# Electrical and Computer Engineering

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The Department of Electrical and Computer Engineering offers academic programs leading to a Bachelor of Science in Electrical Engineering and a Bachelor of Science in Computer Engineering. The Computer Engineering and Electrical Engineering programs are accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Electrical engineers are concerned with electrical devices and systems and with the use of electrical energy. Virtually every industry uses electrical engineers, and electrical engineering is the largest of all engineering disciplines. Examples of the products designed by electrical engineers range from the computers used in business to instruments used in the medical profession, military radar systems, cellular telephones, and video conferencing equipment.

The electrical engineering curriculum allows students to focus on communications, electronic devices, instrumentation, digital signal processing, and automatic control systems. The computer engineering curriculum addresses a variety of technological problems associated with the design and application of computers as well as digital software/hardware in general.

## Electrical and Computer Engineering Educational Objectives

The Department of Electrical and Computer Engineering at The College of New Jersey seeks to prepare its graduates:

- To contribute to the economic development of New Jersey and the nation through the ethical practice of engineering;
- To become successful in their chosen career path, whether it is in the practice of engineering, in advanced studies in engineering or science, or in other complementary disciplines;
- To assume leadership roles in industry or public service through engineering ability;
- To maintain career skills through life-long learning.

## Electrical and Computer Engineering Student Outcomes

The student outcomes listed below are expected of all graduates of the electrical and computer engineering programs. These outcomes outline what TCNJ electrical and computer engineering graduates are expected to know and be able to do at graduation. These outcomes outline the knowledge, abilities, tools, and skills the programs give the graduates to enable them to accomplish the programs' educational objectives. Electrical and computer engineering graduates will have:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

- 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.
- An ability to communicate effectively with a range of audiences
- 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.
- 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.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

## Academic Policies and Standards

A student may repeat any course without seeking approval. However, if a student wishes to repeat a course more than once, permission must be obtained from the chair of the department or coordinator of the program of study and, if appropriate, the chair of the department offering the course. Permission to repeat a major course more than once will be granted only in cases of extreme extenuating circumstances, e.g., illness, financial, etc. When an engineering course is repeated, only the most recent earned grade is counted in the grade point average, although all grades earned will appear on the student's transcript.

## Program Entrance, Retention, and Exit Standards

Every major program at the College has set standards for allowing students to remain in that program, to transfer within the College from one program to another, and to graduate from a program. The following are the standards for engineering majors. Minimum grades are noted in parentheses.

- Retention in the engineering programs is based on the following performance standards in these "critical content courses": PHY 201 (C–); MAT 127 (C–), MAT 128 (C-).  A student who does not achieve these minimum performance standards, earns a grade of F, and/or has a cumulative GPA of less than 2.0 will be placed on the Engineering Programs Academic Warning List. Placement on the Engineering Programs Academic Warning List for two consecutive semesters or three non-consecutive semesters will result in dismissal from the major. Students dismissed from the major may appeal for re-entry into the major.
- To ensure academic success, first year, sophomore, and first-semester junior students will not be permitted to take more than 4.5 course units unless they have a GPA of 2.75 or greater. Upper class students can register for 5.5 course units if they are in good academic standing.

- o Entrance (internal transfer) into the engineering programs from another program within the College is based upon the following performance standards in these "foundation courses": PHY 201 (C); MAT 127 (C).  Internal transfer within engineering programs will be considered as long as enrollment limits are not exceeded.
- o Graduation requires an in-major cumulative GPA of 2.0.

**Bachelor of Science for Both Electrical and Computer Engineering**

Two curricula are presented in the table below, for both electrical (EE) and computer (CompE) engineering. Certain courses (e.g., PHY321, CSC230) are required for one program but not the other and, as such, are clearly marked as EE Only or CompE Only. The fifth column indicates whether a class is required for electrical engineering (y/n). The sixth column indicates whether a class is required for computer engineering.

