Electrical and Computer Engineering

Program description

The department of Electrical and Computer Engineering (ECE) at Effat University offers a Bachelor of Science degree in Electrical and Computer Engineering. Students in the ECE program must have a strong background in mathematics and physics, and a command of the English language to provide the breadth essential for optimum professional growth. The curriculum offered by the Department of ECE meets these objectives because it consists of several curricular components that give the students the opportunity to build a solid foundation of basic physical principles and obtain experience in design as well as an insight into the profession and practice of electrical engineering.

Electrical and computer engineers are the technical driving force behind the progress of technology, electronics industries as well as many other forms of technology that impact the quality of our lives. Electrical engineers design, develop, test, and oversee the manufacturing and maintenance of electrical and electronic systems. The ECE program emphasizes the development of problem-solving skills applied to the analysis and design of real world problems. It encompasses all areas of development, design, and operation of electrical and electronic systems and their components.

Students in the ECE program will be introduced to topics important to the computer engineering field such as computer hardware design, computer networks, and software engineering. As well, topics in electrical engineering, such as communications and signal processing, microelectronics and integrated circuits, wireless communications, microwaves electronics, computer-aided design, control systems, electromagnetism and a number of technical and nontechnical support courses will be examined. Students obtain a broad education necessary to understand the impact of electrical engineering solutions in a global, social, and environmental context.

Educational objectives

The ECE program educational objectives are aligned with the mission of the university and, additionally, the missions of the College of Engineering and the Electrical and Computer Engineering department. The ECE program aims at producing graduates who, after few years from graduation, will have:

- PEO 1 - Contributed in the development of products and processes in electrical and computer engineering and related fields that help satisfy various demands of the society.
- PEO 2 - Demonstrated continuous professional and career growth.
- PEO 3 - Demonstrated high ethical and responsibility values.
- PEO 4 - Ability to pursue their professional development through self-learning and advanced degrees.

Learning outcomes

Students who successfully complete the program shall demonstrate:

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function within multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Career opportunities

Electrical and computer engineers are responsible for developing many of the technological advances that we take for granted. Electrical engineers are heavily involved in the design, development, supervision, and manufacturing of electronic/electrical systems. Computer engineers do similar work with the hardware, software, and networks in computer systems.

The electrical engineering lectures and lab/project sequence prepare students well for success as design engineers in the electrical and computer engineering profession. The ECE faculty members also urge students to participate in activities and take courses that promote professional growth.

ECE students are encouraged to complete an internship as part of their degree requirements.
Upon acceptance to an internship site, students will work with an electrical engineer and/or an electronic technician inspecting, maintaining, calibrating, testing, analyzing, assembling, modifying or designing various types of electronic devices. Programs of instruction will vary but students will be provided with practical work experience in a dynamic environment in which students will be dealing with actual problems requiring practical solutions.

Employment opportunities for ECE program graduates are diverse and plentiful. They will be able to further their education at graduate schools nationally and internationally, and they will be able to find employment in industry and governmental agencies. Graduates find challenging positions in general as:

- Computer Engineers
- Communication and Signal Processing Engineers
- Microelectronics Engineers
- Power and Control Engineers

Areas of concentration

1. Computer Engineering

Overview

Computer Engineering systems are implemented using discrete, quantized, electrical signals which are represented by strings of binary digits. The students in the computer engineering area study Boolean algebra, combinational and sequential logic design, digital integrated circuits, programmable logic devices, computer design, and microprocessor hardware and software. Typical end products of computer engineering design include computers, microprocessors, video games, industrial data acquisition and control systems, medical instrumentation, and automobile instrumentation. The final products developed within many of the Electrical and Computer Engineering area are often integrated with digital systems, such as control systems, telecommunications systems, and signal processing systems.

Career opportunities

Computer engineers are trained to address critical interface issues between hardware and software essential to many current and future applications. They may work on discrete large board-level systems or smaller systems-on-a-chip. Applications of computer engineering systems include all domains of commercial and industrial enterprise. Typical products include supercomputers, personal computers, appliances, cellular phones, video and audio products, data acquisition, process control, instrumentation, and automobile and aviation systems. Examples of career opportunity include

- Designing, constructing, managing and maintaining computer networks.
- Working in specialized computer labs.
- Interfacing computers in measurement and control applications, control systems, and data logging applications.
- Managing computerized automotive systems.
- Operating computer-aided design and computer-aided manufacturing systems.
- Developing operating systems for special computer applications.
- Designing, operating, and maintaining database systems.
- Designing digital and embedded systems
- Designing and managing information security systems.

2. Communications and Signal Processing

Overview

The field of Communications and Signal Processing is concerned with processing signals and finding the best way to transmit and receive voice, picture, or computer data signals. The field of Communication and Signal Processing is a rapidly growing field. In just one century, it has progressed from telegraph systems capable of sending only a few letters per second over wires to the sophisticated protocols used today.

The communications and signal processing field of study includes communication theory, wireless communications, multiple antenna systems design, channel and source coding, space time coding, digital signal processing, machine vision, image processing, neural and soft computing, intelligent machines, studies of data networks, flow control and routing in integrated networks, dynamic resource allocation in telecommunication networks, and high speed network real time video multicasting. The integration of signal processing and communications expertise is providing important results in smart antennas, accurate Global Positioning System (GPS), improved modems, and efficient radar applications.

Career opportunities

Communication, signal processing and image processing engineers are trained to design and maintain communication systems using the latest technologies. Examples of career opportunities in this area of concentration includes

- Managing satellite-based worldwide cellular telephone systems.
- Using satellite-based direct home broadcasting of audio and video data.
- Restructuring telephone networks.
- Updating wired and wireless computer networks.
- Designing inexpensive worldwide navigation systems.
- Refining smart-house systems and security systems.
- Producing telecommunication device designs.
- Working in wired and wireless telecommunication companies.

3. Microelectronics

Overview

Electronic devices are the building blocks of most computers and electrical systems. Some examples of systems include telephones, radios, television, controllers, oscilloscopes, logic gates, memories, digital systems, computers, power circuits, and instrumentation systems. Analysis of devices and circuits is an essential task in the evaluation of these systems. The designers and engineers of this field conceive and design these building blocks while engineers in other areas develop systems using these building blocks.

It is important for every circuit designer to know how electronic devices and circuits work. Students should have a wide spectrum of courses in communications, control, analog and digital electronics, microprocessors, and Very Large Scale Integration (VLSI). The VLSI is the product of the latest revelation in the development of integrated circuits; it's the basic building block of digital and computer electronics. Customized VLSI signal processing chips have been used, for example, to improve the functionality of modern systems since microprocessor controlled instrumentation is already reality.

Career opportunities

The students in microelectronics concentration will use testing and measuring instruments to acquire data, identify, analyze and solve technical problems, analyze and implement systems containing hardware and software components, their skills are of particular importance to the following areas/processes:

- Circuit Design Engineer.
- System Development & Integration Engineer.
- Communication Design Engineer.
- Chief Electronics Engineer.
- Electronics Research Engineer.
- Electronics Testing and Development Engineer.
- CAD and Drafting Engineer.
- Medical Electronics Engineer.
- Service Engineer.
- Project Engineer.
- Hardware Engineer.
- Integration & Verification Engineer.

4. Power and Control Systems

Overview

The goal of Power and Control Systems concentration is to provide students with a high quality applications oriented undergraduate education based on state of the art electrical and electronic equipment associated with electrical power and control systems. The curriculum of the concentration is designed to satisfy the educational needs of the Middle East region by providing a climate that fosters self-awareness, personal growth, and a desire for lifelong learning.

Topics in power engineering deal with the generation, transmission, distribution, and utilization of electricity as well as the design of a range of related devices. The energy and pollution awareness was also included. Control engineering courses offer the study of a diverse range of dynamic systems and the design of controllers that will cause these systems to behave in the desired manner. To implement such controllers, students will learn how to utilize electrical circuits, digital signal processors, and microcontrollers. Applications of control to power systems is an important part in this concentration and, therefore, students will study motor control systems, smart motor controllers, variable frequency drives, motor control centers, and power system control using recent technologies.

Career opportunities

Energy and control systems are essential in all engineering disciplines, Power and Control engineers have a wide employment market. Their study covers automatic control devices and techniques which are required in most modern industry. Important power subjects are included in the program. The graduates are therefore qualified to work in power stations, energy companies, and power system utility companies. Graduates of the program will be able to work productively in the following areas:

- Power Generation Operation Engineer.
- Power Supply QA/QC Engineer.
- Power Engineer.
- Process Engineer.
- Power Protection Engineer.
- Instrumentation & Control Engineer.
- Power Transformer Design Engineer.
- Power System Design & Analysis Engineer
- Control system Engineer.
- Process and Control Engineer.
- Electrical Energy Transmission Engineer.
- Electrical Power scheduling Engineer.
- Electrical distribution planning Engineer.

Graduation requirements

The program is designed to be completed in five years with 154 credit hours. The General Education Program (GEP) requirements form the core foundation for students throughout the university.

General education requirements	Collateral Basic Science and Mathematics Requirements	ECE General Requirements	Concentration Core Requirements (Compulsory)	Concentration Electives	ECE General Electives	TOTAL
Computer Engineering concentration						
42	30	49	15	9	9	**154**
Communications and Signal Processing concentration						
42	30	49	15	9	9	**154**
Microelectronics Concentration						
42	30	49	15	9	9	**154**
Power and Control Systems concentration						
42	30	49	15	9	9	**154**

Course Numerical Identification

Every course is identified by an alphanumeric designation.

