



New Jersey Institute of Technology

**Helen & John C. Hartmann Department
of Electrical and Computer Engineering**

HANDBOOK FOR UNDERGRADUATE STUDENTS

November 2023

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I. INTRODUCTION

We are pleased to present the updated ECE Handbook for Undergraduate Students. This document is meant as a guide to the BS-CoE and BS-EE programs and to provide details of their curricula published in the official university catalog. It also summarizes the department's procedures. Please note that the policies are defined by the university's Undergraduate Catalog for CoE major, EE major, CoE minor, and EE minor. We hope that the Handbook helps you navigate the curriculum and answers most related questions but if further clarification is needed, do not hesitate to talk to your advisor.

The Department of Electrical and Computer Engineering offers bachelor degrees in electrical engineering and computer engineering.

II. ADMINISTRATION

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Career Development Services, Fenster Hall, (973) 596-3100

Student Financial Aid Services, Student Services Mall, (973) 596-3479, finaid@njit.edu

Office of the Dean of Students, 255 Campus Center, (973) 596-3466, dos@njit.edu

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ECE Study Lounge

Located on the first floor of Faculty Hall, Room 104, the ECE Study Lounge offers a quiet environment for students to study, read a book or magazine, or just spend their time along with their fellow ECE students.

IV. ADVISEMENT AND REGISTRATION PROCEDURES

The Student Advisor and the Associate Chair for Undergraduate Studies are the advisors to all undergraduate students. Freshmen, Sophomores, and upperclass students with more than three semesters to graduation are advised by the student adviser, Ms. Ryoko Mathes. The Associate Chair for Undergraduate Studies advises Juniors and Seniors on their tracks and elective courses, approves ECE transfer credits from other institutions and is responsible for certifying EE and CoE students for graduation. For the purpose of ECE advising, Sophomores are students who take 200 level ECE courses; Juniors take 300 level ECE courses and Seniors 400 level courses, regardless of the total number of acquired credits.

Registration begins late in the Fall semester for the next Spring semester and in the Spring for the next Summer and Fall. Students who have a registration hold need to have it removed before registering online. To have the hold removed; Freshmen, Sophomores, and upper class students with more than three semesters remaining until degree completion should make appointments with the ECE Student Advisor Ms. Ryoko Mathes by link: <https://mathesnajtece.youcanbook.me/> Juniors and Seniors who have two or fewer semesters to graduation should make appointments with the Associate Chair by sending her an email to xuan.liu@njit.edu with a completely filled out ECE Student Study Plan and a course checklist for EE or CoE majors. The ECE Student Study Plan form is included at the end of this Handbook. For appointments, you should contact Dr. Liu by e-mail.

Juniors and Seniors who have a high GPA and are on track to graduation may have their holds removed before registration starts without seeing the adviser. If this is your case and you know which courses to take, go ahead and register but you can always contact or meet the adviser if you have questions.

Be prepared for an advising appointment. A useful tool in planning your course schedule is the Academic Checklist of your program. It lists all required courses (from ECE and other departments), semester by semester, and lets you see at a glance which courses you still need to take to graduate. You can find the checklists at the end of this handbook and on the ECE department website. Keep the checklist updated and verify your record with your NJIT transcript on Highlander Pipeline. Make sure that you have taken the prerequisites for the courses you will register for. See the prerequisite listing in Appendix A of this Handbook.

***DegreeWorks* is also useful but it is only advisory, not an official record. It may not account properly, especially technical elective courses.**

Include your student ID in all correspondence with the department.

After your hold is removed or necessary permits obtained, register for courses online through the NJIT self-registration system.

Course Load and Your GPA

Your grade point average (GPA) is an important indicator of your overall academic performance, and it will be considered by your prospective employer or a graduate program admission officer. While students are understandably concerned with the time it takes to graduate, they often make a mistake by overloading their schedule and registering for more courses than they can successfully complete. This trading quality for quantity often does not pay. A GPA lower than 2.0, even for courses taken in one semester, automatically changes student academic status from Good Standing to Warning. If the academic performance does not improve, Probation and Suspension follow. **A student can only be in any of these states for one time during studies at NJIT.** One cannot even graduate with a GPA below 2.0, and if you want to be a successful professional, your score should not be anywhere near that number. Admission to graduate school requires a GPA of at least 3.0.

The following guide shows the relationship between your cumulative GPA and the maximum number of credits that we recommend you should register for in a given semester.

GPA	Number of Credits
2.0*	12**
2.5	15
3.0	19***

- * A lower GPA leads to a warning, followed by a probation, and academic suspension
- ** Minimum credits for full time status
- *** Maximum number of credits allowed per semester

Prerequisites

Prerequisites of a course are other courses that must be completed before registering for the course. For example, Physics 2 (Phys 122) and Calculus 2 (Math 112) are the prerequisites for all ECE courses (except ECE 101), and must be completed before registration for any ECE course. Prerequisite requirements are strictly enforced. See the list of the prerequisites of ECE courses in Appendix A of this handbook. Students who are enrolled in prerequisite courses in a given semester are allowed to register for the follow-up courses in the following semester, assuming that they pass the prerequisite courses. Students must withdraw from a course if they fail even one of its prerequisites. **Note that an Incomplete in a prerequisite course means that the prerequisite condition was not satisfied.** The registrar checks course rosters at the start of every semester and removes from them the students without prerequisites. Permits for registering without prerequisites are given only in special cases for reasons such as a delay in posting the grade of a completed prerequisite or delay in obtaining a transcript from another college. The permits also require the course instructor approval.

Repeating a Course

A course for which a student received an F grade must be repeated. Be diligent and work hard to pass the course on the second try if this happens to you. A new grade will substitute the F, which will not be counted in the calculation of your GPA - but only once. The university policy states that a student can enroll in any course no more than four times, **counting withdrawals**. Attempting four times and not passing a course required in the program results in removing the student from the degree program. If you cannot cope with the course material, it is better to withdraw than to fail but do not take withdrawing decision lightly.

