

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.

Computer engineering is a discipline that addresses a variety of technological problems associated with the design and application of computers. Computer engineering is concerned with the design and implementation of digital hardware and software.

The curriculum for the computer engineering degree provides breadth and depth across the fields of electrical engineering and computer science. The curriculum structure provides a balanced view of hardware, software, hardware-software trade-offs, and basic modeling techniques used to represent the computing process. The degree requirements include completion of coursework from the computer science as well as the electrical and computer engineering departments.

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.

Seniors pursuing bachelor of science degrees in an engineering major are required to take the Fundamentals of Engineering Examination for the Professional Engineer's License.

Given the nature of the engineering curricula, it is extremely important to follow the recommended course sequence. Violations of this guideline may result in dismissal from the engineering majors.

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 Retention List. Placement on the Retention 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.
- 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.
- Graduation requires an in-major cumulative GPA of 2.0.

Bachelor of Science in Computer Engineering

Course Name	Course Number (w/ Links)	Prerequisites	Coreqs	Course Units
Fall Freshman Year				
General Chemistry I	CHE201	complete MAT096/MAT120, OR TCNJ Basic Algebra Readiness Score ≥ 15 , OR SAT Math ≥ 630 , OR ACT > 28	none	1.0
Fundamentals of Engineering Design & Introduction to Electrical and Computer Engineering (or CSC220)	ENG144 & ELC 145	none	none	1.0
Introduction to Engineering	ENG095	none	none	0.0
Engineering Seminar I	ENG091	none	none	0.0
First-Year Writing (if not exempted)*	FYW102	none	none	(1.0)
Calculus A	MAT127	complete MAT096/MAT120, OR TCNJ Calculus Readiness Score ≥ 13 , OR SAT Math ≥ 630 , OR ACT > 28	none	1.0
General Physics I	PHY201	none	MAT125 or MAT127	1.0
Spring Freshman Year				
Computer Science I (or ENG144 & ELC 145)	CSC220	none	none	1.0
Engineering Seminar II	ENG092	none	none	0.0
Calculus B	MAT128	MAT127	none	1.0
General Physics II	PHY202	PHY201 AND MAT 127	MAT128 (suggest)	1.0
First Year Seminar*	FYS16X	none	none	1.0

Electrical and Computer Engineering-4
Undergraduate Bulletin 2022-2023

Creative Design	TST161	none	none	1.0
Fall Sophomore Year				
Modern Physics	PHY321	MAT127 AND PHY202	one	1.0
Computer Science II	CSC230	CSC220 (\geq C)	none	1.0
Circuits Analysis	ENG212	PHY202 (\geq C)	ENG272	1.0
Circuits Analysis Laboratory	ENG214	none	ENG212	0.5
Adv. Engineering Mathematics I	ENG272	MAT128	none	1.0
Digital Circuits and Microprocessors	ENG312	none	CSC220	1.0
Spring Sophomore Year				
Discrete Structures	CSC270	CSC220 (\geq C) OR CSC230 (\geq C) AND MAT127 (\geq C)	none	1.0
Electronics	ELC251	ENG212 AND ENG272	none	1.0
Systems and Signals	ELC321	ENG272	ENG212	1.0
Electronics Lab	ELC333	none	ELC251	0.5
Multivariable Calculus	MAT229	MAT128	none	1.0
Principles of Microeconomics	ECO101	MAT095 OR MAT096	none	1.0
Fall Junior Year				
Software Engineering	CSC415	CSC220 (\geq C)	none	1.0
Microcomputer Systems (Lab)	ELC343	none	ELC411	0.5
Engineering Seminar III	ENG093	none	none	0.0
Computer Architecture and Org.	ELC451	ENG312		1.0
Computer Engineering Laboratory I	ELC363	none	ELC451	0.5
Embedded Systems	ELC411	ELC251 AND ELC312	none	1.0
Technical Elective: ECE Discipline or Engineering*		At least ELC251 AND ELC321	At least ELC451	1.0
Spring Junior Year				
Engineering Seminar IV	ENG094	none	none	0.0
Mathematics Elective*		varies	varies	1.0
Control Systems	ENG352	ENG212 AND ENG272	none	1.0
Control Systems Laboratory	ENG354	none	ENG352	0.5
Engineering Economy	ENG372	MAT128 AND ECO101	none	1.0
Technical Elective: ECE Discipline or Engineering*		At least ELC251 AND ELC321	At least ELC451	1.0
Systems Engineering	ENG348	ENG212 AND ENG222 (Jr/Sr)	none	0.5
Fall Senior Year				
Digital Signal Processing	ELC423	ENG312 AND ELC321	none	1.0
Signal Processing Lab	ELC433	none	ELC423	0.5
Society, Ethics and Technology	IDS252	none	none	1.0
Senior Project I	ELC495	ENG348, ELC411, AND ENG352	none	0.5
Senior Professional Seminar	ENG099	none	none	0.0

