Department of Electrical Engineering

Professor Roger Dorsinville, Chair • Department Office: Steinman 602 • Tel: 212-650-7248

GENERAL INFORMATION

The City College offers the following undergraduate degree in Electrical Engineering:

B.E. (E.E.)

PROGRAMS AND OBJECTIVES

Electrical engineers are involved in the design of components and systems, ranging from the smallest computer chips to large communication systems that span the earth and reach into intergalactic space. The invention of the transistor touched off a technological revolution that continues unabated today, including the development of lasers, fiber optics, microcomputers, satellite communications, control systems, and increasingly sophisticated signal processing algorithms, to name but a few areas.

The undergraduate program in electrical engineering welcomes students who have a solid preparation in mathematics and the sciences. The course of study trains students in analytical procedures to solve specific problems; in laboratory methods to examine complex electrical phenomena; and ultimately in design synthesis to meet specified criteria for systems required to perform specific functions. The program emphasizes mathematical modeling and abstract reasoning because electrical phenomena cannot normally be directly perceived safely by human senses. The program's core curriculum trains students to master the reasoning methods required for electrical engineering. Core areas include linear systems and controls, electromagnetic theory, electronics, communications, and computers. Through a variety of elective courses, students are then able to pursue special interests in such areas as photonics, computer engineering, control systems, digital signal processing, networks, telecommunications, and microwaves.

The faculty of the department enhance their teaching activities with a number of active research programs in such areas as digital signal processing, computer engineering, communications, controls, and photonics. Advanced students are encouraged to participate in these research efforts.

MISSION

The mission of the Department of Electrical Engineering at The City College, in conformity with the mission of the School of Engineering, is:
I. To educate well-rounded and conscientious electrical engineers capable of becoming leaders in their profession.
II. To carry out basic and applied research leading to new ideas, systems, and devices in electrical engineering and related interdisciplinary areas.
III. To offer advice, service, and support to industry, government agencies, schools, community groups and professional societies.
IV. To insure that the above is carried out in appropriate and modern facilities that are conducive to learning.

PROGRAM EDUCATIONAL OBJECTIVES

In order to achieve the above-mentioned mission, the faculty and students of the Electrical Engineering Department have established the following Undergraduate Program Educational Objectives:

A. Perform effectively and ethically in a global multicultural environment in a global multicultural environment.
B. Contribute actively to the field by participating in professional societies, publishing, attending conferences and seeking patents.
C. Function effectively in multidisciplinary teams and progress to leadership roles.
D. Apply sound scientific knowledge and engineering principles to real world problems to meet the needs of society.

PROGRAM OUTCOMES

The Program Educational Objectives listed above are the basis for the following Program Outcomes expected of all graduates receiving the B.E. (E.E.) degree:
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 a process to meet desired needs;
d. an ability to function on multi-disciplinary teams;
e. an ability to identify, formulate, and solve real world electrical engineering problems;
f. an understanding of professional and ethical responsibility;
g. an ability to communicate effectively, including the use of information technology tools when appropriate;
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context;

i. a recognition of the need for, and an ability to engage in life-long learning;
j. a knowledge of contemporary issues: an appreciation of environmental, economic and technological issues and their impact on society;
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
l. preparation for pursuing advanced degrees;
m. competence in computational and simulation tools;
n. competence in engineering probability.

ACCREDITATION

The B.E. (E.E.) program is accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET).

REQUIREMENTS FOR MAJORS

All Electrical Engineering majors must complete the following:

Math and Science Requirements

Required Courses

Chemistry:
General Chemistry* 3
Computer Science:
10200: Introduction to Computing 3
Mathematics:
20102: Calculus I* 3
20202: Calculus II* 3
20300: Calculus III* 4
39100: Methods of Differential Equations* 3
39200: Linear Algebra and Vector Analysis for Engineers* 3
Physics:
20700-20800: General Physics* 8

** Minimum grade of "C" required.*

Total Math and Science Credits 30

English and Liberal Arts (General Education) Requirements

Refer to the School of Engineering section for details.