Closed Courses

It is best to register early as some courses are in demand and fill up quickly. If the courses you want to take are closed, put your name on the waiting list through the Highlander Pipeline. Presence of students on the waiting list may lead to increasing the registration limit and reopening the course. Note however that this may not be possible with laboratories where the number of available places is limited by the equipment availability.

Not all courses may be offered every semester; some may only be offered in the fall semester, others in the spring. This applies especially to upper level courses. Consider this in planning your schedule, especially in the senior year.

Concentration Tracks and Technical Electives

Senior students are allowed to choose different concentration areas (tracks) in electrical engineering and in computer engineering. Tracks consist of the track specific lecture courses and track laboratories. There is some flexibility in choosing track courses including mixing courses from different tracks. Besides track courses, senior students take technical elective courses, which must be 300 or 400 level ECE courses or advisor approved upper level engineering, science or mathematics courses. It is your responsibility to make certain that the elective courses you are taking meet the elective requirements. More information on tracks and technical electives is included in the next chapter.

Senior Design Project

All ECE students must take ECE 414 the semester before registering for Senior Project ECE 416 or ECE 417. Students who are registering for ECE 417 must have the approval of their project advisor. ECE 414 and ECE 416/417 should be taken in the last two semesters of your studies. See more information on Senior Design Projects included in Section IV and V of this Handbook.

Graduate Courses

As undergraduates, you can take graduate courses only with the approval of the ECE Associate Chair for Undergraduate Studies and the graduate adviser. Students who want a graduate course

count for the BS degree must first be admitted to the BS/MS program, which requires a minimum GPA of 3.0. See also information on the BS/MS program in this handbook.

Transfer Credits

Transfer credits for courses completed at other schools that are equivalent to those offered by NJIT are awarded at the time of admission. A minimum grade of C must be earned in the course in order to receive the transfer credits. All transfer credits must be documented by an official transcript issued by the school where the course was completed. Courses completed at New Jersey community colleges are routinely transferred by the admission office but the ultimate decision on accepting the transfer belongs to the department that offers the equivalent course at NJIT. This is especially relevant to transfers from schools other than community colleges in the state, out of state universities, and schools outside the US. Students who have attended foreign institutions of higher education must also submit an evaluation of their work made by World Educational Services Inc. or another approved service. Further information regarding evaluations may be obtained from the Registrar's office.

Students who want to have a course evaluated by the ECE department should present: (1) the course syllabus, or at least a detailed course description, and (2) a copy of the transcript with the grade and the academic semester when the course was completed. Since Physics 2 (Phys 122) and Calculus 2 (Math 112) are the prerequisites for all ECE courses, these prerequisites must be transferred before requesting transfer of ECE courses.

Once a student is admitted, he or she is expected to complete the remaining courses required for graduation at NJIT. Permission for taking courses at other institutions is granted only in special cases and must be approved prior to enrolling in them. Taking a course elsewhere without prior approval may result in not being able to have it transferred.

To be eligible for graduation, students transferring to NJIT must complete in residence at NJIT at least 33 credits in upper division courses approved by the department of their major study. The grades of other schools for transfer courses are not included in the calculation of the NJIT GPA.

V. UNDERGRADUATE PROGRAMS IN THE ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT

Undergraduate Program Educational Objectives

1. Graduates will succeed in electric or computer engineering or other diverse fields that require analytical and/or professional skills.
2. Graduates will pursue professional development, including continuing or advanced education, relevant to their career plans.
3. Graduates will contribute to their fields or professionals and society.

Bachelor of Science Degrees offered in the Electrical and Computer Engineering Department

The curriculum at NJIT provides a broad education in mathematics, the natural sciences, humanities and social sciences. Upon this foundation is built a depth of understanding in engineering fields. The program seeks to produce engineers who can think analytically and creatively, work effectively, and communicate clearly with others.

The Electrical and Computer Engineering Department offers two majors: Bachelor of Science in Electrical Engineering (BSEE) and Bachelor of Science in Computer Engineering (BSCoE).

What is Electrical Engineering?

Electrical Engineering is a diversified and challenging profession concerned with the design, development, fabrication and control of the electrical devices upon which our technological society so largely depends. Electrical engineers utilize their knowledge of devices and systems design in a multitude of areas. These include: integrated circuits, computers, environmental and biomedical instrumentation, energy conversion, power generation and distribution, control systems, microprocessors, and communication devices and systems.

Electrical Engineering graduates with a BSEE have a range of career possibilities. They may enter into industry, professional practice or may pursue advanced studies in electrical engineering or related fields. Electrical Engineering is also a useful basis for further study in a different field such as law, medicine or business.

What is Computer Engineering?

Computer Engineering professionals develop, design, and test computer systems. They understand both computer hardware and software and possess enough engineering breadth to skillfully apply the basic modeling techniques representing the computing process to analyze application tradeoffs, and design computers for a variety of applications. Economics and inherent flexibility have led to the widespread use of computer engineering in all areas of technology, science, business, and medicine. The career potential for graduates with this knowledge has been strong for many years.

Comparison of the BSEE and BSCoE Programs

The curricula leading to the two degrees are almost the same in the Freshman and Sophomore years (with the exception of one course in the sophomore year). The two programs diversify in the Junior year. Further diversification occurs in the curricula of each major as students choose different concentration areas (tracks) in electrical engineering and in computer engineering.

Laboratory Facilities

Laboratory experience is a very important part of a student's education. The ECE department at NJIT emphasizes hands-on and design experience as well as communication skills in its undergraduate curriculum. The EE undergraduate laboratory experience is concentrated in four laboratory core courses: ECE 291, ECE 392, ECE 395, ECE 342, ECE 375, and a Technical Track Laboratory.