| Course Name | Course Number | Prereqs | Coreqs | Elect | Comp | CU |
|---|---|---|---|---|---|---|
| **Fall Freshman Year** | Course Units: | EE=4.0, CompE=4.0 | | | | |
| Introduction to Engineering | ENG095 | | | y | y | 0.0 |
| Fundamentals of Engineering Design (aka. Freshman Design Course) | ENG144 | | | y | y | 1.0 |
| Calculus A | MAT127 | see note below | | y | y | 1.0 |
| General Physics I | PHY201 | | MAT127 | y | y | 1.0 |
| First-Year Writing (if not exempted)* | FYW102 | | | y | y | 0.0 |
| Creative Design | TST161 | | | y | y | 1.0 |
| **Spring Freshman Year** | Course Units: | EE=4.0, CompE=4.0 | | Elect | Comp | CU |
| Calculus B | MAT128 | MAT127 OR MAT125 | | y | y | 1.0 |
| General Physics II | PHY202 | PHY201 AND MAT 127 | MAT128 | y | y | 1.0 |
| Computer Science I | CSC220 | | | y | y | 1.0 |
| ECE-Specific Freshman Design Section | ELC145 | | ENG144 | y | y | 0.0 |
| First Year Seminar* | FYS16X | | | y | y | 1.0 |

| **Fall Sophomore Year** | Course Units: | EE=4.0, CompE=4.0 | | **Elect** | **Comp** | **CU** | |
|---|---|---|---|---|---|---|---|
| Circuits Analysis | ENG212 | PHY202 (>=C-) | ENG272 | y | y | 1.0 | |
| Adv. Engineering Mathematics I | ENG272 | MAT128 | | y | y | 1.0 | |
| Digital Circuits and Microprocessors | ENG312 | CSC215 or CSC220 | | y | y | 1.0 | |
| Computer Science II **(CompE Only)** | CSC230 | CSC220 (>=C) | | no | y | 1.0 | **For Computer Students Only.** |
| Modern Physics **(EE Only)** | PHY321 | MAT128 AND PHY202 | | y | no | 1.0 | **For Electrical Students Only.** |
| **Spring Sophomore Year** | Course Units: | EE=4.5, CompE=5.5 | | **Elect** | **Comp** | **CU** | |
| Electronics | ELC251 | ENG212 AND ENG272 | | y | y | 1.0 | |
| Circuits Analysis Laboratory | ENG214 | | ENG212 | y | y | 0.5 | |
| Systems and Signals | ELC321 | | ENG212 | y | y | 1.0 | |
| Discrete Structures **(CompE Only)** | CSC270 | CSC220 (>=C) OR CSC230 (>=C) | MAT127 | no | y | 1.0 | **For Computer Students Only.** |
| Multivariable Calculus | MAT229 | MAT128 | | y | y | 1.0 | |
| Principles of Microeconomics | ECO101 | MAT095 OR MAT096 | | y | y | 1.0 | |
| **Fall Junior Year** | Course Units: | EE=5.5, CompE=4.5 | | **Elect** | **Comp** | **CU** | |
| Engineering Seminar III | ENG093 | | | y | y | 0.0 | |
| Communication Systems **(EE Only)** | ELC341 | ELC251 AND ELC321 | | y | no | 1.0 | **For Electrical Students Only.** |
| Embedded Systems with Lab | ELC411 | ELC251 AND ELC312 | | y | y | 1.0 | |
| Electronics Lab | ELC333 | | ELC251 | y | y | 0.5 | |
| Computer Architecture and Org. | ELC451 | ENG312 | | y | y | 1.0 | |
| Mathematics Elective* | ENG342 or STA215 | varies | | y | y | 1.0 | |

| | | | | Elect | Comp | CU | |
|---|---|---|---|---|---|---|---|
| Technical Elective: ECE Discipline or Engineering (by advisement) | TechE | At least ELC251 AND ELC321 | | y | y | 1.0 | |
| **Spring Junior Year** | Course Units: | EE=5.0, CompE=4.5 | | **Elect** | **Comp** | **CU** | |
| Engineering Seminar IV | ENG094 | | | y | y | 0.0 | |
| Control Systems | ENG352 | ENG212 AND ENG272 | | y | y | 1.0 | |
| Computer Engineering Laboratory I | ELC363 | | ELC451 | y | y | 0.5 | |
| Engineering Electromagnetics **(EE Only)** | ELC361 | ENG212 AND MAT229 | | y | no | 1.0 | **For Electrical Students Only.** |
| Wireless and Communications Lab **(EE Only)** | ELC373 | ELC341 | ELC361 | y | no | 0.5 | **For Electrical Students Only.** |
| Software Engineering **(CompE Only)** | CSC415 | CSC230, CSC270, AND MAT127 (>=C for all) | | no | y | 1.0 | **For Computer Students Only.** |
| Systems Engineering + Engineering Economy | ENG348 | ENG212 OR ENG222 (Jr/Sr Only) | | y | y | 1.0 | |
| Technical Elective: ECE Discipline or Engineering (by advisement) | TechE | At least ELC251 AND ELC321 | | y | y | 1.0 | |
| **Fall Senior Year** | Course Units: | EE=4.5, CompE=4.5 | | **Elect** | **Comp** | **CU** | |
| Senior Professional Seminar | ENG099 | | | y | y | 0.0 | |
| Senior Project I | ELC495 | ENG348, ENG352, AND ELC411 | | y | y | 0.5 | |
| Digital Signal Processing | ELC423 | ENG312 AND ELC321 | | y | y | 1.0 | |
| Signal Processing Lab | ELC433 | | ELC423 | y | y | 0.5 | |
| Control Systems Laboratory | ENG354 | | ENG352 | y | y | 0.5 | |
| Society, Ethics and Technology | IDS252 | | | y | y | 1.0 | |