- The letter part of the designation is the letter code of the department that offers the course (i.e. ECE is the letter code of the Electrical and Computer Engineering Department).
- The most significant digit of the numeric designation, the hundreds digit, identifies the target level of the course according to the ECE five-year plan.
- The middle digit of the numeric designation, the tens digit, indicates the area of specialization within the department.
- The least significant digit of the numeric designation, the singles digit, indicates the sequence number of the course within a set of courses associated with a particular area of specialization.

Designation of the second digit of the course numbers in Electrical and Computer Engineering

Digit	Topic/Area of study
0	Fundamentals
1	Electronics – Integrated Circuits – VLSI
2	Mathematics for ECE
3	Communications – Information
4	Control – Robotics

Digit	Topic/Area of study
5	Computer Engineering and Digital Systems
6	Power Systems – Energy
7	Fields – Waves – Antenna
8	Signals Processing
9	Project – Internship – Special topics

Explanation of credit hour notations

Credit hours are listed throughout the document in the following format: (3-0-3). The first numeral indicates the number of lecture hours, the second numeral indicates the number of practical hours (if applicable), and the third digit indicates the total number of credit hours awarded after the course has been successfully completed.

ECE major requirements: 112 credit hours

ECE major requirements		Credits
ECE Compulsory Courses (79 credit hours)	Collateral Basics Science and Mathematics Requirements	30
	ECE General Requirements	49
Technical Requirements (33 credit hours)	ECE Concentration Requirements	24
	ECE General Electives	9
TOTAL		**112**

General Education requirements: 42 credit hours

Pillar	Credits	Category	Courses	Credits
Skills Development	20	Linguistic Communication (English)	GENG 161	2
			GENG 263	2
		Linguistic Communication (Arabic)	Any course from the category	3
		Linguistic Communication (Foreign Languages)	Any two courses from the category	4
		Quantitative Reasoning	GMTH 141E	3
			GSTA 140	3
		Information, Media and Technology	GCS 150	3
Literacy	9	Scientific Literacy	GPHY 112	3
		Global Awareness	Any course from the category	3
		Cultural Literacy	Any course from the category	3
Cultivating Positive Disposition	10	Physical and Environmental Wellbeing	Any course from the category	2
		Islamic Though and Ethics	GISL 171	2
			Any two courses from the category	4
		Civic Engagement	Any course from the category	2
Interdisciplinary Research	3		GSEM 200	3
TOTAL CREDIT HOURS	**42**			**42**

Compulsory courses: 79 credit hours (30 + 49 credit hours)

1. Collateral basic Science and Mathematics requirements: 30 credit hours

To fulfil graduation requirements, all ECE students are required to complete the following courses.

Course no.	Course title	Credits	Prerequisite(s)
BIO 113L	Principles of Biology	2-3-3	None
CHEM 113L	Principles of Chemistry	2-3-3	None
MATH 127	Calculus for Engineers I	2-2-3	GMTH 141E
MATH 128	Calculus for Engineers II	2-2-3	MATH 127
MATH 222	Calculus for Engineers III	3-1-3	MATH 128
MATH 321	Discrete Mathematics for Engineers	3-0-3	MATH 222
MATH 322	Linear Algebra	3-1-3	MATH 321
MATH 421	Differential Equations	3-1-3	MATH 322
PHYS 113L	Principles of Electricity and Magnetism	2-3-3	GPHY 112
STAT 321	Probabilistic Methods in Engineering	3-0-3	GSTA 140
TOTAL		**30**	

2. ECE general requirements: 49 credit hours

All ECE students are required to complete the following ECE courses to fulfil graduation requirements.

Course no.	Course title	Credits	Prerequisite(s)
ECE 103L	Introduction to C++ with Engineering Applications	2-3-3	GCS 150
ECE 106L	Introduction to ECE	1-2-2	NONE
ECE 107L	Computing Methods for Engineers	2-2-3	ECE 103L & MATH 128
ECE 201L	Electric Circuit Analysis I	3-2-4	PHYS 113L
ECE 203	Electric Circuit Analysis II	3-0-3	ECE 201L
ECE 204	Signals and Systems	3-1-3	ECE 201L
ECE 211L	Introduction to Electronic Devices	3-2-4	ECE 201L
ECE 212L	Introduction to Electronic Circuits	2-3-3	ECE 211L
ECE 251L	Digital Logic Design	3-2-4	ECE 106L, GPHY 112L
ECE 252L	Microprocessor Systems	2-3-3	ECE 251L
ECE 320L	Digital Communication Systems 1	2-3-3	ECE 204
ECE 340L	Analog Control Systems	2-3-3	ECE 204
ECE 356	Computer Organization and Architecture	3-0-3	ECE 252L
ECE 398	Summer Internship I	0-4-2	Dept. approval & Completion of 65 credit hours
ECE 498	Summer Internship II	0-4-2	ECE 398 & Dept. approval
ECE 491	ECE Capstone Design Project I	1-2-2	Senior standing & Dept. approval
ECE 492	ECE Capstone Design Project II	1-2-2	ECE 491
TOTAL		**49**	

Note: ECE students may take ECE 499 Co-op course instead of the two Summer Internships ECE 398 and ECE 498.

Course no.	Course title	Credits	Prerequisite(s)
ECE 499	Co-op in Electrical and Computer Engineering	0-8-4	Dept. approval & Completion of 65 credit hours

Technical requirements: 33 credit hours (24 + 9 credit hours)

ECE students, in consultation with an academic advisor, must complete technical courses that total **33** credit hours as follows:

- **24** credit hours of ECE Concentration requirements:
  - o **15** credit hours of Concentration Compulsory courses
  - o **9** credit hours of Concentration Electives courses
- **9** credit hours from the ECE General Elective courses.

1. ECE concentration requirements: 18 credit hours

(A) Computer Engineering

Concentration compulsory courses

All students in Computer Engineering concentration are required to take the following courses (15 credit hours)

Course no.	Course title	Credits	Prerequisite(s)
ECE 253L	Data Structures and Algorithmic Design	2-3-3	ECE103L
ECE 353L	Advanced Digital System Design	2-3-3	ECE 251L
ECE 358L	Operating Systems	2-2-3	ECE 356
ECE 459L	Embedded Systems Design	2-3-3	ECE 252L
ECE 445L	Computer Network Architecture	2-2-3	ECE 356

Concentration elective courses

Students in the Computer Engineering Concentration are required to select any three courses (9 credit hours) form the ECE courses below:

Course no.	Course title	Credits	Prerequisite(s)
ECE 357L	Object Oriented Programming in C++	2-3-3	ECE 103L
ECE 394	Special Topics in Computer Engineering	3-0-3	Dept. approval
ECE 452	Advanced Digital Computer Architecture	3-0-3	ECE 356
ECE 446L	CAD for Mixed-Signal Circuits	2-3-3	ECE 212L
ECE 457	Information Security	3-0-3	ECE 356
ECE 411L	VLSI Design	2-3-3	ECE 212L
ECE 494	Advanced Topics in Computer Engineering	3-0-3	Dept. approval

(B) Communication and Signal Processing

Concentration compulsory courses

All students in Communication and Signal Processing Concentration are required to take the following courses (15 credit hours)

Course no.	Course title	Credits	Prerequisite(s)
ECE 370L	Introduction to Electromagnetic Fields	2-2-3	MATH 322 & PHYS 113L
ECE 363L	Fund. of Digital Signal Proc.	2-3-3	ECE 204
ECE 432L	Digital Communication Systems 2	2-3-3	ECE 320L
ECE 434L	Mobile Communication Systems	2-3-3	ECE 320L
ECE 480L	Advanced Digital Signal Processing	2-3-3	ECE 363L

Concentration electives courses

Students in the Communication and Signal Processing Concentration are required to select any three courses (9 credit hours) form the ECE courses below:

Course no.	Course title	Credits	Prerequisite(s)
ECE 332L	Optical Communication Systems	2-3-3	ECE 320L
ECE 334L	Microwave and RF Communication Systems	2-3-3	ECE 320L
ECE 375	Advanced Electromagnetic Fields	3-0-3	ECE 370L
ECE 381L	Digital Image Processing	2-3-3	ECE 363L
ECE 395	Special Topics in Communication and Signal Processing	3-0-3	Dept. approval
ECE 470L	Antenna Theory and Design	2-3-3	ECE 370L
ECE 472	Radar Systems	3-0-3	ECE 320L & ECE 363L
ECE 473	Adaptive Filter Theory	3-0-3	ECE 370L
ECE 481	Signal Detection and Extraction Theory	3-0-3	STAT 321
ECE 483	Digital Speech Processing	3-0-3	ECE 363L
ECE 495	Advanced Topics in Communication and Signal Processing	3-0-3	Dept. approval

(C) Microelectronics

Concentration compulsory courses

All students in Microelectronics Concentration are required to take the following courses (15 credit hours)

Course no.	Course title	Credits	Prerequisite(s)
ECE 308L	Analog Integrated Circuits	2-3-3	ECE 212L
ECE 309L	Digital Integrated Circuits	2-3-3	ECE 212L
ECE 353L	Advanced Digital System Design	2-3-3	ECE 251L
ECE 370L	Introduction to Electromagnetic Fields	2-2-3	MATH 322 & PHYS 113L
ECE 411L	VLSI Design	2-3-3	ECE 212L