The CoE undergraduate laboratory experience is concentrated in four laboratory core courses: ECE 291, ECE 394, ECE 395, ECE 495 and a Technical Track Laboratory.

The laboratory experience for students in both programs starts in the freshman courses FED 101. While the university provides electronic instruments and their accessories (cables, probes, etc.), **students are required to obtain their own electronic parts kits**. The basic kit required in FED 101 can be supplemented by components needed in more advanced laboratories. While the IEEE Student Chapter runs a shop providing a convenient source of parts and whole kits, it may not always have a full stock. **Students can obtain supplies from any vendor and it is their responsibility to have parts for the lab course they registered for.** See <http://ecelabs.njit.edu/> for the manuals of all ECE laboratories and other useful laboratory information.

Senior Design Project

During the senior year, all students are called upon to integrate and direct their knowledge and experience toward a senior project. Successful completion of the project can be challenging but also a very satisfying and exciting experience. It can be also a great item on the resume. Companies have hired our graduates based on their Senior Design Project work.

The project work is structured as a two-semester course, which should be taken in the last two semesters of study for the degree to capitalize on the knowledge and experience gained in all prior courses. Students are expected to form project teams of two or three members. The teams often include CoE and EE students, and sometimes students from other departments, especially in interdisciplinary projects. The teams are given the

opportunity to select a topic and develop a project plan. They submit a formal project proposal for approval in the first semester of the project work (ECE 414). They complete the work on the project in the following semester under supervision of an instructor in a class with other teams (ECE 416), or under supervision of an individual adviser (ECE 417). The project must be completed and presented for review, and a final written report must be submitted and approved. More information on the Senior Design Project can be found on the ECE Department website. http://ece.njit.edu/students/Senior_Project_Documentation.php

Beyond the BS degree

For students who wish to continue their studies in electrical engineering or in computer engineering beyond the BS degree, the Department of Electrical and Computer Engineering offers a variety of areas of specialization at the MS and Ph.D. levels. Many graduate courses are offered in the evening to meet the needs of part-time students. See also description of BS-MS program in Section VII of this Handbook.

VI. COMPUTER ENGINEERING AND ELECTRICAL ENGINEERING CURRICULA

CoE PROGRAM FOUR YEAR PLAN OF STUDY

FIRST YEAR

First Semester

Course ID	Title	Credits
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Laboratory	1
FYS SEM	First Year Seminar	0
	Term Credits	16

Second Semester

Course ID	Title	Credits
CS 115	Intro. to CS I in C++	3
MATH 112	Calculus II	4
Phys 122	Electricity and Magnetism for ECE Applications	3
PHYS 121A	Physics II Laboratory	1
ECE 101	Introduction to Electrical and Computer Engineering	0
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	14

SECOND YEAR

First Semester

Course ID	Title	Credits
CS 116	Intro. to Computer Science II/C++	3
ECE 231	Circuits and Systems I	3
ECE 251	Digital Design	3
MATH 222	Differential Equations	4
GER 200 ^{1,2}	A 200-level course with the prefix COM, ENG, HIST, HUM, LIT, PHIL, STS, or THTR	3
	Term Credits	16

Second Semester

Course ID	Title	Credits
ECE 232	Circuits and Systems II	3
ECE 252	Microprocessors	3
ECE 271	Electronic Circuits I	3
ECE 294	Electrical Engineering Laboratory I	2
Math 213	Calculus III B	4
	Term Credits	15

THIRD YEAR

First Semester

Course ID	Title	Credits
CS 280	Programming Language Concepts	3
ECE 368	Signal Transmission	3
ECE 395	Microprocessor Laboratory	2
MATH 326	Discrete Analysis for Computer Engineers	3
MATH 333	Probability and Statistics	3
	Term Credits	14

Second Semester

Course ID	Title	Credits
CS 332	Principles of Operating Systems	3
MATH 340 or MATH 337	Applied Numerical Methods or Linear Algebra	3
ECE 353	Computer Organization and Architecture	3
PHIL 334	Engineering Ethics and Technological Practice 2	3
Economics or Management	Select from Econ 201, Econ 265, Econ 266, MGMT 390, and IE 492	3
	Term Credits	15

FOURTH YEAR

First Semester

Course ID	Title	Credits
ECE 414	Electrical and Computer Engineering Project I	1
ECE 495	Computer Engineering Design Lab	3
CoE Track Elective I		3
CoE Track Elective II		3
ECE Technical Elective		3
GER 300 level ²	300-level course with the prefix COM, ENG, HIST, HUM,LIT,PHIL, STS, or THTR	3
Term Credits		16

Second Semester

Course ID	Title	Credits
ECE 416 or ECE 417	Electrical and Computer Engineering Project II or Independent Study Project II	3
COE Track Elective III		3
COE Track Laboratory		2
ECE Technical Elective		3
GER Senior Seminar 400 level course in Humanities, History or Social Sciences		3
Term Credits		14

Total Degree Credits

120

¹	Fulfills prerequisite requirements for 300 level GER
²	Students may also take approved courses at Rutgers-Newark to fulfill this requirement. FED 101 can be substituted with transfer credits or a lower level course at NJIT that are offered by other engineering departments or computer science department. ECE 101 is waived for transfer students and students who changed their major from non-ECE majors.

Note: The sequence of track courses and track laboratories depends on prerequisites and may be different from the one shown above for different tracks.

