Electrical & Computer Engineering

Dr. George Giakos
Chair, Department of Electrical and Computer Engineering

Vision Statement

The Electrical and Computer Engineering programs will be recognized for educating highly-valued engineers grounded in fundamental principles who are leaders in developing innovative solutions to engineering challenges.

Mission Statement

The mission of the Electrical and Computer Engineering programs is to bring together students from diverse backgrounds, provide them with a superior technical education based on the fundamental principles of discovery and collaboration, foster an appreciation of ethical, environmental, and economic concerns, and develop within them an understanding of the importance of life-long learning. Graduates of the program will be prepared to become successful and socially-responsible professional and community leaders.

Central to the programs are certain principles, including the importance of collaboration, the discovery and sharing of knowledge, the appreciation of ethical, safety, and economic concerns, and the need for life-long learning and advanced study.

Program Educational Objectives

Graduates of either the Electrical Engineering or Computer Engineering programs will be valued by the engineering community. Graduates will be recognized for their:

• Practicing electrical and computer engineering in a broad range of industries and technical skills in professional or advanced academic settings.

• Committing to the engineering profession and to expanding their knowledge and skill set with increasing independence and responsibility,

• Conducting themselves in a responsible, professional, and ethical manner.

• Participating in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.

Student Outcomes

SO 1:an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

SO 2:an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

SO 3:an ability to communicate effectively with a range of audiences

SO 4:an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

SO 5:an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

SO 6:an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

SO 7:an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The Electrical and Computer Engineering programs use the standard set of ABET, Inc. outcomes (1) through (7) as described above under Engineering.

Electrical and Computer Engineering

Electrical engineers and computer engineers work at the frontier of high technology and are involved in research, the creation of new ideas, the design and development of new products and technologies, manufacturing and marketing activities. In the Electrical and Computer Engineering (ECE) Department, students acquire significant hands-on-lab experience through undergraduate and graduate concentrations and research projects. These areas include bioelectrical engineering, cybersecurity, power grids and green energy engineering, internet-of-Things (IoT), wireless communications, mobile programming, artificial intelligence, and machine learning.

Computer Engineering

The application of computer-based technology is growing at a phenomenal rate. In fact, it pervades our lives. As a result, there is ongoing demand for engineers who can build complex systems which integrate computer hardware and software. This has given rise to the field of computer engineering. By combining the core courses in electrical engineering and relevant knowledge from computer science, the computer engineering curriculum prepares students to enter this challenging field.

A liberal choice of technical electives accommodates a broad spectrum of educational objectives. Those wishing to prepare for an advanced degree may do so by selecting advanced theoretical courses in computer engineering, electrical engineering or computer science. Those wishing to obtain breadth in general engineering practice may do so by choosing electives in engineering science or other engineering disciplines.

Four-Year Program in Computer Engineering

The curriculum for the first year is common to all engineering disciplines within the college. Additionally, students intending to major in computer engineering as well as those in electrical engineering complete a common sophomore year in which basic concepts of contemporary digital environments, modern computer hardware organizations, and analysis of systems underscore coursework. This maximizes the flexibility that a student enjoys in ultimate selections of a major. Discipline-specific courses are undertaken in

both the junior and senior years where software and elements of computer science are integrated into the design of complex computer-based systems. Computer engineering majors can choose from a variety of technical electives to enhance individual educational objectives. The four-year program is summarized below.

Electrical Engineering

Wide in scope and variety, electrical engineering ranges from design of solid state devices and increasingly complex microcircuits to design of communication systems or large scale power generating equipment and plants to meet society's accelerating demand for clean energy. The fundamental principles of information processing and control inherent in an electrical engineer's background find applications in such diverse areas as industry and medicine.

Coursework in both the Electrical Engineering and Computer Engineering programs emphasize understanding of electrical circuits and electromagnetic theory as a framework for courses in electronics, energy conversion, computers, automation and engineering systems. Embedded laboratory experiences associated with the lecture materials provide design experience, stress principles, methods, accuracy of measurements and the limitations of electrical instruments and measuring devices. Senior multidisciplinary research and design projects offer opportunities for creative work with personal guidance.

Four-Year Program in Electrical Engineering

Because of the significant overlap in preparation for career opportunities in both electrical and computer engineering, the four-year curriculum for both programs is essentially the same. This common approach provides maximum flexibility and permits a student to delay the choice of major. Differences in the major depend on the selection of "concentration courses" during the senior year as well as choice of electives. These selections are made with the consultation, advisement, and approval of the chair of the department. The curriculum for the first year is common to all branches of engineering. An important element in the electrical engineering experience is provided within the Capstone Design course. Working cooperatively with computer engineering majors, modern complex systems can be understood as a true integration of hardware and software elements and the role that each plays in such applications. This course offers opportunities for creative work with personal guidance by a faculty member. The four-year program is summarized below.

Undergraduate Concentrations

The integrative curriculum prepares students to identify, formulate, and execute solutions to real-world problems. Students learn how to integrate engineering principles with science, and use engineering tools with activities that reinforce the concepts learned in the classroom. As part of these efforts, concentration study areas have been approved by the New York State Education Department (NYSED). Paired with the rigorous curricula and hands-on project-based approach, concentrations reinforce the broad relevance of the powerful problem-solving methodologies of engineering and illuminate enabling technologies for applications of technology. The ECE Department offers the following undergraduate concentrations:

• Bioelectrical Engineering

• Cybersecurity
• Power Grids and Green Energy Engineering

Concentration in Bioelectrical Engineering

The concentration in Bioelectrical Engineering provides a broad background in the principles, design, and application of bioelectrical, bioinspired, and biocomputing systems and techniques; integrating hardware, signal processing, and artificial intelligence techniques.