Total English and Liberal Arts (General Education) Credits 21

Engineering Requirements

Required Courses

10000: New Freshman Seminar 0

Engineering:
10100: Engineering Design I* 1
10300: Computer-Aided Analysis Tools for Engineers 2
20400: Electrical Circuits 3
23000: Thermodynamics 3
27600: Engineering Economics 3

Electrical Engineering:
20500: Linear Systems Analysis I 3
21000: Switching Systems 3
22100: Electrical Engineering Laboratory I 1
24100: Electronics I 3
25900: Programming for Electrical Engineering 4
30600: Linear Systems Analysis II 3
31100: Probability and Statistics 3
31200: Communication Theory 3
32200: Electrical Engineering Laboratory II 1
32300: Electrical Engineering Laboratory III 1
33000: Electromagnetics 3
33300: Introduction to Antennas, Microwaves and Fiber Optics 3
33900: Semiconductor Materials and Devices 3
34200: Electronics II 3
37100: Linear Feedback Systems 3
44100: Electronic Devices and Semiconductor Materials 3
44400: Digital Computer Systems 3
59866: Senior Design I 3
59867: Senior Design II 3

Total Required Engineering Credits 64

**New transfer students who have successfully completed Calculus II (Math 20200 or 20202) should not take Engr 10100. Instead, they are required to complete an additional EE Advanced Laboratory Elective course.*

Electives

All majors must complete the credit requirements from the A and B Electives lists:

A. Lecture Electives 18

All majors, in consultation with their faculty advisor, must select 18 credits of Lecture Electives, at least 9 credits of which must be in Electrical Engineering courses.

Electrical Engineering:
35700: Electric Power Engineering (3 cr.)
45100: Communication Electronics (3 cr.)
43800: Management Concepts for Engineers (3 cr.)
45200: Fiber Optic Communications (3 cr.)
45300: Digital Signal Processing (3 cr.)
45400: Physical Electronics (3 cr.)
45500: Elements of Power Systems (3 cr.)
45600: Elements of Control Theory (3 cr.)
45700: Digital Integrated Circuits (3 cr.)
45800: Introduction to Lasers (3 cr.)
45900: Microprocessors (3 cr.)
46000: Computer Communication Systems (3 cr.)
46200: Photonic Engineering (3 cr.)
46300: Wireless Communications (3 cr.)
46400: VSLI Design (3 cr.)
51000: Independent Study (3 cr.) (departmental approval required)
Computer Science:
42000: Compiler Construction (3 cr.)
44000: Computational Methods in Numerical Analysis** (3 cr.)
47500: Windows Programming (3 cr.)
Mathematics:
32800: Numerical Analysis** (3 cr.)
43200: Theory of Functions of a Complex Variable (3 cr.)
43500: Partial Differential Equations, Integral Equations, Boundary Value Problems (3 cr.)
Physics:
32100: Modern Physics for Engineers (3 cr.)
45200: Optics (3 cr.)
Engineering***:
30100: Introduction to Satellite Remote Sensing and Imaging (3 cr.)
I0600: Applied Algebra (3 cr.)
I1100: Engineering Analysis (3 cr.)
I1200: Complex Variables (3 cr.)
Biomedical Engineering:
50100: Cell and Tissue Mechanics (3 cr.)

50200: Cell and Tissue Transport (3 cr.)
50300: Cell and Tissue Biomaterial Interactions (3 cr.)
Biology:
32100: Introduction to Human Physiology and Biophysics (4 cr.)
Chemistry:
10401: General Chemistry II (3 cr.) (minimum grade of C required)

*** Credit can not be received for both Math 32800 and CSc 44000.*

**** For graduate courses, GPA of 2.75 or higher; minimum grade of C is required.*

B. Advanced Laboratory Electives 2

Two of the following courses:
Electrical Engineering:
42100: Local Area Network Laboratory (1 cr.)
42200: Analog Laboratory (1 cr.)
42500: Computer Engineering Laboratory (1 cr.)
42600: Control Laboratory (1 cr.)
42800: Photonics Engineering Laboratory (1 cr.)
42900: Solid State Devices Laboratory (1 cr.)

Total Elective Credits 20

Total Credits for Major 135

Additional Requirements for Graduation

Refer to the School of Engineering section for details.

