers, C compilers and Integrated Development Environments) for all of these systems.

The test equipment includes oscilloscopes, power supplies, meters, and signal generators. The lab also has a H-P 3585-A spectrum analyzer.

Fiber Optics Sensors Laboratory

Contact Person: Prof. H. Dhadwal
Location: Room 136, Light Engineering
Usage: ESE363, 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, integrated fiber optic based systems for real time detection of synchronous and asynchronous vibrations in turbomachinery.

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. V. Gorfinkel
Location: Rooms 551-559, Chemistry Building

This lab is involved in design, development, implementation, and testing of various DNA sequencing instruments. 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.

Medical Image Processing Lab

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

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

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

Mobile Systems Design Laboratory

Contact Person: Prof. S. Hong
Location: Room 254, Light Engineering

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

High-Performance Computing and Networking Research Laboratory

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

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

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

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

Opto-Electronics Laboratory

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

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

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

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

Ultra High Speed Computing Laboratory

Contact Person: Prof. M. 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 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 1 Gbit/sec Ethernet LAN.

VLSI Systems Design Laboratory

Contact Person: Prof. Alex Doboli
Location: Old Chemistry Building, Room 225

The lab is equipped for research in the broad area of electronic system design and design automation. The lab contains 11 SUN workstations, 3 PCs, 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 about 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 and sensor network applications.

Wireless and Networking Systems Laboratory

Contact Person: Prof. Xin Wang
Location: Room 241, 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 500 square feet space in the recently renovated Heavy Engineering building. The lab has eight Pentium Dell workstations, a set of crossbow sensors, professional sensor testbed development kit, and other equipments for networking and system researches.

Wireless Sensor and RFID Network (WSRN) Laboratory

Contact Person: Prof. W. Tang
Location: Room 283, Light Engineering

The WSRN laboratory, directed by Dr. Wendy Tang, focuses on network design and performance analysis for wireless sensor networks and RFID networks. The laboratory is equipped with state-of-art computing equipments, wireless sensor nodes by Crossbow Technologies, Inc and MoteIV (now Sentilla), and RFID equipment. Current projects include novel RFID Tag Identification algorithms, RFID anti-collision algorithms, and Consensus protocols.

Mobile Systems Design Laboratory

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

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