Concentration electives courses

Students in the Microelectronics concentration are required to select any three courses (9 credit hours) form the ECE courses below:

Course no.	Course title	Credits	Prerequisite(s)
ECE 313	Semiconductor Devices	3-0-3	ECE 309L
ECE 315	Optics and Modern Physics	3-0-3	PHYS 113L
ECE 396	Special Topics in Microelectronics	3-0-3	Dept. approval
ECE 412L	Microwave Electronics	2-3-3	ECE 308L
ECE 413L	Optoelectronics	2-3-3	ECE 308L
ECE 416L	Microcontrollers Interfacing and applications	2-3-3	ECE 308L
ECE 446L	CAD for Mixed-Signal Circuits	2-3-3	ECE 212L
ECE 459L	Embedded Systems Design	2-3-3	ECE 252L
ECE 496	Advanced Topics in Microelectronics	3-0-3	Dept. approval

(D) Power and Control Systems

Concentration compulsory courses

All students in Power and Control Systems concentration are required to take the following courses (15 credit hours)

Course no.	Course title	Credits	Prerequisite(s)
ECE 349	Modern Control	3-0-3	ECE 340L
ECE 361L	Electromechanical Systems	2-3-3	ECE 203
ECE 362L	Basic Electrical Machines and Transformers	2-2-3	ECE 211L
ECE 458	Synthe. & Verific. of VLSI Systems	3-0-3	ECE 361L
ECE 460	VLSI System Testing	3-0-3	ECE 361L

Concentration electives courses

Students in the Power Control Systems are required to select any three courses (9 credit hours) form the ECE courses below:

Course no.	Course title	Credits	Prerequisite(s)
ECE 364	Renewable Electrical Energy	3-0-3	PHYS 113L
ECE 365L	Power Electronics	2-2-3	ECE 212L
ECE 397	Special Topics in Power and Control	3-0-3	Dept. approval
ECE 441	Digital Control Systems	3-0-3	ECE 340L
ECE 442L	Instrumentation and Process Control	2-3-3	ECE 340L
ECE 443L	Robot Dynamics and Control	2-3-3	ECE 340L
ECE 465	Electric Drives	3-0-3	ECE 361L
ECE 466	Power System Control	3-0-3	ECE 460
ECE 497	Advanced Topics in Power and Control	3-0-3	Dept. approval

2. ECE General Electives: 9 credit hours

ECE students, in consultation with an academic advisor and with the Department approval, must complete courses that total 9 credit hours from either:

1. Courses from the table below including ECE courses from any concentration area other than the student's chosen concentration area
2. 300 level or more from the Computer Science (CS) Department
3. Combination of both.

Course no.	Course title	Credits	Prerequisite(s)
PHYS 311	Modern Physics	3-0-3	PHYS 113L
PHYS 411	Quantum Mechanics	3-0-3	PHYS 311
MATH 422	Numerical Analysis	3-1-3	MATH 421
MATH 423	Partial Differential Equations	3-0-3	MATH 421

Study plan

The Department of Electrical and Computer Engineering requires of its students to develop an individual graduation plan. The purpose of these plans is to help students work efficiently towards their goals, and maximize their academic achievements. Normally, students are expected to complete their degree requirements in no more than five years or ten semesters. The following is a proposed general five-year plan for ECE students for all concentrations to complete their degree requirements. A proposed five-year plan for each concentration are also given.

A) General 5-Year Study Plan for all concentrations

Semester 1

Course no.	Course title	Credits	Prerequisite(s)
GENG 161	Project-based language Learning and Critical Thinking	2-1-2	Placement
GMTH 141E	Algebra and Trigonometry	2-2-3	None
GCS 150	Digital Skills: Information and Computer Literacy	2-2-3	None
BIO 113L	Principles of Biology	2-3-3	None
GISL 171	Social and Moral Values in Islam	2-1-2	None
GPHY 112	Foundations in Physics	2-3-3	None
TOTAL		**16**	

Semester 2

Course no.	Course title	Credits	Prerequisite(s)
GENG 263	Engineering Communication	2-1-2	GENG 161
GSTA 140	Elementary Statistics	2-2-3	GMTH 141E
MATH 127	Calculus For Engineers I	2-2-3	GMTH 141E
PHYS 113L	Principles of Electricity and Magnetism	2-3-3	GPHY 112
ECE 103L	Introduction to C++ with Engineering Applications	2-3-3	GCS 150
ECE 106L	Introduction to ECE	1-2-2	None
TOTAL		**16**	

Semester 3

Course no.	Course title	Credits	Prerequisite(s)
MATH 128	Calculus for Engineers II	2-2-3	MATH 127
CHEM 113L	Principles of Chemistry	2-3-3	None
GSEM 200	Interdisciplinary Seminar and Research	2-2-3	None
ECE 201L	Electric Circuit Analysis I	3-2-4	PHYS113L
ECE 251L	Digital Logic Design	3-2-4	ECE 106L, GPHY 112
TOTAL		**17**	

Semester 4

Course no.	Course title	Credits	Prerequisite(s)
MATH 222	Calculus for Engineers III	3-0-3	MATH 128
ECE 203	Electric Circuit Analysis II	3-0-3	ECE 201L
ECE 204	Signals and systems	3-1-3	ECE 201L
ECE 211L	Introduction to Electronic Devices	3-2-4	ECE 201L
ECE 252L	Microprocessor Systems	2-3-3	ECE 251L
TOTAL		**16**	

Semester 5

Course no.	Course title	Credits	Prerequisite(s)
ECE 212L	Introduction to Electronic Circuits	2-3-3	ECE 211L
MATH 321	Discrete Mathematics for Engineers	3-0-3	MATH 222
ECE 320L	Digital Communication Systems 1	2-3-3	ECE 204
ECE 340L	Analog Control Systems	2-3-3	ECE 204
Choice	Linguisitic Communication (Foreing Languages)	2-1-2	None
	ECE Concentration Compulsory 1	3	
TOTAL		**17**	

Semester 6

Course no.	Course title	Credits	Prerequisite(s)
STAT 321	Probabilistic Methods in Engineering	3-0-3	GSTA 140
MATH 322	Linear Algebra	3-1-3	MATH 321
Choice	Linguisitic Communication (Arabic)	2-2-3	None
	ECE Concentration Compulsory 2	3	
ECE 107L	Computing Methods for Engineers	2-2-3	ECE 103L & MATH 128
TOTAL		**15**	

Summer 1

Course no.	Course title	Credits	Prerequisite(s)
ECE 398	Summer Internship 1 **This course requires the completion of 180 hours of training in industry**	0-4-2	Dept. approval & Completion of 65 credit hours
TOTAL		**2**	

Semester 7

Course no.	Course title	Credits	Prerequisite(s)
MATH 421	Differential Equations	3-1-3	MATH 322
ECE 356	Computer Organization and Architecture	3-0-3	ECE 252L
Choice	Islamic Though and Ethics	2-1-2	None
	ECE Concentration Compulsory 3	3	
Choice	Civic Engagement	2	
	ECE Concentration Elective 1	3	
TOTAL		**16**	

Semester 8

Course no.	Course title	Credits	Prerequisite(s)
	ECE General Elective 1	3	
Choice	Islamic Though and Ethics	2	None
	ECE Concentration Compulsory 4	3	
	ECE Concentration Elective 2	3	
Choice	Cultural Literacy	3	Choice
PEW-Choice	Physical and environmental wellbeing	2	None
TOTAL		**16**	

Summer 2

Course no.	Course title	Credits	Prerequisite(s)
ECE 498	Summer Internship 2 **This course requires the completion of 180 hours of training in industry**	0-4-2	ECE 398 & Dept. approval
TOTAL		**2**	

Semester 9

Course no.	Course title	Credits	Prerequisite(s)
	ECE Concentration Compulsory 5	3	
	ECE Concentration Elective 3	3	
	ECE General Elective 2	3	
ECE 491	ECE Capstone Design Project 1	1-2-2	Senior standing & Dept. approval
Choice	Global Awareness	3	None
TOTAL		**14**	

Semester 10

Course no.	Course title	Credits	Prerequisite(s)
	ECE General Elective 3	3	
ECE 492	ECE Capstone Design Project II	1-2-2	ECE 491
Choice	Linguisitic Communication (Foreing Languages)	2-1-2	None
TOTAL		**7**	

Note: ECE students may take ECE 499 Co-op course instead of the two Summer Internships ECE 398 and ECE 498.