COMPUTER ENGINEERING TRACKS

Computer Engineering Tracks. In the senior year, students emphasize an area of interest by selecting a track consisting of three lecture courses and a laboratory. Tracks are advisory tools designed to assist students in selecting courses in the area of their interest and career choice. In addition to track courses, COE students take two technical electives courses, which may cover a wide range of topics, and can include courses outside the ECE department. *See a separate section describing technical electives below.*

Note that you are getting a degree in Computer Engineering, not in a track, which is not listed on the diploma. Completing all four track courses is not mandatory but a required track lab, has a prerequisite. *Other lecture track courses may be substituted by a lecture course from the other track (effectively mixing the tracks) or by a technical elective with permission for the total of 17 credits for the track and technical electives.*

Guidelines for the selection of track courses are listed below.

1. A total of 17 credits are required for track and technical elective courses.
2. If a student does not complete the track by taking all the track courses (four courses for CoE and three courses for EE), the student can substitute the missing track course with a track course from a different track, or another ECE course, on 300 or 400 level. Students in the BS/MS program can substitute it with a graduate level ECE course.
3. In general, **a track course substitute has to be an ECE course.** If there is a need to use a course from a different department as a track course, the student must submit a written justification and get approval from the advisor.

The CoE tracks are listed below in alphabetical order with their courses in the following tables:

Computer Communications: The Computer Communications track provides students with a working knowledge of digital data communications and computer network design. Particular emphasis is put on its physical and data link layers, the devices which make computer networks a reality, and methods for predicting network performance. CoE students interested in general telecommunication can select an option of taking the telecommunication (ECE 489) lab instead of the networking lab (ECE 429).

Advanced Computer Systems: The emphasis in this track is on the architectural characteristics of advanced computer systems and the techniques for their design and analysis. The topics include computer system design, design advances in computer architecture, and simulation of computer systems.

See the list of in CoE track courses in the tables below.

<u>1. Advanced Computer Systems Track</u>		
ECE 451	Advanced Computer Architecture	3
ECE 452	Advanced Computer Architecture II	3
ECE 453	Introduction to Discrete Event Systems	3

ECE 459	Advanced Computer Systems Design Lab	2
2. Computer Communications Track		
ECE 421	Digital Data Communications	3
ECE 422	Computer Communications Networks	3
ECE 425	Wireless Communication Systems	3
ECE 429	Computer Communications Lab*	2
ECE 489	Communications Systems Laboratory*	2
* Students interested in general telecommunication rather than in networking may take ECE 489 instead of ECE 429. ECE 421 is the prerequisite for ECE 489 while ECE 422 is the prerequisite for ECE 429.		

TECHNICAL ELECTIVES

The ECE technical elective must be a 300 or 400 level ECE course or advisor approved upper level engineering, science, or mathematics course. Technical electives have to be substantially different than other courses in the program; they cannot cover the same material on the same or a lower level.

Acceptable technical elective courses include (1) ECE track courses from a different track; (2) CS 301, CS331, CS 337, CS 357 (needs ECE 422 or CS 356 prerequisite), Math 331, Math 332, Math 335, Math 337 (EE program only), Math 340, Math 345, MATH 346, MATH 347, IE 335, IE 455; (3) graduate courses taken by students in the BS/MS program unless they substitute track courses, with advisor approval; (4) other 300 or 400 level ECE course or upper-level engineering, science or mathematics course, with advisor approval.

Courses that cannot be used as technical elective courses include (1) Engineering Technology program courses; (2) ENGR courses; (3) IT courses; (4) IS courses; (5) IE courses that are not listed above as acceptable; (6) ECE 368 (for EE students); (7) Math 333, Math 305, Math 309, Math 322; (8) ECE 405.

Courses that can be used as technical electives conditionally: (1) CS 356 for students who do not have ECE 422, as they are equivalent; (2) IE 492 for students who have ECON or MGMT courses **and need a TE course to graduate.**

NOTE: Degree Works may not account properly for technical electives but it will not affect your path to graduation.

EE PROGRAM FOUR YEAR PLAN OF STUDY

FIRST YEAR

First Semester

Course ID	Title	Credits
CHEM 125	General Chemistry I	3
FED 101	Fundamentals of Engineering Design	2
ENGL 101	English Composition: Introduction to Academic Writing	3
MATH 111	Calculus I	4
PHYS 111	Physics I	3
PHYS 111A	Physics I Laboratory	1
FYS SEM	First Year Seminar	0
	Term Credits	16

Second Semester

Course ID	Title	Credits
CS 115	Intro. to CS I in C++	3
MATH 112	Calculus II	4
Phys 122	Electricity and Magnetism for ECE Applications	3
PHYS 121A	Physics II Laboratory	1
ECE 101	Introduction to Electrical and Computer Engineering	0
ENGL 102	English Composition: Writing, Speaking, Thinking II	3
	Term Credits	14

SECOND YEAR

First Semester

Course ID	Title	Credits
ECE 231	Circuits and Systems I	3
ECE 251	Digital Design	3
MATH 222	Differential Equations	4
GER 200 ^{1,2}	A 200-level course with the prefix COM, ENG, HIST, HUM, LIT, PHIL, STS, or THTR	3
PHYS 234	Physics III	3
	Term Credits	16

Second Semester

Course ID	Title	Credits
ECE 232	Circuits and Systems II	3
ECE 252	Microprocessors	3
ECE 271	Electronic Circuits I	3
ECE 294	Electrical Engineering Laboratory I	2
MATH 213	Calculus III B	4
	Term Credits	15

THIRD YEAR**First Semester**

Course ID	Title	Credits
ECE 333	Signals and Systems	3
ECE 361	Electromagnetic Fields	3
ECE 371	Electronic Circuits II	4
ECE 395	Microprocessor Laboratory	2
Economics or Management	Select from Econ 201, Econ 265, Econ 266, MGMT 390, and IE 492	3
	Term Credits	15

Second Semester

Course ID	Title	Credits
ECE 321	Random Signals and Noise	3
ECE 362	Electromagnetic Waves Propagation	3
ECE 375	Introduction to Semiconductor Devices	4
ECE 342	Energy Conversion	4
	Term Credits	14