Electrical and Computer Engineering-5**Undergraduate Bulletin 2022-2023**

Technical Elective: ECE Discipline or Engineering*		At least ELC251 AND ELC321	At least ELC451	1.0
Liberal Learning Elective*		none	none	1.0
Spring Senior Year				
Operating Systems	CSC345	MAT127, CSC230, ELC451, AND CSC270 (>=C)	none	1.0
Computer Engineering Laboratory II	ELC463	ELC363	none	0.5
Senior Project II	ELC496	ELC495	none	0.5
Technical Elective: ECE Discipline or Engineering*		At least ELC251 AND ELC321	At least ELC451	1.0
Liberal Learning Elective*		none	none	1.0
FE Review	ENG098	none	none	0.0
Total**				39.0

* By Advisement

**39 course units are required for the degree. Transfer courses that are accepted as equivalent to TCNJ courses may yield a fractional course unit, even though the course content is satisfied. In this case, students need to complete additional coursework to meet the 39 course unit requirement.

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:

Computer Engineering Discipline-Specific Elective Listing

At Least Two of The Following: Between 2 and 4

- o ELC383: Electronics II
- 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 ELC477: Power Systems and Renewability
- o ELC480: Digital Video Processing and Compression
- o ELC435: Artificial Neural Networks
- o ELC470: Special Topics (by advisement only)

Engineering Elective Listing

At Most Two Of The Following:

- o ENG470: Sustainability Europe
- o ENG222: Statics
- o ENG262: Dynamics
- o ENG322: Thermodynamics
- o CSC315: Database Systems
- o CSC335: Analysis of Algorithms
- o CSC350: Computer Graphics
- o CSC360: Computer Networking
- o CSC380: Artificial Intelligence
- o CSC425: Compilers & Interpreters

Electrical and Computer Engineering-6

- CSC435: Programming Languages
- CSC470: Topics in Computer Science
- MEC381: Introduction to Mechatronics
- ELC391: Independent Study (not 492)

Mathematics Elective

- ENG342: Advanced Engineering Mathematics II
- STA215: Statistical Inference and Probability

Minor in Computer Engineering

CSC	250/Computer Science I, II or the equivalent	1 course unit
ENG	212/Circuit Analysis	1 course unit
ENG	312/Digital Circuits and Microprocessors	1 course unit
ELC	343/Microcomputer Systems	.5 course unit
ELC	363/Computer Engineering Lab I	.5 course unit
ELC	451/Computer Architecture and Organization	1 course unit

Total course units**5* course units**

* Only one course unit taken as part of the student's major may also be counted toward the student's minor.

Bachelor of Science in Electrical Engineering

Course Name	Course Number (w/ Links)	Prerequisites	Coreqs	Course Units
Fall Freshman Year				
General Chemistry I	CHE201	complete MAT096/MAT120, OR TCNJ Basic Algebra Readiness Score ≥ 15 , OR SAT Math ≥ 630 , or ACT > 28	none	1.0
Fundamentals of Engineering Design & Introduction to Electrical and Computer Engineering (or CS220)	ENG144 & ELC 145	none	none	1.0
Introduction to Engineering	ENG095	none	none	0.0
Engineering Seminar I	ENG091	none	none	0.0
First-Year Writing (if not exempt)*	FYW102	none	none	(1.0)
Calculus A	MAT127	complete MAT096/MAT120, OR TCNJ Calculus Readiness Score ≥ 13 , OR SAT Math ≥ 630 , OR ACT > 28	none	1.0
General Physics I	PHY201	none	MAT125 or MAT127	1.0