Course no.	Course title	Credits	Prerequisite(s)
ECE 499	Co-op in Electrical and Computer Engineering **This course offers students the opportunity to spend one full semester in industry or research**	0-8-4	Dept. approval & Completion of 65 credit hours

Academic Plan for Electrical and Computer Engineering (ECE)

B) Computer Engineering concentration 5-Year Study Plan

Semester 1

Course no.	Course title	Credits	Prerequisite(s)
GENG 161	Project-Based Language Learning and Critical Thinking	2-1-2	Placement
GMTH 141E	Algebra and Trigonometry	2-2-3	None
GCS 150	Digital Skills: Information and Computer Literacy	2-2-3	None
BIO 113L	Principles of Biology	2-3-3	None
GISL 171	Social and Moral Values in Islam	2-1-2	None
GPHY 112	Foundations in Physics	2-3-3	None
TOTAL		**16**	

Semester 2

Course no.	Course title	Credits	Prerequisite(s)
GENG 263	Engineering Communication	2-1-2	GENG 161
GSTA 140	Elementary Statistics	2-2-3	GMTH 141E
MATH 127	Calculus for Engineers I	2-2-3	GMTH 141E
PHYS 113L	Principles of Electricity and Magnetism	2-3-3	GPHY 112
ECE 103L	Introduction to C++ with Engineering Applications	2-3-3	GCS 150
ECE 106L	Introduction to ECE	1-2-2	None
TOTAL		**16**	

Semester 3

Course no.	Course title	Credits	Prerequisite(s)
MATH 128	Calculus for Engineers II	2-2-3	MATH 127
CHEM 113L	Principles of Chemistry	2-3-3	None
ECE 201L	Electric Circuit Analysis I	3-2-4	PHYS 113L
ECE 251L	Digital Logic Design	3-2-4	ECE 106L, GPHY 112
GSEM 200	Interdisciplinary Seminar and Research	2-2-3	None
TOTAL		**17**	

Semester 4

Course no.	Course title	Credits	Prerequisite(s)
MATH 222	Calculus for Engineers III	3-0-3	MATH 128
ECE 203	Electric Circuit Analysis II	3-0-3	ECE 201L
ECE 204	Signals and Systems	3-1-3	ECE 201L
ECE 211L	Introduction to Electronic Devices	3-2-4	ECE 201L
ECE 252L	Microprocessor Systems	2-3-3	ECE 251L
TOTAL		**16**	

Semester 5

Course no.	Course title	Credits	Prerequisite(s)
ECE 212L	Introduction to Electronic Circuits	2-3-3	ECE 211L
MATH 321	Discrete Mathematics for Engineers	3-0-3	MATH 222
ECE 320L	Digital Communication Systems 1	2-3-3	ECE 204
ECE 340L	Analog Control Systems	2-3-3	ECE 204
Choice	Linguisitic Communication (Foreing Languages)	2-1-2	None
ECE 353L	Advanced Digital System Design (ECE Concentration Compulsory 1 in Computer Engineering)	2-3-3	ECE 251L
TOTAL		**17**	

Semester 6

Course no.	Course title	Credits	Prerequisite(s)
STAT 321	Probabilistic Methods in Engineering	3-0-3	GSTA 140
MATH 322	Linear Algebra	3-1-3	MATH 321
Choice	Linguisitic Communication (Arabic)	2-2-3	None
ECE 107L	Computing Methods for Engineers	2-2-3	ECE 103L & MATH 128
ECE 253L	Data Structures and Algorithmic Design (ECE Concentration Compulsory 2 in Computer Engineering)	2-3-3	ECE 103L
TOTAL		**15**	

Summer 1

Course no.	Course title	Credits	Prerequisite(s)
ECE 398	Summer Internship 1 **This course requires the completion of 180 hours of training in industry**	0-4-2	Dept. approval & Completion of 65 credit hours
TOTAL		**2**	

Semester 7

Course no.	Course title	Credits	Prerequisite(s)
MATH 421	Differential Equations	3-1-3	MATH 322
ECE 356	Computer Organization and Architecture	3-0-3	ECE 252L
Choice	Islamic Thoughts and Ethics	2-1-2	None
Choice	Civic Engagement	2	
ECE 459L	Embedded Systems Design (ECE Concentration Compulsory 3 in Computer Engineering)	2-3-3	ECE 252L
	ECE Concentration Elective 1 in Computer Engineering	3	
TOTAL		**16**	

Semester 8

Course no.	Course title	Credits	Prerequisite(s)
Choice	Islamic Thoughts and Ethics	2	None
Choice	Cultural Literacy	3	Choice
PEW-Choice	Physical and Environmental Well Being	2	None
	ECE General Elective 1 from another concentration	3	
ECE 358	Operating Systems (ECE Concentration Compulsory 4 in Computer Engineering)	2-2-3	ECE 356
	ECE Concentration Elective 2 in Computer Engineering	3	
TOTAL		**16**	

Summer 2

Course no.	Course title	Credits	Prerequisite(s)
ECE 498	Summer Internship 2 **This course requires the completion of 180 hours of training in industry**	0-4-2	ECE 398 & Dept. approval
TOTAL		**2**	

Semester 9

Course no.	Course title	Credits	Prerequisite(s)
	ECE General Elective 2 from another concentration	3	
ECE 445L	Computer Network Architecture (ECE Concentration Compulsory 5 in Computer Engineering)	2-2-3	ECE 356
	ECE Concentration Elective 3 in Computer Engineering	3	
ECE 491	ECE Capstone Design Project I	1-2-2	Senior standing & Dept. approval
Choice	Global Awareness	3	None
TOTAL		**14**	

Semester 10

Course no.	Course title	Credits	Prerequisite(s)
Choice	Linguisitic Communication (Foreing Languages)	2-1-2	None
	ECE General Elective 3 from another concentration	3	
ECE 492	ECE Capstone Design Project II	1-2-2	ECE 491
TOTAL		**7**	

Note: ECE students may take ECE 499 Co-op course instead of the two Summer Internships ECE 398 and ECE 498.

Course no.	Course title	Credits	Prerequisite(s)
ECE 499	Co-op in Electrical and Computer Engineering **This course offers students the opportunity to spend one full semester in industry or research**	0-8-4	Dept. approval & Completion of 65 credit hours

Technical requirements

ECE students, in consultation with an academic advisor, must complete technical courses that total **33** credit hours as follows:

- **24** credit hours of ECE Concentration requirements:
  - o **15** credit hours of Concentration Compulsory courses
  - o **9** credit hours of Concentration Electives courses
- **9** credit hours from the ECE General Elective courses.

Concentration Compulsory courses in **Computer Engineering:** (15 credit hours)

All students in Communications and Signal Processing concentration are required to take the following courses (15 credit hours)

Course no.	Course title	Credits	Prerequisite(s)
ECE 253L	Data Structures and Algorithmic Design	2-3-3	ECE103L
ECE 353L	Advanced Digital System Design	2-3-3	ECE 251L
ECE 358L	Operating Systems	2-2-3	ECE 356
ECE 459L	Embedded Systems Design	2-3-3	ECE 252L
ECE 445L	Computer Network Architecture	2-2-3	ECE 356

Elective courses in **Computer Engineering:** (9 credit hours)

Students in the Communications and Signal Processing concentration are required to select any three courses (9 credit hours) form the ECE courses below:

Course no.	Course title	Credits	Prerequisite(s)
ECE 357L	Object Oriented Programming in C++	2-3-3	ECE 103L
ECE 394	Special Topics in Computer Engineering	3-0-3	Dept. approval
ECE 452	Advanced Digital Computer Architecture	3-0-3	ECE 356
ECE 456L	CAD for Mixed-Signal Circuits	2-3-3	ECE 212L
ECE 457	Information Security	3-0-3	ECE 356
ECE 411L	VLSI Design	2-3-3	ECE 212L
ECE 494	Advanced Topics in Computer Engineering	3-0-3	Dept. approval

ECE General Electives: 9 credit hours

ECE students, in consultation with an academic advisor and with the Department approval, must complete courses with total 9 credit hours from either:

1. Courses from the table below including ECE courses from any concentration area other than the student's chosen concentration area.
2. 300 level or more from the Computer Science (CS) Department.
3. Combination of both.

Course no.	Course title	Credits	Prerequisite(s)
PHYS 311	Modern Physics	3-0-3	PHYS 113L
PHYS 411	Quantum Mechanics	3-0-3	PHYS 311
MATH 422	Numerical Analysis	3-1-3	MATH 421
MATH 423	Partial Differential Equations	3-0-3	MATH 421
ECE 370L	Introduction to Electromagnetic Fields	2-2-3	MATH 322 & PHYS 113L
ECE 363L	Fund. of Digital Signal Proc.	2-3-3	ECE 204
ECE 432L	Digital Communication Systems 2	2-3-3	ECE 320L
ECE 434L	Mobile Communication Systems	2-3-3	ECE 320L
ECE 480L	Advanced Digital Signal Processing	2-3-3	ECE 363L
ECE 332L	Optical Communication Systems	2-3-3	ECE 320L
ECE 334L	Microwave and RF Communication Systems	2-3-3	ECE 320L
ECE 375	Advanced Electromagnetic Fields	3-0-3	ECE 370L
ECE 381L	Digital Image Processing	2-3-3	ECE 363L
ECE 470L	Antenna Theory and Design	2-3-3	ECE 370L
ECE 472	Radar Systems	3-0-3	ECE 320L & ECE 363L
ECE 473	Adaptive Filter Theory	3-0-3	ECE 370L
ECE 481	Signal Detection and Extraction Theory	3-0-3	STAT 321
ECE 483	Digital Speech Processing	3-0-3	ECE 363L
ECE 308L	Analog Integrated Circuits	2-3-3	ECE 212L
ECE 309L	Digital Integrated Circuits	2-3-3	ECE 212L
ECE 313	Semiconductor Devices	3-0-3	ECE 309L
ECE 315	Optics and Modern Physics	3-0-3	PHYS 113L
ECE 412L	Microwave Electronics	2-3-3	ECE 308L
ECE 413L	Optoelectronics	2-3-3	ECE 308L
ECE 416L	Microcontrollers Interfacing and applications	2-3-3	ECE 308L
ECE 349	Modern Control	3-0-3	ECE 340L
ECE 361L	Electromechanical Systems	2-3-3	ECE 203
ECE 362L	Basic Electrical Machines and Transformers	2-2-3	ECE 211L
ECE 458	Synthe. & Verific. of VLSI Systems	3-0-3	ECE 361L
ECE 460	VLSI System Testing	3-0-3	ECE 458
ECE 364	Renewable Electrical Energy	3-0-3	PHYS 113L
ECE 365L	Power Electronics	2-2-3	ECE 212L
ECE 441	Digital Control Systems	3-0-3	ECE 340L
ECE 442L	Instrumentation and Process Control	2-3-3	ECE 340L
ECE 443L	Robot Dynamics and Control	2-3-3	ECE 340L
ECE 465	Electric Drives	3-0-3	ECE 361L
ECE 466	Power System Control	3-0-3	ECE 460