FOURTH YEAR**First Semester**

Course ID	Title	Credits
ECE 414	Electrical and Computer Engineering Project I	1
	EE Track Elective I	3
	EE Track Elective II	3
	ECE Technical Elective	3
PHIL 334	Engineering Ethics and Technological Practice 2	3
GER 300 level ²	300-level course with the prefix COM, ENG, HIST, HUM,LIT,PHIL, STS, or THTR	3
	Term Credits	16

Second Semester

ECE 416 or ECE 417	Electrical and Computer Engineering Project II or Independent Study Project II	3
	EE Track Laboratory	2
	ECE Technical Elective	3
	ECE Technical Elective	3
	GER Senior Seminar 400 level course in Humanities, History or Social Sciences	3
	Term Credits	14

Total Degree Credits**120**

Notes:

1	Fulfills prerequisite requirements for 300 level GER
2	Students may also take approved courses at Rutgers-Newark to fulfill this requirement. FED 101 can be substituted with transfer credits or a lower level course at NJIT that are offered by other engineering departments or computer science department. ECE 101 is waived for transfer students and students who changed their major from non-ECE majors.

Note: The sequence of track courses and track laboratories depends on prerequisites and may be different from the one shown above for different tracks.

ELECTRICAL ENGINEERING TRACKS

Electrical Engineering Tracks. In the senior year, students emphasize an area of interest by selecting a track consisting of two lectures and a laboratory. Tracks are advisory tools designed to assist students in selecting courses in the area of their interest and career choice. In addition to track courses, EE students take three technical elective courses, which may cover a wide range of topics, and can include courses outside the ECE department. *See a separate section describing technical electives below.*

Note that you are getting a degree in Electrical Engineering, not in a track, which is not listed on the diploma. Completing all three track courses is not mandatory but a required track lab has a prerequisite (or a co-requisite). *A student who only takes a track lab and its prerequisite (or a co-requisite) has to take a course from another track for the total of 17 credits for the track and technical electives.*

Guidelines for the selection of track courses are listed below.

1. A total of 17 credits are required for track and technical elective courses.
2. If a student does not complete the track by taking all the track courses (four courses for CoE and three courses for EE), the student can substitute the missing track course with a track course from a different track, or another ECE course, on 300 or 400 level. Students in the BS/MS program can substitute it with a graduate level ECE course.
3. In general, a track course substitute has to be an ECE course. If there is a need to use a course from a different department as a track course, the student must submit a written justification and get approval from the advisor.

The EE tracks are listed below in alphabetical order with their courses in the following tables:

Computer Systems: Students in the EE major may elect an in-depth study of computer system organization and computer system design. Students study Central Processor Unit (CPU) design, memory organization and I/O processing. This track requires taking an additional 1 credit lab (ECE 394).

Controls: The mechanism of feedback pervades nature, science, and technology. The curriculum in Controls teaches how engineers can use the feedback mechanism to design systems for controlling a variety of dynamic processes, used in the operation of systems ranging from spacecraft, aircraft, and automobiles to heating, ventilation, and air conditioning systems.

Power Systems: The Power Systems track includes the study of the economic generation and stable transmission of electrical energy to consumers.

Telecommunication and Networking : The information revolution is built on an infrastructure of communications and computer networks. The Telecommunications and Networking track focuses on the analysis and design of wireless & wireline systems for information delivery. EE students usually take general communication courses (ECE 421, ECE 489) but they also have an option of concentrating on computer networking (ECE 422, ECE 429).

See the list of EE track courses in the tables below.

Electrical Engineering Tracks - Select one of the following:

1. Control Systems Track

Course ID	Title	Credits
ECE 431	Introduction to Feedback Control Systems *	3
ECE 432	Control Systems Elective	3
ECE 439	Control Systems Laboratory	2

2. Power Track

Course ID	Title	Credits
ECE 442	Power Systems **	3
ECE 443	Renewable Energy Systems	3
ECE 449	Power Systems Laboratory	2

3. Telecommunications & Networking Track

A – with telecommunication lab

Course ID	Title	Credits
ECE 421	Digital Communications Systems *	3
ECE 425	Wireless Communication Systems	3
ECE 489	Communications Systems Laboratory	2

B – with networking lab

Course ID	Title	Credits
ECE 421	Digital Communications Systems *	3
ECE 422	Computer Communication Networks *	3
ECE 429	Computer Communications Lab	2

Students may choose either version A or B of the track. Note that ECE 421 is a prerequisite for ECE 489 lab and ECE 422 is a prerequisite for ECE 429 lab.

4. Computer Systems Track

Course ID	Title	Credits
ECE 353	Computer Organization and Architecture	3
ECE 451	Advanced Computer Architecture	3
ECE 495	Computer Engineering Design Lab	2

<i>Note: ECE 495 lab has ECE 394 prerequisite. Selecting this track requires 1 lab additional credit.</i>		
Course ID	Title	Credits
ECE 461	Microwave and Integrated Optics	3
ECE 462	RF/Fiber Optics Systems Elective **	3
ECE 469	RF/Microwave and Fiber Optics Systems Laboratory	2

TECHNICAL ELECTIVES

The ECE technical elective must be a 300 or 400 level ECE course or advisor approved upper level engineering, science, or mathematics course. Technical electives have to be substantially different than other courses in the program; they cannot cover the same material on the same or a lower level.

Acceptable technical elective courses include (1) ECE track courses from a different track; (2) CS 301, CS331, CS 337, CS 357 (needs ECE 422 or CS 356 prerequisite), Math 331, Math 332, Math 335, Math 337 (EE program only), Math 340, Math 345, MATH 346, MATH 347, IE 335, IE 455; (3) graduate courses taken by students in the BS/MS program unless they substitute track courses, with advisor approval; (4) ENGR 301, ENGR 423, ENGR 424, ENGR 499; (5) other 300 or 400 level ECE course or upper-level engineering, science or mathematics course, with advisor approval.