RECOMMENDED SEQUENCE OF COURSES

First Semester*
Math 20102: Calculus I (3 cr.)
General Chemistry (3 cr.)
Engr 10100: Engineering Design I (1 cr.)
Eng 11000: Freshman Composition (3 cr.)
Two Liberal Arts courses (6 cr.)
16 Credits

**New freshman students must take NSS 10000: New Freshman Seminar (0 cr.) in their first semester.*

Second Semester
Math 20202: Calculus II (3 cr.)
Phys 20700: General Physics I (4 cr.)
CSc 10200: Introduction to Computing (3 cr.)
Engr 10300: Computer-Aided Analysis Tools for Electrical Engineers (2 cr.)
Eng 21007: Writing for Engineering (3 cr.)
One Liberal Arts course (3 cr.)
18 Credits

Third Semester
Math 20300: Calculus III (4 cr.)
Phys 20800: General Physics II (4 cr.)
Engr 20400: Electrical Circuits (3 cr.)
EE 21000: Switching Systems (3 cr.)
One Liberal Arts course (3 cr.)
17 Credits

Fourth Semester
Math 39100: Methods of Differential Equations (3 cr.)
Math 39200: Linear Algebra and Vector Analysis for Engineers (3 cr.)
EE 20500: Linear Systems Analysis I (3 cr.)
EE 22100: Electrical Engineering Laboratory I (1 cr.)
EE 24100: Electronics I (3 cr.)
EE 25900: Programming for EE (4 cr.)
17 Credits

Fifth Semester
EE 30600: Linear Systems Analysis II (3 cr.)
EE 31100: Probability and Statistics (3 cr.)
EE 32200: Electrical Engineering Laboratory II (1 cr.)
EE 33000: Electromagnetics (3 cr.)
EE 34200: Electronics II (3 cr.)
One Lecture Elective course (3 cr.)
16 Credits

Sixth Semester
EE 31200: Communication Theory (3 cr.)
EE 32300: Electrical Engineering Laboratory III (1 cr.)
EE 33300: Introduction to Antennas, Microwaves and Fiber Optics (3 cr.)
EE 33900: Semiconductor Materials and Devices (3 cr.)
EE 37100: Linear Feedback Systems (3 cr.)
One Lecture Elective course (3 cr.)
16 Credits

Seventh Semester
EE 44100: Electronic Devices and Semiconductor Materials (3 cr.)
EE 44400: Digital Computer Systems (3 cr.)
Engr 23000: Thermodynamics (3 cr.)
Two Lecture Elective courses (6 cr.)
EE 59866: Senior Design I (3 cr.)
18 Credits

Eighth Semester
EE 59867: Senior Design II (3 cr.)
Engr 27600: Engineering Economics (3 cr.)
Two Lecture Elective courses (6 cr.)
Two EE Advanced Laboratory Elective courses (2 cr.)
One Liberal Arts course (3 cr.)
17 Credits

ADVISEMENT

All full-time faculty serve as undergraduate advisors. Students attending mostly in the evening should consult the Department bulletin board for special arrangements.

COURSE DESCRIPTIONS

20500: Linear Systems Analysis I
Laplace Transform, s-domain circuit analysis, network functions, frequency response. Fourier series and Fourier Transform. Parceval Theorem. Prereq, Engr 20400; pre- or coreq.: Engr 10300, Math 39100 (min. C grade). 3 HR./WK.; 3 CR.

21000: Switching Systems
Analysis and synthesis of combinatorial circuits. Karnaugh maps. Analysis and design of sequential circuits. Digital computer and industrial applications. Prereq.: Math 20200 (or Math 20202) (min. C grade). 3 HR./WK.; 3 CR.

22100, 32200, 32300: Electrical Engineering Laboratory I, II, III
Experiments and design problems based on material drawn from the electrical engineering (Engr 20400, EE 21000, EE 24100, EE 34200). Test and measurement instruments, Virtual instruments and computer instrumentation, Electric and electronic circuits. Transient and frequency response, Logic circuits, Logic circuits, Discrete circuits. Operational amplifiers. 3 LAB HR./WK.; 1 CR. EACH. EE 22100: prereq.: Engr 20400, EE 21000; pre- or coreq: Engr 10300. EE 32200 prereq.: EE 22100, EE 24100. EE 32300 prereq.: EE 32200, EE 34200.

24100: Electronics I
Electronic devices and their use in analog circuits. Prereq.: Phys 20800 (min. C grade); pre- or coreq.: EE 20500 and EE 21000. 3 HR./WK.; 3 CR.