Academic Plan for Electrical and Computer Engineering (ECE)

C) Communications and Signal Processing concentration 5-Year Study Plan

Semester 1

Course no.	Course title	Credits	Prerequisite(s)
GENG 161	Project-Based Language Learning and Critical Thinking	2-1-2	Placement
GMTH 141E	Algebra and Trigonometry	2-2-3	None
GCS 150	Digital Skills: Information and Computer Literacy	2-2-3	None
BIO 113L	Principles of Biology	2-3-3	None
GISL 171	Social and Moral Values in Islam	2-1-2	None
GPHY 112	Foundations in Physics	2-3-3	None
TOTAL		**16**	

Semester 2

Course no.	Course title	Credits	Prerequisite(s)
GENG 263	Engineering Communication	2-1-2	GENG 161
GSTA 140	Elementary Statistics	2-2-3	GMTH 141E
MATH 127	Calculus for Engineers I	2-2-3	GMTH 141E
PHYS 113L	Principles of Electricity and Magnetism	2-3-3	GPHY 112
ECE 103L	Introduction to C++ with Engineering Applications	2-3-3	GCS 150
ECE 106L	Introduction to ECE	1-2-2	None
TOTAL		**16**	

Semester 3

Course no.	Course title	Credits	Prerequisite(s)
MATH 128	Calculus for Engineers II	2-2-3	MATH 127
CHEM 113L	Principles of Chemistry	2-3-3	None
ECE 201L	Electric Circuit Analysis I	3-2-4	PHYS 113L
ECE 251L	Digital Logic Design	3-2-4	ECE 106L, GPHY 112
GSEM 200	Interdisciplinary Seminar and Research	2-2-3	None
TOTAL		**17**	

Semester 4

Course no.	Course title	Credits	Prerequisite(s)
MATH 222	Calculus for Engineers III	3-0-3	MATH 128
ECE 203	Electric Circuit Analysis II	3-0-3	ECE 201L
ECE 204	Signals and Systems	3-1-3	ECE 201L
ECE 211L	Introduction to Electronic Devices	3-2-4	ECE 201L
ECE 252L	Microprocessor Systems	2-3-3	ECE 251L
TOTAL		**16**	

Semester 5

Course no.	Course title	Credits	Prerequisite(s)
ECE 212L	Introduction to Electronic Circuits	2-3-3	ECE 211L
MATH 321	Discrete Mathematics for Engineers	3-0-3	MATH 222
ECE 320L	Digital Communication Systems 1	2-3-3	ECE 204
ECE 340L	Analog Control Systems	2-3-3	ECE 204
ECE 363L	Fund. of Digital Signal Proc. (ECE Concentration Compulsory 1 in Communications and Signal Processing)	2-3-3	ECE 204
Choice	Linguisitic Communication (Foreing Languages)	2-1-2	None
TOTAL		**17**	

Semester 6

Course no.	Course title	Credits	Prerequisite(s)
STAT 321	Probabilistic Methods in Engineering	3-0-3	GSTA 140
MATH 322	Linear Algebra	3-1-3	MATH 321
Choice	Linguistic Communication (Arabic)	2-2-3	None
ECE 432L	Digital Communication Systems 2 (ECE Concentration Compulsory 2 in Communications and Signal Processing)	2-3-3	ECE 320L
ECE 107L	Computing Methods for Engineers	2-2-3	ECE 103L & MATH 128
TOTAL		**15**	

Summer 1

Course no.	Course title	Credits	Prerequisite(s)
ECE 398	Summer Internship I **This course requires the completion of 180 hours of training in industry**	0-4-2	Dept. approval & Completion of 65 credit hours
TOTAL		**2**	

Semester 7

Course no.	Course title	Credits	Prerequisite(s)
MATH 421	Differential Equations	3-1-3	MATH 322
ECE 356	Computer Organization and Architecture	3-0-3	ECE 252L
Choice	Islamic Thoughts and Ethics	2-1-2	None
Choice	Civic Engagement	2	
ECE 370L	Introduction to Electromagnetic Fields (ECE Concentration Compulsory 3 in Communications and Signal Processing)	2-2-3	MATH 322 & PHYS 113
	ECE Concentration Elective 1 in Communications and Signal Processing	3	
TOTAL		**16**	

Semester 8

Course no.	Course title	Credits	Prerequisite(s)
Choice	Cultural Literacy	3	Choice
PEW-Choice	Physical and Environmental Well Being	2	None
Choice	Islamic Thoughts and Ethics	2	None
	ECE General Elective 1 from another concentration	3	
ECE 434L	Mobile Communication Systems (ECE Concentration Compulsory 4 in Communications and Signal Processing)	2-3-3	ECE 320L
	ECE Concentration Elective 2 in Communications and Signal Processing	3	
TOTAL		**16**	

Summer 2

Course no.	Course title	Credits	Prerequisite(s)
ECE 498	Summer Internship II **This course requires the completion of 180 hours of training in industry**	0-4-2	ECE 398 & Dept. approval
TOTAL		**2**	

Semester 9

Course no.	Course title	Credits	Prerequisite(s)
	ECE General Elective 2 from another concentration	3	
ECE 480L	Advanced Digital Signal Processing (ECE Concentration Compulsory 5 in Communications and Signal Processing)	2-3-3	ECE 363L
	ECE Concentration Elective 3 in Communications and Signal Processing	3	
ECE 491	ECE Capstone Design Project I	1-2-2	Senior standing & Dept. approval
ECE 491	ECE Capstone Design Project I	1-2-2	Senior standing & Dept. approval
Choice	Global Awareness	3	None
TOTAL		**14**	

Semester 10

Course no.	Course title	Credits	Prerequisite(s)
Choice	Linguistic Communication (Foreign Languages)	2-1-2	None
	ECE General Elective 3 from another concentration	3	
ECE 492	ECE Capstone Design Project II	1-2-2	ECE 491
TOTAL		**7**	

Note: ECE students may take ECE 499 Co-op course instead of the two Summer Internships ECE 398 and ECE 498.

Course no.	Course title	Credits	Prerequisite(s)
ECE 499	Co-op in Electrical and Computer Engineering **This course offers students the opportunity to spend one full semester in industry or research**	0-8-4	Dept. approval & Completion of 65 credit hours

Technical requirements

ECE students, in consultation with an academic advisor, must complete technical courses that total **33** credit hours as follows:

- **24** credit hours of ECE Concentration requirements:
  - o **15** credit hours of Concentration Compulsory courses
  - o **9** credit hours of Concentration Electives courses
- **9** credit hours from the ECE General Elective courses.

Concentration Compulsory Courses in **Microelectronics**: (15 credit hours)

Concentration Compulsory courses in **Communications and Signal Processing:** (15credit hours)
All students in Communications and Signal Processing Concentration are required to take the following courses (15 credit hours)

Course no.	Course title	Credits	Prerequisite(s)
ECE 370L	Introduction to Electromagnetic Fields	2-2-3	MATH 322 & PHYS 113L
ECE 363L	Fund. of Digital Signal Proc.	2-3-3	ECE 204
ECE 432L	Digital Communication Systems 2	2-3-3	ECE 320L
ECE 434L	Mobile Communication Systems	2-3-3	ECE 320L
ECE 480L	Advanced Digital Signal Processing	2-3-3	ECE 363L

Concentration Elective courses in **Communications and Signal Processing:** (9 credit hours)
Students in the Communications and Signal Processing Concentration are required to select any three courses (9 Credit Hours) form the ECE courses below:

Course no.	Course title	Credits	Prerequisite(s)
ECE 332L	Optical Communication Systems	2-3-3	ECE 320L
ECE 334L	Microwave and RF Communication Systems	2-3-3	ECE 320L
ECE 375	Advanced Electromagnetic Fields	3-0-3	ECE 370L
ECE 381L	Digital Image Processing	2-3-3	ECE 363L
ECE 395	Special Topics in Communications and Signal Processing	3-0-3	Dept. approval
ECE 470L	Antenna Theory and Design	2-3-3	ECE 370L
ECE 472	Radar Systems	3-0-3	ECE 320L & ECE 363L
ECE 473	Adaptive Filter Theory	3-0-3	ECE 370L
ECE 481	Signal Detection and Extraction Theory	3-0-3	STAT 321
ECE 483	Digital Speech Processing	3-0-3	ECE 363L
ECE 495	Advanced Topics in Communications and Signal Processing	3-0-3	Dept. approval

ECE General Electives: 9 credit hours

ECE students, in consultation with an academic advisor and with the Department approval, must complete courses with total 9 credit hours from either:

1. Courses from the table below including ECE courses from any concentration area other than the student's chosen concentration area.
2. 300 level or more from the Computer Science (CS) Department.
3. Combination of both.