Courses that can be used as technical electives conditionally: (1) CS 356 for students who do not have ECE 422, as they are equivalent; (2) IE 492 for students who have ECON or MGMT courses and need a TE course to graduate; (3) ENGR 320, ENGR 350, ENGR 430, with approval with Associate Chair for students involved in research, senior design projects or independent studies.

Courses that cannot be used as technical elective courses include (1) Engineering Technology program courses; (2) ENGR courses not listed above; (3) IT courses; (4) IS courses; (5) IE courses that are not listed above; (6) ECE 368 (for EE students); (7) Math 333, Math 305, Math 309, Math 322; (8) ECE 405.

NOTE: Degree Works may not account properly for technical electives but it will not affect your path to graduation.

CoE AND EE PROGRAMS FIVE YEAR PLAN OF STUDY WITH CO-OP

In addition to the standard 4-year BSCoE and BSEE curricula, ECE department offers 5-year programs, which include Cooperative Education as an integral part of the curriculum, integrating real world work experience and learning with the student's academic experience. It gives employers the opportunity to assist in the student's development and supplement their workforce with emerging talent, while enhancing the student's potential for employment at graduation.

A cooperative education program is offered to all ECE students with GPA ≥ 2.7 by the end of their second year of studies. It includes two assignments of 25 weeks each and must be completed using a two-cycle fixed schedule.

COE and EE 5 year Study Plan with COOP*

SEMESTER	4-YEAR PLAN	A	B
1	FRESHMAN 1	FRESHMAN 1	FRESHMAN 1
2	FRESHMAN 2	FRESHMAN 2	FRESHMAN 2
3	SOPHOMORE 1	SOPHOMORE 1	SOPHOMORE 1
4	SOPHOMORE 2	SOPHOMORE 2	SOPHOMORE 2
YEAR 2 SUMMER		COOP 1	
5	JUNIOR 1	COOP 1	JUNIOR 1
6	JUNIOR 2	JUNIOR 1	COOP 1
YEAR 3 SUMMER		COOP 2	COOP 1
7	SENIOR 1	COOP 2	JUNIOR 2
8	SENIOR 2	JUNIOR 2	COOP 2
YEAR 4 SUMMER			COOP 2
9		SENIOR 1	SENIOR 1
10		SENIOR 2	SENIOR 2

* ENGR 210 (1 credit) required before starting COOP

An ECE student desiring to participate in the program should choose a co-op cycle and meet with the ECE Undergraduate Student Advisor Mrs. Ryoko Mathes at mathes@njit.edu regarding the co-op schedule, program requirements and a choice of the qualified employer. The list of qualified employers and other important information can be obtained from the NJIT Career Development Services (CDS). After acceptance as a cooperative program employee by a university-approved employer, a student takes ENGR 210 - Career Planning Seminar for Engineers (1 credit) and formally enters the program. The student then registers in ENGR 310 (COOP 1 or ENGR 410 (COOP 2). Each course is 12 credits not counted towards degree but provides full time student status. After finishing the program, a student receives the regular engineering degree (BS EE/CoE)

and a certificate indicating completion of the cooperative education program with industry.

VII. SPECIAL PROGRAMS

BS/MS

The BS/MS Program permits qualified NJIT undergraduate students (3.0 minimum GPA) to earn credits toward a graduate degree. Students with a GPA of at least 3.0 can take nine (9) credits of graduate course work that may be counted towards both the bachelor and master's degree at NJIT. The graduate courses can count as technical electives and, in some cases, they can replace the required courses in the program curriculum. See the academic adviser for details.

BS/MS students are encouraged to pursue graduate study immediately following the completion of the bachelor's degree. However, courses can be applied to the graduate degree up to two (2) years after completing the bachelor's degree.

To take a graduate course, you must first apply to the BS/MS program:

<https://connect.njit.edu/register/dualadmissionapp>

Upon admission, fill out the registration form and send it to the adviser for approval:

[UNDERGRADUATE STUDENTS TAKING GRADUATE COURSES AS PART OF THE JOINT DEGREE PROGRAM](#)

There is also the BS/PhD program which accelerates a path to the higher degree. It allows for up to four (4) graduate courses to count for the BS degree.

For further information, please see: [New Process - Office of the Registrar | Office of The Registrar \(njit.edu\)](#)

Minors in the ECE Department

In addition to major BS degrees, students in the ECE department or other departments can obtain a minor BS degree by passing the following courses:

EE Minor for CoE (17 credits): ECE 333, ECE 342, ECE 361, ECE 371, ECE 375

EE Minor for other (16-18 credits): ECE 231, ECE 232, ECE 271, ECE 294, two from ECE 333, ECE 342, ECE 361, ECE 371, ECE 375

CoE Minor for EE (13 credits): CS 116, CS 332, ECE 353, ECE 495

CoE Minor for other (17 credits): ECE 231, ECE 251, or CS 251, ECE 252, ECE 294, ECE 353, ECE 495.

VIII. PROFESSIONAL AND HONOR SOCIETIES

There are very active student technical/honor societies in the department: the Institute of Electrical and Electronics Engineers (IEEE) Student Chapter-North Jersey Section; Eta Kappa Nu-Gamma Chapter, the electrical engineering honor society; and Tau Beta Pi, an engineering honor society.

IEEE (Faculty Advisor: Mr. Mohammed Feknous)

The IEEE has more than 300,000 members world-wide, encompassing all aspects of electrical technology from electron device physics to super computer networks.