For the Concentration, all students are required to take:

EECE 443 Biomedical Imaging Systems 3
EECE 455 Bionanophotonics 3

and two elective courses from the following:

EECE 417 Mobile Applications and Cybersecurity 3
EECE 436 Computer Graphics 3
EECE 442 Computer Vision and Imaging 3
EECE 447 Image Processing and Pattern Recognition 3
EECE 448 Applied Machine Learning 3
EECE 453 Applied Bioinformatics 3
EECE 457 Bioinspired Robotic Vision Systems 3

Total credit hours for concentration: 12

Concentration in Cybersecurity

The concentration in Cybersecurity provides a broad background in the principles, design, and applications of cybersecurity systems for cloud computing and Internet of Things (IoT).

For the Concentration, all students are required to take:

EECE 454 Big Data, and Deep Learning 3
EECE 458 Cybersecurity Systems 3

and two elective courses from the following:

EECE 417 Mobile Applications and Cybersecurity 3
EECE 442 Computer Vision and Imaging 3
EECE 448 Applied Machine Learning 3
EECE 460 Data and Application Security 3
EECE 461 Network Security Systems 3
EECE 570 Modern Portable Wireless Devices 3

Total credit hours for concentration: 12

Concentration in Power Grids and Green Energy Engineering

The concentration in Power Grids and Green Energy Engineering provides a broad background in the principles, analysis, and design of large electric power and green

energy systems, smart grids, electric energy conversion, and the application of electronic devices at high power levels.

For the Concentration, all students are required to take:

EECE 466 Green Energy Sources 3
EECE 477 Power and Energy Systems 3

and two elective courses from the following:

EECE 400 Industrial Electric Drives 3
EECE 439 Protective Relays 3
EECE 591 Power Design of Green Buildings 3
EECE 592 Smart Grid Technologies 3
EECE 593 Power Electronics 3
EECE 594 NERC Standards & Operation 3
EECE 595 SCADA Systems 3
EECE 596 Wind Energy Essentials 3

Total for Concentration credit hours: 12

Electrical Engineering

Freshman

Fall	Credits	Spring	Credits
ENGS 115	3	ENGS 116	3
MATH 185*	3	MATH 186*	3
CHEM 101/103 or PHYS 101/191*	4	CHEM 101/103 or PHYS 101/191*	4
ENGL 110 or RELS 110	3	ENGL 110 or RELS 110	3
GEN ED ELEC	3	GEN ED ELEC	3
	16		16

Sophomore

Fall	Credits	Spring	Credits
EECE 201	3	EECE 203	3
EECE 210	3	EECE 232	3
EECE 229	3	MATH 286*	3
MATH 285*	3	PHYS 102	3
ENGL ELECTIVE	3	PHYS 192	1
GEN ED or RELS ELEC	3	GEN ED or RELS ELEC	3
	18		16

Junior

Fall	Credits	Spring	Credits
EECE 303	3	EECE 304	4
EECE 305	4	EECE 306	4
EECE 307	4	EECE 311	3
EECE 321	3	EECE 315	4

GEN ED ELEC	3	EECE 326	3
	17		18

Senior

Fall	Credits	Spring	Credits
EECE 410	3	EECE 411	3
EECE 477	3	EECE 425	3
TECHNICAL ELECTIVE	3	EECE 474	3
TECHNICAL ELECTIVE	3	TECHNICAL ELECTIVE	3
TECHNICAL ELECTIVE	3	TECHNICAL ELECTIVE	3
TECHNICAL ELECTIVE	3	GENERAL EDUCATION ELECTIVE	3
	18		18

Total Credits: 137

Computer Engineering

Freshman

Fall	Credits	Spring	Credits
ENGS 115	3	ENGS 116	3
MATH 185	3	MATH 186	3
CHEM 101/103 or PHYS 101/191	4	CHEM 101/103 or PHYS 101/191	4
ENGL 110 or RELS 110	3	ENGL 110 or RELS 110	3
GEN ED ELEC	3	GEN ED ELEC	3
	16		16

Sophomore

Fall	Credits	Spring	Credits
EECE 201	3	EECE 203	3
EECE 210	3	EECE 232	3
EECE 229	3	MATH 286	3
MATH 285	3	PHYS 102	3
ENGL ELECTIVE	3	PHYS 192	1
GEN ED or RELS ELEC	3	GEN ED or RELS ELEC	3
	18		16

Junior

Fall	Credits	Spring	Credits
EECE 303	3	EECE 304	4
EECE 305	4	EECE 306	4
EECE 307	4	EECE 311	3
EECE 321	3	EECE 315	4
GEN ED ELEC	3	EECE 320	3
	17		18

Senior

Fall	Credits	Spring	Credits
EECE 410	3	EECE 411	3
EECE 476	3	EECE 473	3
TECHNICAL ELECTIVE	3	EECE 475	3
TECHNICAL ELECTIVE	3	TECHNICAL ELECTIVE	3
TECHNICAL ELECTIVE	3	GENERAL EDUCATION ELECTIVE	3
TECHNICAL ELECTIVE	3	TECHNICAL ELECTIVE	3
	18		18

Total Credits: 137

Footnotes

* Students must earn a grade of C (2.0) or better in calculus I, II, III, differential equations, chemistry and physics.

Notes:

1. EECE 201 Fundamentals of Electrical Systems Analysis I and 203 Electrical Systems Analysis II *must be completed* with a grade of C (2.0) of better.