Course no.	Course title	Credits	Prerequisite(s)
PHYS 311	Modern Physics	3-0-3	PHYS 113L
PHYS 411	Quantum Mechanics	3-0-3	PHYS 311
MATH 422	Numerical Analysis	3-1-3	MATH 421
MATH 423	Partial Differential Equations	3-0-3	MATH 421
ECE 253L	Data Structures and Algorithmic Design	2-3-3	ECE 103L
ECE 353L	Advanced Digital System Design	2-3-3	ECE 251L
ECE 358L	Operating Systems	2-2-3	ECE 356
ECE 459L	Embedded Systems Design	2-3-3	ECE 252L
ECE 445L	Computer Network Architecture	2-2-3	ECE 356
ECE 357L	Object Oriented Programming in C++	2-3-3	ECE 103L
ECE 452	Advanced Digital Computer Architecture	3-0-3	ECE 356
ECE 446L	CAD for Mixed-Signal Circuits	2-3-3	ECE 212L
ECE 457	Information Security	3-0-3	ECE 356
ECE 411L	VLSI Design	2-3-3	ECE 212L
ECE 308L	Analog Integrated Circuits	2-3-3	ECE 212L
ECE 309L	Digital Integrated Circuits	2-3-3	ECE 212L
ECE 353L	Advanced Digital System Design	2-3-3	ECE 251L
ECE 370L	Introduction to Electromagnetic Fields	2-2-3	MATH 322 & PHYS 113L
ECE 313	Semiconductor Devices	3-0-3	ECE 309L
ECE 315	Optics and Modern Physics	3-0-3	PHYS 113L
ECE 412L	Microwave Electronics	2-3-3	ECE 308L
ECE 413L	Optoelectronics	2-3-3	ECE 308L
ECE 416L	Microcontrollers Interfacing and applications	2-3-3	ECE 308L
ECE 459L	Embedded Systems Design	2-3-3	ECE 252L
ECE 349	Modern Control	3-0-3	ECE 340L
ECE 361L	Electromechanical Systems	2-3-3	ECE 203
ECE 362L	Basic Electrical Machines and Transformers	2-2-3	ECE 211L
ECE 458	Synthe. & Verific. of VLSI Systems	3-0-3	ECE 361L
ECE 460	VLSI System Testing	3-0-3	ECE 458
ECE 364	Renewable Electrical Energy	3-0-3	PHYS 113L
ECE 365L	Power Electronics	2-2-3	ECE 212L
ECE 441	Digital Control Systems	3-0-3	ECE 340L
ECE 442L	Instrumentation and Process Control	2-3-3	ECE 340L
ECE 443L	Robot Dynamics and Control	2-3-3	ECE 340L
ECE 465	Electric Drives	3-0-3	ECE 361L
ECE 466	Power System Control	3-0-3	ECE 460

Academic Plan for Electrical and Computer Engineering (ECE)

D) Microelectronics concentration 5-Year Study Plan

Semester 1

Course no.	Course title	Credits	Prerequisite(s)
GENG 161	Project-Based Language Learning and Critical Thinking	2-1-2	Placement
GMTH 141E	Algebra and Trigonometry	2-2-3	None
GCS 150	Digital Skills: Information and Computer Literacy	2-2-3	None
BIO 113L	Principles of Biology	2-3-3	None
GISL 171	Social and Moral Values in Islam	2-1-2	None
GPHY 112	Foundations in Physics	2-3-3	None
TOTAL		**16**	

Semester 2

Course no.	Course title	Credits	Prerequisite(s)
GENG 263	Engineering Communication	2-1-2	GENG 161
GSTA 140	Elementary Statistics	2-2-3	GMTH 141E
MATH 127	Calculus for Engineers I	2-2-3	GMTH 141E
PHYS 113L	Principles of Electricity and Magnetism	2-3-3	GPHY 112
ECE 103L	Introduction to C++ with Engineering Applications	2-3-3	GCS 150
ECE 106L	Introduction to ECE	1-2-2	None
TOTAL		**16**	

Semester 3

Course no.	Course title	Credits	Prerequisite(s)
MATH 128	Calculus for Engineers II	2-2-3	MATH 127
CHEM 113L	Principles of Chemistry	2-3-3	None
ECE 201L	Electric Circuit Analysis I	3-2-4	PHYS 113L
ECE 251L	Digital Logic Design	3-2-4	ECE 106L, GPHY 112
GSEM 200	Interdisciplinary Seminar and Research	2-2-3	None
TOTAL		**17**	

Semester 4

Course no.	Course title	Credits	Prerequisite(s)
MATH 222	Calculus for Engineers III	3-0-3	MATH 128
ECE 203	Electric Circuit Analysis II	3-0-3	ECE 201L
ECE 204	Signals and Systems	3-1-3	ECE 201L
ECE 211L	Introduction to Electronic Devices	3-2-4	ECE 201L
ECE 252L	Microprocessor Systems	2-3-3	ECE 251L
TOTAL		**16**	

Semester 5

Course no.	Course title	Credits	Prerequisite(s)
ECE 212L	Introduction to Electronic Circuits	2-3-3	ECE 211L
MATH 321	Discrete Mathematics for Engineers	3-0-3	MATH 222
ECE 320L	Digital Communication Systems 1	2-3-3	ECE 204
ECE 340L	Analog Control Systems	2-3-3	ECE 204
Choice	Linguisitic Communication (Foreing Languages)	2-1-2	None
ECE 353L	Advanced Digital System Design (ECE Concentration Compulsory 1 in Microelectronics)	2-3-3	ECE 251L
TOTAL		**17**	

Semester 6

Course no.	Course title	Credits	Prerequisite(s)
STAT 321	Probabilistic Methods in Engineering	3-0-3	GSTA 140
MATH 322	Linear Algebra	3-1-3	MATH 321
Choice	Linguisitic Communication (Arabic)	2-2-3	None
ECE 107L	Computing Methods for Engineers	2-2-3	ECE 103L & MATH 128
ECE 308L	Analog Integrated Circuits (ECE Concentration Compulsory 2 in Microelectronics)	2-3-3	ECE 212L
TOTAL		**15**	

Summer 1

Course no.	Course title	Credits	Prerequisite(s)
ECE 398	Summer Internship I **This course requires the completion of 180 hours of training in industry**	0-4-2	Dept. approval & Completion of 65 credit hours
TOTAL		**2**	

Semester 7

Course no.	Course title	Credits	Prerequisite(s)
MATH 421	Differential Equations	3-1-3	MATH 322
ECE 356	Computer Organization and Architecture	3-0-3	ECE 252L
Choice	Islamic Thoughts and Ethics	2-1-2	None
Choice	Civic Engagement	2	
ECE 309L	Digital Integrated Circuits (ECE Concentration Compulsory 3 in Microelectronics)	2-3-3	ECE 212L
	ECE Concentration Elective 1 in Microelectronics	3	
TOTAL		**16**	

Semester 8

Course no.	Course title	Credits	Prerequisite(s)
Choice	Islamic Thoughts and Ethics	2	None
Choice	Cultural Literacy	3	Choice
PEW-Choice	Physical and environmental wellbeing	2	None
	ECE General Elective 1 from another concentration	3	
ECE 411L	VLSI Design (ECE Concentration Compulsory 4 in Microelectronics)	2-3-3	ECE 212L
	ECE Concentration Elective 2 in Microelectronics	3	
TOTAL		**16**	

Summer 2

Course no.	Course title	Credits	Prerequisite(s)
ECE 498	Summer Internship II **This course requires the completion of 180 hours of training in industry**	0-4-2	ECE 398 & Dept. approval
TOTAL		**2**	

Semester 9

Course no.	Course title	Credits	Prerequisite(s)
Choice	Global Awareness	3	None
	ECE General Elective 2 from another concentration	3	
ECE 370L	Introduction to Electromagnetic Fields (ECE Concentration Compulsory 5 in Microelectronics)	2-3-3	MATH 322 & PHYS 113L
	ECE Concentration Elective 3 in in Microelectronics	3	
ECE 491	ECE Capstone Design Project I	1-2-2	Senior standing & Dept. approval
TOTAL		**14**	

Semester 10

Course no.	Course title	Credits	Prerequisite(s)
Choice	Linguistic Communication (Foreign Languages)	2-1-2	None
	ECE General Elective 3 from another concentration	3	
ECE 492	ECE Capstone Design Project II	1-2-2	ECE 491
TOTAL		**7**	

Note: ECE students may take ECE 499 Co-op course instead of the two Summer Internships ECE 398 and ECE 498.

Course no.	Course title	Credits	Prerequisite(s)
ECE 499	Co-op in Electrical and Computer Engineering **This course offers students the opportunity to spend one full semester in industry or research**	0-8-4	Dept. approval & Completion of 65 credit hours

Technical requirements

ECE students, in consultation with an academic advisor, must complete technical courses that total **33** credit hours as follows:

- **24** credit hours of ECE Concentration requirements:
  - o **15** credit hours of Concentration Compulsory courses
  - o **9** credit hours of Concentration Electives courses
- **9** credit hours from the ECE General Elective courses.