Electrical and Computer Engineering-7
Undergraduate Bulletin 2022-2023

Spring Freshman Year				
Computer Science I (or ENG144 & ELC 145)	CSC220	none	none	1.0
Engineering Seminar II	ENG092	none	none	0.0
Calculus B	MAT128	MAT127	none	1.0
General Physics II	PHY202	PHY201 AND MAT 127	MAT128 (suggest)	1.0
Creative Design	TST161	none	none	1.0
First Year Seminar*	FYS16X	none	none	1.0
Fall Sophomore Year				
Modern Physics	PHY321	MAT127 AND PHY202	one	1.0
Principles of Microeconomics	ECO101	MAT095 OR MAT096	none	1.0
Circuits Analysis	ENG212	PHY202 (\geq C)	ENG272	1.0
Circuits Analysis Laboratory	ENG214	none	ENG212	0.5
Adv. Engineering Mathematics I	ENG272	MAT128	none	1.0
Digital Circuits and Microprocessors	ENG312	none	CSC220	1.0
Spring Sophomore Year				
Discrete Structures	CSC270	CSC220 (\geq C) OR CSC230 (\geq C) AND MAT127 (\geq C)	none	1.0
Electronics	ELC251	ENG212 AND ENG272	none	1.0
Systems and Signals	ELC321	ENG272	ENG212	1.0
Electronics Lab	ELC333	none	ELC251	0.5
Multivariable Calculus	MAT229	MAT128	none	1.0
Society, Ethics and Technology	IDS252	none	none	1.0
Fall Junior Year				
Communication Systems	ELC341	ELC251 AND ELC321	none	1.0
Microcomputer Systems (Lab)	ELC343	none	ELC411	0.5
Engineering Seminar III	ENG093	none	none	0.0
Embedded Systems	ELC411	ELC251 AND ELC312	none	1.0
Computer Architecture and Org.	ELC451	ENG312		1.0
Computer Engineering Laboratory I	ELC363	none	ELC451	0.5
Technical Elective: ECE Discipline or Engineering*		At least ELC251 AND ELC321	At least ELC451	1.0
Spring Junior Year				
Engineering Electromagnetics	ELC361	MAT229, ENG212, AND ENG272	none	1.0
Wireless and Communications Lab	ELC373	ELC341	ELC361	0.5
Engineering Seminar IV	ENG094	none	none	0.0
Control Systems	ENG352	ENG212 AND ENG272	none	1.0
Control Systems Laboratory	ENG354	none	ENG352	0.5
Systems Engineering	ENG348	ENG212 OR ENG222 (Jr/Sr)	none	0.5

Electrical and Computer Engineering-8		Undergraduate Bulletin 2022-2023		
Technical Elective: ECE Discipline or Engineering*		At least ELC251 AND ELC321	At least ELC451	1.0
Fall Senior Year				
Digital Signal Processing	ELC423	ENG312 AND ELC321	none	1.0
Signal Processing Lab	ELC433	none	ELC423	0.5
Engineering Economy	ENG372	MAT128 AND ECO101	none	1.0
Senior Project I	ELC495	ENG348, ELC411, AND ENG352	none	0.5
Senior Professional Seminar	ENG099	none	none	0.0
Technical Elective: ECE Discipline or Engineering*		At least ELC251 AND ELC321	At least ELC451	1.0
Liberal Learning Elective*		varies	varies	1.0
Spring Senior Year				
Mathematics Elective*		varies	varies	1.0
Electronics II	ELC383	ELC251	none	1.0
Senior Project II	ELC496	ELC495	none	0.5
Technical Elective: ECE Discipline or Engineering*		At least ELC251 AND ELC321	At least ELC451	1.0
Liberal Learning Elective*		varies	varies	1.0
FE Review	ENG098	none	none	0.0
			Total**	39.0

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- ELC453: Digital Control Systems
- ELC471: VLSI Design
- ELC475: Advanced Digital Signal Processing
- ELC477: Power Systems and Renewability
- ELC480: Digital Video Processing and Compression
- ELC435: Artificial Neural Networks
- ELC470: Special Topics (by advisement only)

Engineering Elective Listing

At Most Two of The Following:

- ENG470: Sustainability Europe
- ENG222: Statics
- ENG262: Dynamics

Electrical and Computer Engineering-9

- ENG322: Thermodynamics
- MEC381: Introduction to Mechatronics
- ELC391: Independent Study (not 492)

Mathematics Elective

- ENG342: Advanced Engineering Mathematics II
- STA215: Statistical Inference and Probability

Minor in Electrical Engineering

ENG 212/Circuit Analysis	1 course unit
ELC 251/Electronics	1 course unit
ENG 312/Digital Circuits and Microprocessors	1 course unit
ELC 321/Systems and Signals	1 course unit
Electrical Engineering Elective*	1 course unit

Total course units

5 course units**

* *Electrical engineering elective must be chosen from the following: ELC 341, ENG 352, ELC 383, ELC 423, ELC 441.*

** *Only one course unit taken as part of the student's major may also be counted toward the student's minor.*