Recent activities of this Student Chapter include: the organization of a student leadership conference; the offering of a tutorial session for students in need of extra help; feedback sessions where students meet with the ECE chair and associates to voice their complaints and concerns as well as to offer support for the department's efforts; organization of a workshop on programmable logic devices; and arranging on-site company visits. Frequently they conduct a student professional activities conference to discuss workplace issues. The IEEE student chapter office is located in 104A and 104B Faculty Memorial Hall.

Eta Kappa Nu (Faculty Advisor: Mr. Mohammed Feknous)

Membership in this honor society is eagerly sought by students in electrical engineering. With the assistance of the faculty advisor, the chapter is actively engaged in promoting the professional advancement of students. Outside speakers are invited to address the students on technical as well as ethical issues. Eta Kappa Nu has a tutoring program for all ECE students and arranges visits to companies. Eta Kappa Nu honor society is located in 303 Faculty Memorial Hall.

Tau Beta Pi (Faculty Advisor: Mr. Mohammed Feknous)

Tau Beta Pi is an honor society founded in 1885 to recognize engineering students of superior scholarship and outstanding character, as well as engineers of eminent achievement. Beyond distinguished scholarship, members must also have exemplary character. Tau Beta Pi honor society is located in 323 Faculty Memorial Hall.

APPENDIX A: ELECTRICAL AND COMPUTER ENGINEERING PREREQUISITES AND CO-REQUISITES

Course (credits)	Title	Prerequisites	Co-requisites
ECE 101 (0)	Intro.to Electrical and Computer Engineering	None	
ECE 231 (3)	Circuits and Systems I	PHYS 122, MATH 112 or MATH 133 <i>*Phys 121 is acceptable ONLY for students A) minoring in COE or EE or B) first-time transfer students, C) students with AP credits in Phys 121, or D) students who changed their major from other engineering programs and completed Phys 121 with a B or above grade.</i>	
ECE 232 (3)	Circuits and Systems II	ECE 231	MATH 222
ECE 251 (3)	Digital Design	PHYS 122 <i>*Phys 121 is acceptable ONLY for students A) minoring in COE or EE or B) first-time transfer students, C) students with AP credits in Phys 121, or D) students who changed their major from other engineering programs and completed Phys 121 with a B or above grade.</i>	
ECE 252 (3)	Microprocessor	ECE 251	
ECE 271 (3)	Electronics I	ECE 231	ECE 232
ECE 294 (1)	Electrical Engineering Lab. I	ECE 231, ECE 251, ENGL 101	ECE 232
ECE 321 (3)	Random Signal and Noise	ECE 232	ECE 333
ECE 333 (3)	Signals and Systems	ECE 232, MATH 222	
ECE 342 (4)	Energy Conversion	ECE 231, ECE 294	
ECE 353 (3)	Computer Architecture and Organization	ECE 252	
ECE 361 (3)	Electromagnetic Fields I	ECE 231, MATH 213, MATH 222	
ECE 362 (3)	Electromagnetic Fields II	ECE 361	
ECE 368 (2)	Signal Transmission*	ECE 232, ECE 251	
ECE 371 (4)	Electronics II	ECE 232, ECE 271	
ECE 375 (4)	Electronic Devices I	ECE 271, ECE 294	
ECE 392 (2)	Electrical Engineering Lab. II	ECE 271, ECE 291	ECE 372
ECE 394 (1)	Digital System Lab.	ECE 251, ECE 271, ECE 291	
ECE 395 (2)	Microprocessor Lab.	ECE 252, ECE 294 or ECE 291	
ECE 414 (1)	ECE Project I To be taken in the semester preceding the last semester before graduation	EE: ECE 321, ECE 342, ECE 371 (ECE 372 and ECE 392), and ECE 395 COE: ECE 294 (ECE 291 and ECE 394), ECE 353, ECE 368, and ECE 395 <i>One course and/or one lab from the prerequisites can be taken as corequisites with ECE 414 when a student can graduate within two semesters with permission from the Department. Students must provide</i>	

		<i>justification and realistic study plans to the associate chair of the department when requesting this exception.</i>	
ECE 416 (3)	ECE Project II	ECE 414	
ECE 417 (3)	Independent Study ECE Project II	INSTRUCTOR'S PERMISSION and ECE 414	
ECE 418 (3)	Independent Study	ADVISOR'S PERMISSION	
ECE 421 (3)	Digital Data Communications	ECE 232, MATH 333 OR ECE 321	
ECE 422 (3)	Computer Communication Networks	ECE 321 OR MATH 333	
ECE 423 (3)	Data Communication Network Devices	ECE 421 OR ECE 481	
ECE 424 (3)	Optical Communication Networks	ECE 232, ECE 321 OR MATH 333	
ECE 425 (3)	Wireless Communication Systems	ECE 421 OR ECE 481	
ECE 429 (2)	Computer Communication Lab.	ECE 422	
ECE 431 (3)	Systems and Virtual Instrumentation	ECE 333	
ECE 432 (3)	Control Systems Elective	ECE 431	
ECE 439 (2)	Control Systems Lab.	ECE 431	ECE 432
ECE 442 (3)	Power Systems Elective	ECE 342	
ECE 443 (3)	Renewal Energy Systems	ECE 231, 271	
ECE 449 (2)	Power Systems Lab.	ECE 342	ECE 442
ECE 451 (3)	Advanced Computer Architecture I	ECE 353	
ECE 452 (3)	Advanced Computer Architecture II	ECE 451	
ECE 453 (3)	Introduction to Discrete Event Systems	ECE 251 or CIS251, MATH 333 OR ECE 321	
ECE 459 (2)	Computer System Design Lab.	ECE 451, ECE 495	ECE 452
ECE 461 (3)	Microwave and Integrated Optics	ECE 362	
ECE 462 (3)	RF/Fiber Optics Systems Elective	ECE 362	
ECE 463 (3)	Optoelectronics	ECE 375	
ECE 469 (2)	RF/Fiber Optics Systems Lab.	ECE 462	
ECE 475 (3)	VLSI Circuits	ECE 372	
ECE 489 (2)	Communications Systems Lab.	ECE 421	
ECE 494 (2)	Electrical Engineering Lab. III	ECE 342, ECE 375, ECE 371 (or ECE 372 and ECE 392)	ECE 341 or 374
ECE 495 (3)	Computer Engineering Design Lab.	ECE 353, ECE 294 (ECE 291 and ECE 394)	
ECE 498 (3)	Special Topics in Electrical and Computer Engineering	Depends on the course topic	