25900: Programming for Electrical Engineering
Part I. C++ and UNIX: UNIX preliminaries, C++ program format, data types, file I/O classes, overload operators, inheritance. Part II. Electrical engineering applications: projects on numerical solutions of linear equation systems, numerical differentiation/integration, least square approximations, etc. Prereq.: CSc 10200, Engr 10300; pre- or coreq.: Math 39100 (min. C grade), Math 39200 (min. C grade). 4 HR./WK., 4 CR.

30600: Linear Systems Analysis II
Discrete-time signals. Discrete-time systems. Linear, shift-invariant discrete-time systems. Convolution. The Z-transform. Transfer functions. The Fourier transform. Fourier analysis of discrete-time systems. Sampling in the time and frequency domains. Prereq.: EE 20500. 3 HR./WK.; 3 CR.

31100: Probability and Statistics
Sample space and probability theory. Density and distribution functions of single and multiple discrete and continuous random variables. Functions of random variables. Expectation, variance and transforms. Independence, covariance and correlation. Central limit theorem, weak/strong law of large numbers. Introduction to Random Processes. Confidence intervals, hypothesis testing, simple linear regression techniques, chi-square minimization methods. Prereq.: EE 20500. 3 HR./WK.; 3 CR.

31200: Communication Theory
Noise in amplitude and frequency modulation systems. Digital modulation techniques, baseband signal receiver, matched filter, probability of error. Prereq.: EE 31100. 3 HR./WK.; 3 CR.

33000: Electromagnetics
Complex vectors. Maxwell's Equations. Boundary conditions. Wave equation. Uniform plane waves. Polarization. Propagation in lossless and lossy media. Poyting Vector. Reflection and transmission of waves at normal and oblique incidence. Transmission lines (propagation, Smith Chart, transients). Topics in waves. Prereq.: Phys 20800, Math 39100 and 39200 (min. C grade). 3 HR./WK.; 3 CR.

33300: Introduction to Antennas, Microwaves and Fiber Optics
Antennas, antenna arrays, and applications. Propagation in free space, Microwave waveguides and resonators. Fiber-optic wave guides. Wave optics. Light sources and detectors. Prereq.: EE 33000 (or 33100). 3 HR./WK.; 3 CR.

33900: Semiconductor Materials and Devices
The crystal structure of solids. Introduction to quantum mechanics and quantum theory of solids. Charge carriers in semiconductors. Carrier transport phenomena. Carrier generation and recombination. Mathematical analysis of diffusion phenomena. Ambipolar transport. Surface effects. Basic structure of the pn junction. Prereq.: EE 33000 (or 33100). 3 HR./WK.; 3 CR.

34200: Electronics II
Electronic devices and circuits. Feedback amplifiers, regulated power supplies, oscillators. Comparators and Schmitt triggers. Logic gates and logic families. Flip-flops. Semiconductor memories. A/D and D/A conversion. Timing circuits. Prereq.: EE 24100. 3 HR./WK.; 3 CR.

35700: Electric Power Engineering
Analysis of magnetic circuits. Equivalent circuits and operations of power transformers, autotransformers, three-phase transformers. Basic principles of electromechanical energy conversion, single and double excitation. Elementary power systems and per-unit calculations. Power transmission, distribution, three-phase induction machines. Prereq.: EE 20500, EE 33000 (or 33100). 3 HR./WK.; 3 CR.

37100: Linear Feedback Systems
Analysis of feedback systems including block diagrams, signal flow graphs, time domain specifications, Routh's stability criterion, root locus, Bode and Nyquist diagrams, and state feedback. Prereq.: EE 20500; pre- or coreq: MATH 39100, 39200. 3 HR./WK.; 3 CR.

42100: Local Area Network Laboratory
Introduction to computer networks: local area network, wide-area network and interconnected network; packet switching and circuit switching. Design and simulation of various networks. Measurements and control of performance parameters such as throughput, delay and call blocking rate. Networks and services for simulations include datagram and virtual circuit (WAN), Ethernet and Token Bus (LAN). Pre- or coreq.: EE 46000. 3 LAB HR./WK.; 1 CR.

42200: Analog Communication Laboratory
Analog communication systems, including frequency translation, AM signal generation and reaction, double and single sideband modulation, FM signal bandwidth, narrow and wide angle modulation, FM signal generation and reception, frequency division multiplexing, and noise in FM. Prereq.: EE 31200. 3 LAB HR./WK.; 1 CR.

