

Electrical Engineering Curriculum

Bachelor of Science in Electrical Engineering (2021 Update)

Learn More About ECE: <https://bit.ly/ECEatTCNJvideo>

** Note: That students who have already taken CSC215 as opposed to CSC220 will take CSC250 instead of CSC230 as a follow-up. Those students will also use CSC215 and CSC250 as substitute prerequisites whenever CSC220 or CSC230 are listed below. Consult your advisor if you have questions.

Course Name	Course Number (w/ Links)	Prerequisites	Coreqs	Course Units
Fall Freshman Year				
General Chemistry I	CHE201	MAT096, MAT120, SAT Math \geq 630, or ACT $>$ 28	none	1.0
Fundamentals of Engineering Design (or CS220)	ENG142	none	none	1.0
Introduction to Engineering	ENG095	none	none	0.0
Engineering Seminar I	ENG091	none	none	0.0
First-Year Writing	FYW102	none	none	1.0
Calculus A	MAT127	MAT096, MAT120, SAT Math \geq 630, or ACT $>$ 28	none	1.0
General Physics I	PHY201	none	MAT125 or MAT127	1.0
Spring Freshman Year				
Computer Science I (or ENG142)	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 (>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 (>C) or CSC230 (>C), MAT127 (>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
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	1.0

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:

ECE Discipline Elective Listing (between 2 and 4)

- ELC431: RF/Microwave Engineering
- ELC441: Digital Engineering Systems
- 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 (2 maximum)

- ENG470: Sustainability Europe
- ENG152: Engineering Materials Science
- ENG222: Statics
- ENG262: Dynamics
- ENG322: Thermodynamics
- MEC381: Introduction to Mechatronics
- ELC391: Independent Study (not 492)

Notes on Mathematics Elective – Students must take one of the following, separate from the technical elective requirement:

- ENG342: Advanced Engineering Mathematics II
- STA216: Statistical Inference and Probability

Notes on Liberal Learning Electives – Students must take liberal learning electives to address both requirements below.

- *Requirement #1: Civic Responsibilities* (<http://bit.ly/2hJfWpr>) - There are three civic responsibilities (Race, Gender, Global), aside from Community Engagement that students fulfill through their FSP. ECE students must take at least one liberal learning course relevant to each responsibility, in addition to fulfilling the domain-related requirement below.
- *Requirement #2: Broad Areas of Human Inquiry* (<http://bit.ly/2gegblR>) - There are three broad areas of human inquiry (Arts and Humanities, Social Sciences and History, and Natural Sciences and Quantitative Reasoning). These areas of inquiry are then subdivided into two domains each, as illustrated in the table below. After consideration of courses like TST161 required by both ECE curricula, our students must take two courses to fulfill requirement #2:
 - At least one course must come from the Social Change in Historical Perspectives domain.
 - The other course may come from any domain outside of Natural Science and Quantitative Reasoning.

Broad Areas of Inquiry	Domains	What relevant courses do ALL ECEs take?	How many are left for ECEs to take?
Arts and Humanities	Literary, Visual, and Performing Arts	TST161	at most one
	World Views and Ways of Knowing	IDS252	at most one
Social Sciences and History	Behavioral, Social, or Cultural Perspectives	ECO101	at most one
	Social Change in Historical Perspective	n/a	at least one, at most two
Natural Science and Quantitative Reasoning	Natural Science	CHE201	none
	Quantitative Reasoning	MAT127	none
	Extra Course	PHY201	none

Students may complete their liberal learning requirement (theoretically) in two courses, assuming they choose courses correctly. This is because one course can address up to two Civic Responsibilities, but only one Area of Human Inquiry. For example, a student could take:

- Course A from the domain Social Change in Historical Perspective that addresses both Race and Gender responsibilities.

- Course B from the domain World and Ways of Knowing that addresses the Global responsibility.

Additional information is available through the websites below.

- <https://liberallearning.tcnj.edu/choosing-liberal-learning-courses/>
- <https://engineering.tcnj.edu/resources/liberal-learning/>

Note on Advanced Placement (AP) – Students may be awarded for a number of courses including Calculus, Physics, Chemistry, etc. For further details on AP placement click this link (<https://bit.ly/2t7ixPF>).

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 retention list or academic probation.

Note on 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.
- Students on academic probation are limited to 3.0 course units per semester.
- 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-), MAT 128 (C-). Internal transfer within engineering programs will be considered if enrollment limits are not exceeded.
- Graduation requires an in-major cumulative GPA of 2.0

Term Limits:

- ECE Freshmen/Sophomores with Cum GPA < 2.75 = 4.5 course units
- All Other ECE Students = 5.5 course units
- Those on Retention List / Academic Probation = 3.0 course units

Computer Requirements – Students should have full-time access to a computer that meets or exceeds the following specifications:

- Form – Laptop computers are recommended, although desktops are acceptable.
- Release Year – All components within the system, including the processor, should have been released within the last two years, preceding the purchase. For example, a computer purchased for use in fall 2020 cannot employ an Intel Coffee Lake Processor released in April 2018. Any new machine purchased from a major retailer should meet this requirement.
- Operating System – Windows 10 64-bit Home or Pro, not operating in the limited capability S-mode.
 - Students are strongly discouraged from buying a non-Windows device. They are responsible for handling ALL compatibility problems associated with the use of AppleOS or LinuxOS computers. Students should NOT rely on machines like tablets, iPads, or Chromebooks as their main computing device.
- Screen Size – Greater than 13.3 inches.
- Video Card – NVIDIA GeForce GTX 1600 or better.
 - Alternative brands with similar performance may be acceptable.
- Processor – Intel Core i7 or higher. AMD Ryzen 7 or higher.
- RAM – 16GB or more. 32GB recommended.
- Hard Drive – 512GB or higher. 1TB+ recommended.