# Electrical & Computer Engineering

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## 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 an excellent 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 professionals 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 the Electrical Engineering and the Computer Engineering programs will be valued by the engineering community. Graduates will be recognized for:

• 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

In order to prepare our students to meet these objectives after graduation the Electrical and Computer Engineering department has adopted the ABET 1 to 7 criteria as the appropriate student outcomes that our curriculum is designed to foster in our students:

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.

# Electrical and Computer Engineering

## Electrical Engineering

Electrical engineering is a creative field that leads in the design, development, testing, and supervision of equipment, technologies, and devices that use electricity and electromagnetism. Wide in scope and variety, electrical engineering ranges from design of solid-state devices and increasingly complex microcircuits to the development of communication systems and power generation and transmission equipment to meet society's accelerating demand for clean energy. The fundamental principles of information processing and control systems inherent in an electrical engineer's background also find applications in such diverse areas as medicine, aerospace, transportation, artificial intelligence, financial systems, cybersecurity, telecommunications, consumer products, entertainment, green energy, and power systems.

The Electrical Engineering Program is accredited by the Engineering Accreditation Commission of ABET, under the General Criteria and the Electrical Engineering Program Criteria.

## Computer Engineering

Computers continue to advance at a staggering pace and are being embedded into every kind of technology including consumer products, transportation, space systems, medical products, and military systems. Manhattan University's Computer Engineering Program offers a comprehensive analysis and design curriculum in computer systems, concentrating on both hardware and software, in order to provide an outstanding, cutting-edge education. This program incorporates the latest developments in electronics, communications, and control systems and programming in a variety of emerging areas, such as Cyber Security, Parallel Computers, Image Processing, Wireless Networks, VLSI (Very Large-Scale Integration), Big Data, Data Mining, and Artificial Intelligence.

Graduates in Computer Engineering will be prepared to develop digital systems for a variety of platforms such as supercomputers, smartphones, laptops, servers, IoT devices, and

robots. Many of our graduates currently hold positions in the manufacturing, research, financial services, health, and government sectors.

The Computer Engineering Program is accredited by the Engineering Accreditation Commission of ABET, under the General Criteria and the Computer Engineering Program Criteria.

# Four-Year Electrical Engineering and Computer Engineering Programs

The ECE department offers two-degree programs: Computer Engineering and Electrical Engineering. The curriculum for the first year is common to all engineering disciplines within the School of Engineering. Additionally, ECE students complete a common sophomore year in which basic concepts of both fields are presented. This common approach provides flexibility and permits a student to delay the choice of major within the ECE department.

Discipline-specific courses are taken in both the junior and senior years. Here, both Computer and Electrical Engineering majors choose from a variety of technical electives and "concentration courses" to enhance individual educational and career objectives. The four-year programs for both majors are summarized below.

## Electrical Engineering Program

**Freshman**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| ENGS 115 | 3 | ENGS 116 | 3 |
| MATH 185[1] | 4 | MATH 186[1] | 4 |
| CHEM 101/103 or PHYS 101/191[1] | 4 | CHEM 101/103 or PHYS 101/191[1] | 4 |
| ENGL 110 or RELS 110 | 3 | ENGL 110 or RELS 110 | 3 |
| GEN ED ELEC | 3 | GEN ED ELEC | 3 |
| | **17** | | **17** |

**Sophomore**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| EECE 201[2] | 3 | EECE 203[2] | 3 |
| EECE 210 | 3 | EECE 232 | 3 |
| EECE 229 | 3 | MATH 286[1] | 3 |
| MATH 285[1] | 4 | PHYS 102[1] | 3 |
| ENGL ELECTIVE | 3 | PHYS 192[1] | 1 |
| | | GEN ED or RELS ELEC | 3 |
| | **16** | | **16** |

**Junior**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| EECE 303 | 3 | EECE 306 | 4 |
| EECE 305 | 4 | EECE 312 | 3 |
| EECE 311 | 3 | EECE 316 | 3 |

| | | | |
|---|---|---|---|
| EECE 321 | 3 | EECE 326 | 3 |
| GEN ED ELEC | 3 | Math/Science Elective | 3 |
| | **16** | | **16** |

**Senior**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| EECE 410 | 3 | EECE 411 | 3 |
| EECE 477 | 3 | EECE 425 | 3 |
| ECE ELECTIVE | 3 | EECE 474 | 3 |
| ECE ELECTIVE | 3 | ECE ELECTIVE | 3 |
| ECE ELECTIVE | 3 | ECE ELECTIVE | 3 |
| GEN ED or RELS ELEC | 3 | GENERAL EDUCATION ELECTIVE | 3 |
| | **18** | | **18** |

**Total Credits: 134**

## Computer Engineering Program

**Freshman**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| ENGS 115 | 3 | ENGS 116 | 3 |
| MATH 185[1] | 4 | MATH 186[1] | 4 |
| CHEM 101/103 or PHYS 101/191[1] | 4 | CHEM 101/103 or PHYS 101/191[1] | 4 |
| ENGL 110 or RELS 110 | 3 | ENGL 110 or RELS 110 | 3 |
| GEN ED ELEC | 3 | GEN ED ELEC | 3 |
| | **17** | | **17** |

**Sophomore**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| EECE 201[2] | 3 | EECE 203[2] | 3 |
| EECE 210 | 3 | EECE 232 | 3 |
| EECE 229 | 3 | MATH 286[1] | 3 |
| MATH 285[1] | 4 | PHYS 102[1] | 3 |
| ENGL ELECTIVE | 3 | PHYS 192[1] | 1 |
| | | GEN ED or RELS ELEC | 3 |
| | **16** | | **16** |