APPENDIX B

BS CoE COURSE CHECKLIST

Student name _____

ID # _____

Freshman 1st Semester	Semester	Grade	Freshman 2nd Semester	Semester	Grade
(3) CHEM 125			(3) CS 115		
(2) FED 101 ^a			(4) MATH 112		
(3) ENGL 101			(3) PHYS 122		
(4) MATH 111			(1) PHYS 121A		
(3) PHYS 111			(0) ECE 101 ^b		
(1) PHYS 111A			(3) ENGL 102		
(0) FYS Seminar ^b					

16 credits

14 credits

Sophomore 1st Semester	Semester	Grade	Sophomore 2nd Semester	Semester	Grade
(3) CS 116			(3) ECE 232		
(3) ECE 231			(3) ECE 252		
(3) ECE 251			(3) ECE 271		
(4) MATH 222			(2) ECE 294		
(3) GER 200 level ^c			(4) MATH 213		

16 credits

15 credits

Junior 1st Semester	Semester	Grade	Junior 2nd Semester	Semester	Grade
(3) CS 280			(3) CS 332		
(3) ECE 368			(3) MATH 337/MATH 340		
(2) ECE 395			(3) ECE 353		
(3) MATH 326			(3) PHIL 334		
(3) MATH 333			(3) MGMT/ IE 492/ ECON ^d		

14 credits

15 credits

Senior 1st Semester	Semester	Grade	Senior 2nd Semester	Semester	Grade
(1) ECE 414			(3) ECE 416/417		
(3) ECE 495			(3) Track 3 ^e		
(3) Track 1			(2) Track Lab ^e		
(3) Track 2 ^e			(3) Technical Elective		
(3) Technical Elective			(3) GER 400 Senior Seminar ^g		
(3) GER 300 level ^f					

16 credits

14 credits

Total 120 credits

a. Maybe substituted for transfer students

b. Waived for transfer students

d. Select from MGMT 390, Econ 201, Econ 265, Econ 266, and IE 492

- c. Must be a 200-level course with the prefix COM, ENG, HIST, HUM,LIT,PHIL, STS, or THTR
- e. The order of track courses depends on prerequisites in the track
- f. Must be a 300-level course with the prefix COM, ENG, HIST, HUM,LIT,PHIL, STS, or THTR
- g. Humanities or History Seminar HSS 4xx

APPENDIX C

BS EE COURSE CHECKLIST

Student name _____ ID # _____

Freshman 1st Semester	Semester	Grade	Freshman 2nd Semester	Semester	Grade
(3) CHEM 125			(3) CS 115		
(2) FED 101 ^a			(4) MATH 112		
(3) ENGL 101			(3) PHYS 122		
(4) MATH 111			(1) PHYS 121A		
(3) PHYS 111			(0) ECE 101 ^b		
(1) PHYS 111A			(3) ENGL 102		
(0) FYS Seminar ^b					
16 credits			14 credits		

Sophomore 1st Semester	Semester	Grade	Sophomore 2nd Semester	Semester	Grade
(3) ECE 231			(3) ECE 232		
(3) ECE 251			(3) ECE 252		
(4) MATH 222			(3) ECE 271		
(3) GER 200 level ^c			(2) ECE 294		
(3) PHYS 234			(4) MATH 213		
16 credits			15 credits		

Junior 1st Semester	Semester	Grade	Junior 2nd Semester	Semester	Grade
(3) ECE 333			(3) ECE 321		
(3) ECE 361			(3) ECE 362		
(4) ECE 371			(4) ECE 375		
(2) ECE 395			(4) ECE 342		
(3) MGMT/ IE 492/ Econ ^d					
15 credits			14 credits		

Senior 1st Semester	Semester	Grade	Senior 2nd Semester	Semester	Grade
(1) ECE 414			(3) ECE 416/417		
(3) Track 1 ^e			(2) Track Lab ^e		
(3) Track 2 ^e			(3) Technical Elective		
(3) Technical Elective			(3) Technical Elective		
(3) PHIL 334			(3) Senior Seminar ^g		
(3) GER 300 level ^f					
16 credits			14 credits		Total 120 Credits

- a. Maybe substituted for transfer students
- b. Waived for transfer students
- d. Select from MGMT 390, Econ 201, Econ 265, Econ 266, and IE 492
- c. Must be a 200-level course with the prefix COM, ENG, HIST, HUM,LIT,PHIL, STS, or THTR
- e. The order of track courses depends on prerequisites in the track
- f. Must be a 300-level course with the prefix COM, ENG, HIST, HUM,LIT,PHIL, STS, or THTR
- g. Humanities or History Seminar HSS 4xx

APPENDIX D

ECE STUDENT STUDY PLAN

PROGRAM: CoE ____ EE ____

Bring this form when you come to the ECE office to meet your adviser. Also fill the course checklist with grades obtained so far.

Current Semester Courses:

Any Winter/Summer courses?

Course	Credits	Expected Grade

Next Semester _____

Following Semester _____

Course	Credits

Course	Credits

Other courses remaining to graduation: _____
(for Seniors only)

Expected graduation (semester) _____ GPA _____

Student name _____ ID # _____

Signature _____ Date _____