Concentration Compulsory courses in **Microelectronics**: (15 credit hours)

All students in Microelectronics concentration are required to take the following courses (15 credit hours)

Course no.	Course title	Credits	Prerequisite(s)
ECE 308L	Analog Integrated Circuits	2-3-3	ECE 212L
ECE 309L	Digital Integrated Circuits	2-3-3	ECE 212L
ECE 353L	Advanced Digital System Design	2-3-3	ECE 251L
ECE 370L	Introduction to Electromagnetic Fields	2-2-3	MATH 322 & PHYS 113L
ECE 411L	VLSI Design	2-3-3	ECE 212L

Concentration Elective courses in **Microelectronics**: (9 credit hours)

Students in the Microelectronics concentration are required to select any three courses (9 credit hours) form the ECE courses below:

Course no.	Course title	Credits	Prerequisite(s)
ECE 313	Semiconductor Devices	3-0-3	ECE 309L
ECE 315	Optics and Modern Physics	3-0-3	PHYS 113L
ECE 396	Special Topics in Microelectronics	3-0-3	Dept. approval
ECE 412L	Microwave Electronics	2-3-3	ECE 308L
ECE 413L	Optoelectronics	2-3-3	ECE 308L
ECE 416L	Microcontrollers Interfacing and Applications	2-3-3	ECE 308L
ECE 446L	CAD for Mixed-Signal Circuits	2-3-3	ECE 212L
ECE 459L	Embedded Systems Design	2-3-3	ECE 252L
ECE 496	Advanced Topics in Microelectronics	3-0-3	Dept. approval

ECE General Electives: 9 credit hours

ECE students, in consultation with an academic advisor and with the Department approval, must complete courses with total 9 credit hours from either:

1. Courses from the table below including ECE courses from any concentration area other than the student's chosen concentration area.
2. 300 level or more from the Computer Science (CS) Department.
3. Combination of both.

Course no.	Course title	Credits	Prerequisite(s)
PHYS 311	Modern Physics	3-0-3	PHYS 113L
PHYS 411	Quantum Mechanics	3-0-3	PHYS 311
MATH 422	Numerical Analysis	3-1-3	MATH 421
MATH 423	Partial Differential Equations	3-0-3	MATH 421
ECE 253L	Data Structures and Algorithmic Design	2-3-3	ECE103L
ECE 358L	Operating Systems	2-2-3	ECE 356
ECE 445L	Computer Network Architecture	2-2-3	ECE 356
ECE 357L	Object Oriented Programming in C++	2-3-3	ECE 103L
ECE 452	Advanced Digital Computer Architecture	3-0-3	ECE 356
ECE 457	Information Security	3-0-3	ECE 356
ECE 363L	Fund. of Digital Signal Proc.	2-3-3	ECE 204
ECE 432L	Digital Communication Systems 2	2-3-3	ECE 320L
ECE 434L	Mobile Communication Systems	2-3-3	ECE 320L
ECE 480L	Advanced Digital Signal Processing	2-3-3	ECE 363L
ECE 332L	Optical Communication Systems	2-3-3	ECE 320L
ECE 334L	Microwave and RF Communication Systems	2-3-3	ECE 320L
ECE 375	Advanced Electromagnetic Fields	3-0-3	ECE 370L
ECE 381L	Digital Image Processing	2-3-3	ECE 363L
ECE 470L	Antenna Theory and Design	2-3-3	ECE 370L
ECE 472	Radar Systems	3-0-3	ECE 320L & ECE 363L
ECE 473	Adaptive Filter Theory	3-0-3	ECE 370L
ECE 481	Signal Detection and Extraction Theory	3-0-3	STAT 321
ECE 483	Digital Speech Processing	3-0-3	ECE 363L
ECE 349	Modern Control	3-0-3	ECE 340L
ECE 361L	Electromechanical Systems	2-3-3	ECE 203
ECE 362L	Basic Electrical Machines and Transformers	2-2-3	ECE 211L
ECE 458	Synthe. & Verific. of VLSI Systems	3-0-3	ECE 361L
ECE 460	VLSI System Testing	3-0-3	ECE 458
ECE 364	Renewable Electrical Energy	3-0-3	PHYS 113L
ECE 365L	Power Electronics	2-2-3	ECE 212L
ECE 441	Digital Control Systems	3-0-3	ECE 340L
ECE 442L	Instrumentation and Process Control	2-3-3	ECE 340L
ECE 443L	Robot Dynamics and Control	2-3-3	ECE 340L
ECE 465	Electric Drives	3-0-3	ECE 361L
ECE 466	Power System Control	3-0-3	ECE 460

Academic Plan for Electrical and Computer Engineering (ECE)

E) Power and Control Systems concentration 5-Year Study Plan

Semester 1

Course no.	Course title	Credits	Prerequisite(s)
GENG 161	Project Based Language and Critical Thinking	2-1-2	Placement
GMTH 141E	Algebra and Trigonometry	2-2-3	None
GCS 150	Digital Skills: Information and Computer Literacy	2-2-3	None
BIO 113L	Principles of Biology	2-3-3	None
GISL 171	Social and Moral Values in Islam	2-1-2	None
GPHY 112	Foundations in Physics	2-3-3	None
TOTAL		**16**	

Semester 2

Course no.	Course title	Credits	Prerequisite(s)
GENG 263	Engineering Communication	2-1-2	GENG 161
GSTA 140	Elementary Statistics	2-2-3	GMTH 141E
MATH 127	Calculus for Engineers I	2-2-3	GMTH 141E
PHYS 113L	Principles of Electricity and Magnetism	2-3-3	GPHY 112
ECE 103L	Introduction to C++ with Engineering Applications	2-3-3	GCS 150
ECE 106L	Introduction to ECE	1-2-2	None
TOTAL		**16**	

Semester 3

Course no.	Course title	Credits	Prerequisite(s)
MATH 128	Calculus for Engineers II	2-2-3	MATH 127
CHEM 113L	Principles of Chemistry	2-3-3	None
GSEM 200	Interdisciplinary Seminar and Research	2-2-3	None
ECE 201L	Electric Circuit Analysis I	3-2-4	PHYS 113L
ECE 251L	Digital Logic Design	3-2-4	ECE 106L, GPHY 112
TOTAL		**17**	

Semester 4

Course no.	Course title	Credits	Prerequisite(s)
MATH 222	Calculus for Engineers III	3-0-3	MATH 128
ECE 203	Electric Circuit Analysis II	3-0-3	ECE 201L
ECE 204	Signals and Systems	3-1-3	ECE 201L
ECE 211L	Introduction to Electronic Devices	3-2-4	ECE 201L
ECE 252L	Microprocessor Systems	2-3-3	ECE 251L
TOTAL		**16**	

Semester 5

Course no.	Course title	Credits	Prerequisite(s)
ECE 212L	Introduction to Electronic Circuits	2-3-3	ECE 211L
MATH 321	Discrete Mathematics for Engineers	3-0-3	MATH 222
ECE 320L	Digital Communication Systems 1	2-3-3	ECE 204
ECE 340L	Analog Control Systems	2-3-3	ECE 204
Choice	Linguisitic Communication (Foreing Languages)	2-1-2	None
ECE 361L	Electromechanical Systems (ECE Concentration Compulsory 1 in Power and Control Systems)	2-3-3	ECE 203
TOTAL		**17**	

Semester 6

Course no.	Course title	Credits	Prerequisite(s)
STAT 321	Probabilistic Methods in Engineering	3-0-3	GSTA 140
MATH 322	Linear Algebra	3-1-3	MATH 321
Choice	Linguisitic Communication (Arabic)	2-2-3	None
ECE 107L	Computing Methods for Engineers	2-2-3	ECE 103L & MATH 128
ECE 349	Modern Control (ECE Concentration Compulsory 2 in Power and Control Systems)	3-0-3	ECE 340L
	ECE Concentration Elective 1 in Power and Control Systems	3	
TOTAL		**18**	

Summer 1

Course no.	Course title	Credits	Prerequisite(s)
ECE 398	Summer Internship 1 **This course requires the completion of 180 hours of training in industry**	0-4-2	Dept. approval & Completion of 65 credit hours
TOTAL		**2**	

Semester 7

Course no.	Course title	Credits	Prerequisite(s)
MATH 421	Differential Equations	3-1-3	MATH 322
ECE 356	Computer Organization and Architecture	3-0-3	ECE 252L
Choice	Islamic Thoughts and Ethics	2-1-2	None
Choice	Civic Engagement	2	
ECE 362L	Basic Electrical Machines and Transformers (ECE Concentration Compulsory 3 in Power and Control Systems)	2-2-3	ECE 211L
	ECE Concentration Elective 2 in Power and Control Systems	3	
TOTAL		**16**	

Semester 8

Course no.	Course title	Credits	Prerequisite(s)
Choice	Islamic Thoughts and Ethics	2	None
Choice	Cultural Literacy	3	Choice
PEW-Choice	Physical and Environmental Well Being	2	None
	ECE General Elective 1 from another concentration	3	
ECE 458	Synthe. & Verific. of VLSI Systems (ECE Concentration Compulsory 4 in Power and Control Systems)	3-0-3	ECE 361L
	ECE Concentration Elective 3 in Power and Control Systems	3	
TOTAL		**16**	

Summer 2

Course no.	Course title	Credits	Prerequisite(s)
ECE 498	Summer Internship 2 **This course requires the completion of 180 hours of training in industry**	0-4-2	ECE 398 & Dept. approval
TOTAL		**2**	

Semester 9

Course no.	Course title	Credits	Prerequisite(s)
ECE 460	Power Systems Analysis (ECE Concentration Compulsory 5 in Power and Control Systems)	3-0-3	ECE 458
	ECE General Elective 2 from another concentration	3	
ECE 491	ECE Capstone Design Project I	1-2-2	Senior standing & Dept. approval
Choice	Global Awareness	3	None
TOTAL		**11**	

Semester 10

Course no.	Course title	Credits	Prerequisite(s)
Choice	Linguistic Communication (Foreign Languages)	2-1-2	None
	ECE General Elective 3 from another concentration	3	
ECE 492	ECE Capstone Design Project II	1-2-2	ECE 491
TOTAL		**7**	

Note: ECE students may take ECE 499 Co-op course instead of the two Summer Internships ECE 398 and ECE 498.