**Junior**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| EECE 303 | 3 | EECE 306 | 4 |
| EECE 305 | 4 | EECE 312 | 3 |
| EECE 311 | 3 | EECE 316 | 3 |
| EECE 321 | 3 | EECE 320 | 3 |

| | | | |
|---|---|---|---|
| GEN ED ELEC | 3 | Math/Science Elective | 3 |
| | **16** | | **16** |

**Senior**

| Fall | Credits | Spring | Credits |
|---|---|---|---|
| EECE 410 | 3 | EECE 411 | 3 |
| EECE 476 | 3 | EECE 473 | 3 |
| ECE ELECTIVE | 3 | EECE 475 | 3 |
| ECE ELECTIVE | 3 | ECE ELECTIVE | 3 |
| ECE ELECTIVE | 3 | ECE ELECTIVE | 3 |
| GEN ED or RELS ELEC | 3 | GENERAL EDUCATION ELECTIVE | 3 |
| | **18** | | **18** |

**Total Credits: 134**

Notes:
1. Students must earn a grade of C (2.0) or better in calculus I, II, III, differential equations, chemistry and physics.
2. EECE 201 Fundamentals of Electrical Systems Analysis I and EECE 203 Fundamentals of Electrical Systems Analysis II must be completed with a grade of C (2.0) of better.
3. MATH/SCI electives must be approved by the department chair.

## Undergraduate Concentrations

The integrative curriculum prepares students to identify, formulate, and execute solutions to real-world problems. Students learn how to combine 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 a 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 Electrical Engineering program offers the following three concentrations:
  - Applied Artificial Intelligence in Electrical Engineering (9 credits)
  - Cybersecurity (9 credits)
  - Power Grids and Green Energy Engineering (9 credits)
- The Computer Engineering program offers the following two concentrations:
  - Applied Artificial Intelligence in Computer Engineering (9 credits)
  - Cybersecurity (9 credits)

## Applied Artificial Intelligence Concentration

The Applied Artificial Intelligence (AI) in Electrical Engineering and in Computer Engineering Bachelor of Science concentrations are designed to provide ECE students with the fundamental concepts of artificial intelligence from an engineering perspective. A major component of these concentrations is the design and development of AI-based intelligent

systems such as IoT, robotics, power-grids, and controls.The course listings for both the Electrical Engineering and the Computer Engineering programs are the same and are indicated below:

### Plan of Study for the Applied Artificial Intelligence Concentration - 9 credits total

Students who plan to take the Applied Artificial Intelligence Concentration in Electrical Engineering and Computer Engineering must take the following required course:

| | | |
|---|---|---|
| EECE 471 | Artificial Intelligence Applications in Electrical & Computer Engineering | 3 |

and select two elective courses from the following list*:

| | | |
|---|---|---|
| EECE 442 | Computer Vision & Imaging | 3 |
| EECE 448 | Applied Machine Learning for Electrical & Computer Engineering | 3 |
| EECE 449 | Unmanned Autonomous Vehicles | 3 |
| EECE 457 | Bioinspired Robotic Vision Systems | 3 |
| EECE 460 | Big Data, & Deep Learning for Electrical & Computer Engineering | 3 |
| EECE 494 | Special Topics in Artificial Intelligence (AI) in Electrical and Computer Engineering | 3 |
| EECE 469 | Introduction to Remote Sensing | 3 |

Note*: Elective courses may be substituted by the Chairperson as the need arises.

## Cybersecurity Concentration

The cybersecurity undergraduate concentration equips students with the knowledge and skills to protect and defend digital systems against cyber threats, ensuring the security and integrity of critical information.

### Plan of Study for Cybersecurity Concentration - 9 credits total

Students who plan to take the Cybersecurity Concentration must select a total of three elective courses from the following list*:

| | | |
|---|---|---|
| EECE 409 | Ethical Hacking and Penetration Testing | 3 |
| EECE 417 | Mobile App. & Cybersecurity | 3 |
| EECE 461 | Network Security Systems | 3 |
| EECE 462 | Data & Applications Security | 3 |
| EECE 488 | Cyber-Physical Systems Security | 3 |
| EECE 490 | Cybersecurity Systems Fundamentals | 3 |
| EECE 493 | Special Topics in Cybersecurity | 3 |
| EECE 448 | Applied Machine Learning for Electrical & Computer Engineering | 3 |

Or

| | | |
|---|---|---|
| EECE 460 | Big Data, & Deep Learning for Electrical & Computer Engineering | 3 |
| EECE 458 | Cybersecurity Systems | 3 |

Note*: Elective courses may be substituted by the Chairperson as the need arises.

## Electrical Engineering 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.

### Plan of Study for Power Grids and Green Energy Engineering Concentration - 9 credits total

Students who plan to take the Power Grids and Green Energy Engineering Concentration must take the following required course:

| | | |
|---|---|---|
| EECE 477 | Power & Energy Systems | 3 |

and select two elective courses from the following list*:

| | | |
|---|---|---|
| EECE 400 | Industrial Electric Drives (IED) | 3 |
| EECE 416 | NERC Standards & Operation | 3 |
| EECE 418 | Intro to Power Electronics | 3 |
| EECE 434 | Bulk Power System Operation | 3 |
| EECE 439 | Protective Relays | 3 |
| EECE 466 | Green Energy Sources | 3 |
| EECE 482 | Grid Integration of Wind Energy | 3 |
| EECE 492 | Special Topics in Power Systems | 3 |

Note*: Elective courses may be substituted by the Chairperson as the need arises