42500: Computer Engineering Laboratory
Introduction to the operation and applications of microcomputers and design experiments in computer interface engineering utilizing a microprocessor-based computer. Design projects include computer input-output device selection, program interrupt, on-line control, direct memory access, and circular input-output buffer. Prereq.: EE 44400 (or CSc 21000 and 34200). 3 LAB HR./WK.; 1 CR.

42600: Control Laboratory
Control of an analog servomechanism including velocity feedback, system following error, speed control, 3-term control, and frequency response. Prereq.: EE 37100. 3 LAB HR./WK.; 1 CR.

42800: Photonics Engineering Laboratory
Interferometers. Characteristics of CW laser. Diffraction through slits, gratings, pinholes, and sharp edges. Spatial filtering and holography. Radiometry and photometry. Polarization and wave plates. Pre- or coreq: EE 33000 (or 33100). 3 LAB HR./WK.; 1 CR.

42900: Solid State Devices Laboratory
Designed to complement the lectures presented in EE 44100 through device testing and measurement. Observations of semiconductor materials properties through experiments involving the Hall effect, photo generation/recombination, and anisotropic etching. Semiconductor PN junctions, uni- and bipolar device characterization through C-V plotting, DC and AC measurements of devices in packages and on wafers and subsequent development of device model parameters. Optional special project opportunity. Laboratory notebook required. Pre- or coreq.: EE 44100. 3 LAB HR./WK.; 1 CR.

43800: Management Concepts for Engineers
The principles and techniques of team management in a high-technology environment. Concepts in developing leadership and entrepreneurial skills as well as communication skills in a business context. A term paper will be required. Prereq.: at least upper junior status. 3 HR./WK.; 3 CR.

44100: Electronic Devices and Semiconductor Materials
Fundamental properties of semiconductors. Device fabrication, the PN junction, metal-semiconductor junction, the bipolar transistor, the field effect transistor, the MOS transistor. Prereq.: EE 33900. 3 HR./WK.; 3 CR.

44400: Digital Computer Systems
Digital system description. Algorithmic processor design. Organization of a simple digital computer. Control unit design, microprogramming. Elements of programming. General CPU, memory, and input/output organization. Microcomputer organization. Prereq: EE 21000, pre or coreq.: EE 25900. 3 HR./WK.; 3 CR.

45100: Communication Electronics
Components of end-to-end communications systems. Noise in circuits and systems. Behavior of wideband and tuned amplifiers; limits on small signal operation. Gain controlled amplifiers, limiters, frequency multipliers, oscillators, coupling networks. Nonlinear elements, distortion, amplitude, frequency, and phase modulators, transmitters and low-noise receivers. Prereq.: EE 31200. 3 HR./WK.; 3 CR.

45200: Fiber Optic Communications
This course is intended to provide the basic materials for an introductory senior or first-year graduate course in the theory and application of optical fiber communication technology with emphasis on both digital and analog point-to-point very-high-bit-rate long haul optical transmission systems. Topics covered include: an overview of the fundamental components of advantages of optical fibers relative to other transmission media; basic laws and definitions of optics that are relevant to optical fibers; degradation of light signals arising from attenuation and distortion mechanisms; main devices encountered in a fiber optic system, light sources, light detectors. Analog and digital modulation formats at the transmitter: theory and design of receivers, noise and detection for optical fiber links; performance analysis and design of both digital and analog point-to-point very high bit-rate long-haul optical transmission systems. Prereq.: EE 31200, EE 33300 (or 33200), EE 44100. 3 HR./WK.; 3 CR.

45300: Digital Signal Processing
Introduction to basic digital signal processing concepts; the finite Fourier transform, cyclic convolution, digital filters, Z-transform. Design of algorithms computing the finite Fourier transform and cyclic convulsion. Cooley-Tukey and Winograd algorithms. Prereq.: EE 30600. 3 HR./WK.; 3 CR.

45400: Physical Electronics
Statistical distributions in physics. Metals. Band theory. Semiconductors. Phonons. Transport coefficients. Prereq.: EE 33900. 3 HR./WK.; 3 CR.