| | | | | Elect | Comp | CU | |
|---|---|---|---|---|---|---|---|
| Technical Elective: ECE Discipline or Engineering (by advisement) | TechE | At least ELC251 AND ELC321 | | y | y | 1.0 | |
| **Spring Senior Year** | Course Units: | EE=4.5, CompE=5.0 | | | | | |
| Senior Project II | ELC496 | ELC495 | | y | y | 0.5 | |
| Electronics II **(EE Only)** | ELC383 | ELC251 | | y | no | 1.0 | **For Electrical Students Only.** |
| Operating Systems **(CompE Only)** | CSC345 | MAT127, CSC230, CSC270, AND ELC451 (>=C for all) | | no | y | 1.0 | **For Computer Students Only.** |
| Computer Engineering Laboratory II **(CompE Only)** | ELC463 | ELC363 | | no | y | 0.5 | **For Computer Students Only.** |
| Technical Elective: ECE Discipline or Engineering (by advisement) | TechE | At least ELC251 AND ELC321 | | y | y | 1.0 | |
| College Core Elective (by advisement) | LL | | | y | y | 1.0 | |
| College Core Elective (by advisement) | LL | | | y | y | 1.0 | |
| | | | **Total CU** | | | **36.0** | |

**Note on Technical Electives** – Students must take a total of four technical electives from the list below. Two categories exist: 1) ECE discipline electives and 2) engineering electives. Students may fulfill the technical elective requirement by taking: 1) four ECE discipline electives, 2) three ECE discipline electives and one engineering elective, or 3) two ECE discipline electives and two engineering electives. See the list below:

- o  ECE-Specific Technical Elective Listing (between 2 and 4)
  - o  ELC477: Power Systems and Renewability
  - o  ELC435: Artificial Neural Networks
  - o  ELC431: RF/Microwave Engineering
  - o  ELC441: Digital Engineering Systems
  - o  ELC453: Digital Control Systems
  - o  ELC471: VLSI Design
  - o  ELC475: Advanced Digital Signal Processing
  - o  ELC480: Digital Video Processing and Compression

- o ELC470: Cybersecurity
- o ELC470: Advanced Sensor Networks
- o ELC470: Advanced Semiconductor Materials
- o ELC470: Other Special Topics (by advisement only)
- o The following course(s) are allowed for computer engineering students only.
  - o ELC341: Communication Systems
  - o ELC383: Electronics II
- o General Engineering Elective Listing (2 maximum)
  - o ENG470: Sustainability Europe
  - o ENG152: Engineering Materials Science
  - o ENG222: Statics
  - o ENG262: Dynamics
  - o ENG322: Thermodynamics
  - o CSC300/400 Level Courses: Ask your advisor.

**Notes on Mathematics Elective** – Students must take one of the following, separate from the technical elective requirement: ENG342: Advanced Engineering Mathematics II, STA215: Statistical Inference and Probability.

**Note on Credit Limit** - To improve retention in the School of Engineering, students with fewer than 22.5 completed course units that achieve a cumulative GPA of 2.75 or less are limited to 4.5 course units per semester. This limit may be lower for students on the academic warning list or academic probation.

- o 5.5 Course Units - for all ECE first semester students and seniors.
- o 5.5 Course Units - for ECE freshmen/sophomore/juniors with cumulative GPA >= 2.75.

Otherwise:

- o 4.5 Course Units - for ECE freshmen/sophomores/juniors with cumulative GPA < 2.75.

Those on the academic warning list are limited to only 3.0 course units/semester.