45500: Elements of Power Systems
Analysis of transmission lines, transformers, and electric machines as the elements of power systems. Prereq.: EE 35700. 3 HR./WK.; 3 CR.

45600: Elements of Control Theory
Design of classical and state space controllers for continuous time and sampled data systems. Lead, log, and lag-lead compensation. State feedback, separation theorem, reduced order estimators. Lead compensation using w-plane. Discrete equivalent state space models. Deadbeat response. Prereq.: EE 37100. 3 HR./WK.; 3 CR.

45700: Digital Integrated Circuits
Design of logic circuits: CMOS, Pseudo-nMOS, and high-performance circuits, such as dynamic pre-charge circuits and clocked CMOS, etc. Design of flip-flops and memories at the transistor level. Design of arithmetic circuits, I/O circuits, registers and control circuits, as well as analysis of digital circuit characteristics. Prereq.: EE 24100. 3 HR./WK.; 3 CR.

45800: Introduction to Lasers
Resonant optical cavities. Interaction of radiation with matter. Gas, solid-state, and injection lasers. Light modulation (internal and external). Prereq.: EE 33300 (or 33200), EE 33900. 3 HR./WK.; 3 CR.

45900: Microprocessors
Introduction to stored program computers and microcomputers. Reviews of number systems, binary arithmetic, register transfer language, and micro-operations. Digital computer and microcomputer functional elements, input-output devices, system organization and control. Accumulator-based processors, general register processors. Linear pipelining and cache memory. Prereq.: EE 44400. 3 HR./WK.; 3 CR.

46000: Computer Communication Systems
Queuing theory, Markovian networks, packet, message and circuit switching networks, assignment of link capacities and flows, routing algorithms, stability, flow control and error control, packet radio networks, multiple access schemes and network protocols. Prereq.: EE 31200. 3 HR./WK.; 3 CR.

46200: Photonic Engineering
Study of basic optics and computer-aided design for optics. Application of study to solve engineering problems and design photonic devices. Topics will be selected from: ray tracing; lens design; interferometry; analysis of optical systems; spectroscopic techniques; Fourier optics; fibers, waveguides, integrated optics; video disk; optical detectors. Prereq.: EE 33300 (or 33200). 3 HR./WK.; 3 CR.

46300: Wireless Communications
Introduction to wireless/mobile communications systems. Cellular systems concept: frequency reuse, co-channel and adjacent channel interference, capacity improvement. Wireless channel characteristics: long-term fading, short-term fading. Diversity techniques: DPSK, QPSK, 4QPOSK, QAM, GMSK. Multiple access techniques for wireless communications: FDMA, TDMA, CDMA. Personal communications services. Current standards of PCS and cellular systems. Prereq.: EE 31200. 3 HR./WK.; 3 CR.

46400: VLSI Design
Introduction to CMOS circuits, CMOS processing technology and physical characterization of gates, clocking strategies, I/O structures, and structured design concepts. The student will design, simulate, and lay out mask description of digital CMOS VLSI circuits. The design will be simulated using SPICE and RSIM. Circuit layout is created using MAGIC software package. The circuit will be fabricated by the foundry service supported by NSF/DARPA and tested. A final report detailing all the work is required. Pre-or coreq: EE 45700. 2 CLASS, 3 LAB HR./WK.; 3 CR.

51000: Independent Study
The student pursues a program of independent study under the direction of a faculty mentor. Open only to students who have shown exceptional ability (minimum GPA 3.5). Students desiring to register in this course should apply by Dec. 1 for the spring term and by May 1 for the fall term. A final report is required. Prereq.: departmental approval. 3 HR./WK.; 3 CR.

59866 & 59867: Capstone Design for Electrical Engineering
This is a two-semester capstone design course. The student is required to design and implement a solution to an engineering project. Topics include introduction to engineering design, identification of a problem, background research, social, environmental, ethical and economic considerations, intellectual property and patents and proposal writing, including methods of engineering analysis and theoretical modeling. A detailed concept and design proposal is completed during the first semester and the implementation phase may also begin. A functional physical prototype or computer model is completed and tested in the second semester. Each student is required to write an in depth engineering report and to make an oral presentation to the faculty. Pre-requisites: EE 32300, Senior students only. Prerequisite for EE59867: EE59866. 3 CLASS, 3 DESIGN HR./WK; 3 CR.

FACULTY

Samir Ahmed, Herbert Kayser Professor
B.A., Cambridge Univ., M.A.; Ph.D., Univ. College (UK)
Mohamed A. Ali, Professor
B.S., Azar Univ. (Egypt); M.S., The City College; Ph.D., CUNY
Mark Arend, Assistant Professor
B.S. (Physics), Univ. of Washington, M.S.; M.Phil., Columbia Univ., Ph.D.
Joseph Barba, Professor and Acting Dean, School of Engineering
B.E., The City College, M.E.; Ph.D., CUNY
Mitra Basu, Associate Professor
B.E., Regional Engr. College, Durgapur (India); M.S. , Univ. of Pittsburgh; Ph.D., Purdue Univ.
Xinghao Chen, Associate Professor
M.S. (ECE), Rutgers Univ., Ph.D. (ECE)
Michael Conner, Professor
B.E.S., Johns Hopkins Univ.; M.S., Univ. of Maryland, Ph.D.
David Crouse, Assistant Professor
B.S. (Physics), Purdue Univ.; Ph.D., Cornell Univ.
Roger Dorsinville, Professor and Chair
B.S., Moscow State Univ. (Russia), M.S., Ph.D.
Barry M. Gross, Associate Professor
B.A. (Physics/Math), Yeshiva Univ.; M.S. , The City College; Ph.D. , CUNY
Ibrahim W. Habib, Professor
B.S., Ain Shams Univ. (Egypt); M.S., Polytechnic Univ. of New York; Ph.D., CUNY
Ping-Pei Ho, Professor
B.S., Tsing-Hun Univ.(Taiwan); M.B.A., Kent State Univ.; Ph.D., CUNY
George M. Kranc, Professor
B.Sc., Univ. of St. Andrews (Scotland); M.S., Columbia Univ., D.Sc.Eng.
Myung Jong Lee, Professor
B.S., Seoul National Univ. (Korea), M.S.; Ph.D., Columbia Univ.
Jamal T. Manassah, Professor
B.S., American Univ. of Beirut (Lebanon); M.A., Columbia Univ., Ph.D.
Fred Moshary, Associate Professor
B.S. (Applied Physics), Cornell Univ., M.S. ; Ph.D. (Applied Physics), Columbia Univ.
Leonid Roytman, Professor
B.S., Moscow Polytechnical (Russia), M.S.; Ph.D., Novosibirsk Polytechnical Inst. (Russia)
Tarek N. Saadawi, Professor
B.Sc., Cairo Univ. (Egypt), M.Sc.; Ph.D., Univ. of Maryland
Norman Scheinberg, Professor
B.E.E., Cooper Union; M.S., M.I.T.; Ph.D., CUNY
Kenneth Sobel, Professor
B.E., The City College; M.E., Rensselaer Polytechnic Inst., Ph.D.
Gerald E. Subak-Sharpe, Professor
B.Sc. (Eng.), Univ. College (UK); Ph.D., Univ. of London (UK); D. Engr. Sci., Columbia Univ.
Yi Sun, Assistant Professor
B.S., Shanghai Jiao Tong Univ. (China), M.S.; Ph.D., Univ. of Minnesota
Frederick E. Thau, Professor
B.E.E., New York Univ., M.E.E., D.Eng.Sc.
M. Ümit Uyar, Associate Professor
B.S., Istanbul Teknik Univ. (Turkey); M.S., Cornell Univ., Ph.D.
Ardie D. Walser, Associate Professor and Associate Dean
B.E., The City College, M.E.; Ph.D., CUNY
Jizhong Xiao, Assistant Professor
B.S., East China Inst. of Tech. (China); M.S. (EE), Nanyang Tech. Univ. (China); Ph.D. (ECE), Michigan State Univ.
Mohamed Zahran, Assistant Professor
B.S., Cairo Univ. (Egypt), M.S.; Ph.D., Univ. of Maryland

PROFESSORS EMERITI

Abraham Abramowitz
Egon Brenner
Shee-Ming Chen
George J. Clemens
Vincent Deltoro
Demos Eitzer
Cecile Froehlich
Henry B. Hansteen
William T. Hunt, Jr.
Mansour Javid
Irving Meth
Donald L. Schilling
Robert Stein
Herbert Taub
Richard Tolimieri
Louis Weinberg