Course no.	Course title	Credits	Prerequisite(s)
ECE 499	Co-op in Electrical and Computer Engineering **This course offers students the opportunity to spend one full semester in industry or research**	0-8-4	Dept. approval & Completion of 65 credit hours

Technical requirements

ECE students, in consultation with an academic advisor, must complete technical courses that total **33** credit hours as follows:

- **24** credit hours of ECE Concentration requirements:
  - o **15** credit hours of Concentration Compulsory courses
  - o **9** credit hours of Concentration Electives courses
- **9** credit hours from the ECE General Elective courses.

Concentration Compulsory courses in **Power and Control Systems:** (15 credit hours)

All students in Power and Control Systems concentration are required to take the following courses (15 credit hours)

Course no.	Course title	Credits	Prerequisite(s)
ECE 349	Modern Control	3-0-3	ECE 340L
ECE 361L	Electromechanical Systems	2-3-3	ECE 203
ECE 362L	Basic Electrical Machines and Transformers	2-2-3	ECE 211L
ECE 458	Synthe. & Verific. of VLSI Systems	3-0-3	ECE 361L
ECE 460	VLSI System Testing	3-0-3	ECE 458

Concentration Elective courses in **Power and Control Systems**: (9 credit hours)

Students in the Power Control Systems are required to select any three courses (9 credit hours) form the ECE courses below:

Course no.	Course title	Credits	Prerequisite(s)
ECE 364	Renewable Electrical Energy	3-0-3	PHYS 113L
ECE 365L	Power Electronics	2-2-3	ECE 212L
ECE 397	Special Topics in Power and Control	3-0-3	Dept. approval
ECE 441	Digital Control Systems	3-0-3	ECE 340L
ECE 442L	Instrumentation and Process Control	2-3-3	ECE 340L
ECE 443L	Robot Dynamics and Control	2-3-3	ECE 340L
ECE 465	Electric Drives	3-0-3	ECE 361L
ECE 466	Power System Control	3-0-3	ECE 460
ECE 497	Advanced Topics in Power and Control	3-0-3	Dept. approval

ECE General Electives: 9 credit hours

ECE students, in consultation with an academic advisor and with the Department approval, must complete courses with total 9 credit hours from either:

1. Courses from the table below including ECE courses from any concentration area other than the student's chosen concentration area.
2. 300 level or more from the Computer Science (CS) Department.
3. Combination of both.

Course no.	Course title	Credits	Prerequisite(s)
PHYS 311	Modern Physics	3-0-3	PHYS 113L
PHYS 411	Quantum Mechanics	3-0-3	PHYS 311
MATH 422	Numerical Analysis	3-1-3	MATH 421
MATH 423	Partial Differential Equations	3-0-3	MATH 421
ECE 253L	Data Structures and Algorithmic Design	2-3-3	ECE103L
ECE 353L	Advanced Digital System Design	2-3-3	ECE 251L
ECE 358L	Operating Systems	2-2-3	ECE 356
ECE 459L	Embedded Systems Design	2-3-3	ECE 252L
ECE 445L	Computer Network Architecture	2-2-3	ECE 356
ECE 357L	Object Oriented Programming in C++	2-3-3	ECE 103L
ECE 452	Advanced Digital Computer Architecture	3-0-3	ECE 356
ECE 446L	CAD for Mixed-Signal Circuits	2-3-3	ECE 212L
ECE 457	Information Security	3-0-3	ECE 356
ECE 411L	VLSI Design	2-3-3	ECE 212L
ECE 308L	Analog Integrated Circuits	2-3-3	ECE 212L
ECE 309L	Digital Integrated Circuits	2-3-3	ECE 212L
ECE 353L	Advanced Digital System Design	2-3-3	ECE 251L
ECE 370L	Introduction to Electromagnetic Fields	2-2-3	MATH 322 & PHYS 113L
ECE 313	Semiconductor Devices	3-0-3	ECE 309L
ECE 315	Optics and Modern Physics	3-0-3	PHYS 113L
ECE 412L	Microwave Electronics	2-3-3	ECE 308L
ECE 413L	Optoelectronics	2-3-3	ECE 308L
ECE 416L	Microcontrollers Interfacing and Applications	2-3-3	ECE 308L
ECE 459L	Embedded Systems Design	2-3-3	ECE 252L
ECE 363L	Fund. of Digital Signal Proc.	2-3-3	ECE 204
ECE 432L	Digital Communication Systems 2	2-3-3	ECE 320L
ECE 434L	Mobile Communication Systems	2-3-3	ECE 320L
ECE 480L	Advanced Digital Signal Processing	2-3-3	ECE 363L
ECE 332L	Optical Communication Systems	2-3-3	ECE 320L
ECE 334L	Microwave and RF Communication Systems	2-3-3	ECE 320L
ECE 375	Advanced Electromagnetic Fields	3-0-3	ECE 370L
ECE 381L	Digital Image Processing	2-3-3	ECE 363L
ECE 470L	Antenna Theory and Design	2-3-3	ECE 370L
ECE 472	Radar Systems	3-0-3	ECE 320L & ECE 363L
ECE 473	Adaptive Filter Theory	3-0-3	ECE 370L
ECE 481	Signal Detection and Extraction Theory	3-0-3	STAT 321
ECE 483	Digital Speech Processing	3-0-3	ECE 363L

Summary table of Electrical and Computer Engineering courses

Course no.	Course title	Credits	Prerequisite(s)
ECE 103L	Introduction to C++ with Engineering Applications	2-3-3	GCS 150
ECE 106L	Introduction to ECE	1-2-2	None
ECE 107L	Computing Methods for Engineers	2-2-3	ECE 103L & MATH 128
ECE 201L	Electric Circuit Analysis I	3-2-4	PHYS113L
ECE 203	Electric Circuit Analysis II	3-0-3	ECE 201L
ECE 204	Signals and systems	3-1-3	ECE 201L
ECE 211L	Introduction to Electronic Devices	3-2-4	ECE 201L
ECE 212L	Introduction to Electronic Circuits	2-3-3	ECE 211L
ECE 251L	Digital Logic Design	3-2-4	ECE 106L & GPHY 112L
ECE 252L	Microprocessor Systems	2-3-3	ECE 251L
ECE 253L	Data Structures and Algorithmic Design	2-3-3	ECE103L
ECE 308L	Analog Integrated Circuits	2-3-3	ECE 212L
ECE 309L	Digital Integrated Circuits	2-3-3	ECE 212L
ECE 313	Semiconductor Devices	3-0-3	ECE 309L
ECE 315	Optics and Modern Physics	3-0-3	PHYS 113L
ECE 320L	Digital Communication Systems 1	2-3-3	ECE 204
ECE 332L	Optical Communication Systems	2-3-3	ECE 320L
ECE 334L	Microwave and RF Communication Systems	2-3-3	ECE 320L
ECE 340L	Analog Control Systems	2-3-3	ECE 204
ECE 349	Modern Control	3-0-3	ECE 340L
ECE 353L	Advanced Digital System Design	2-3-3	ECE 251L
ECE 356	Computer Organization and Architecture	3-0-3	ECE 252L
ECE 357L	Object Oriented Programming in C++	2-3-3	ECE 103L
ECE 358	Operating Systems	2-2-3	ECE 356
ECE 361L	Electromechanical Systems	2-3-3	ECE 203
ECE 362L	Basic Electrical Machines and Transformers	2-2-3	ECE 211L
ECE 364	Renewable Electrical Energy	3-0-3	PHYS 113L
ECE 365L	Power Electronics	2-2-3	ECE 212L
ECE 370L	Introduction to Electromagnetic Fields	2-2-3	MATH 322 & PHYS 113L
ECE 375	Advanced Electromagnetic Fields	3-0-3	ECE 370L
ECE 363L	Fund. of Digital Signal Proc.	2-3-3	ECE 204
ECE 381L	Digital Image Processing	2-3-3	ECE 363L
ECE 394	Special Topics in Computer Engineering	3-0-3	Dept. approval
ECE 395	Special Topics in Communication and Signal Processing	3-0-3	Dept. approval
ECE 396	Special Topics in Microelectronics	3-0-3	Dept. approval
ECE 397	Special Topics in Power and Control	3-0-3	Dept. approval
ECE 398	Summer Internship I	0-4-2	Dept. approval & Completion of 65 credit hours
ECE 411L	VLSI Design	2-3-3	ECE 212L
ECE 412L	Microwave Electronics	2-3-3	ECE 308L
ECE 413L	Optoelectronics	2-3-3	ECE 308L

Course no.	Course title	Credits	Prerequisite(s)
ECE 416L	Microcontrollers Interfacing and applications	2-3-3	ECE 308L
ECE 432L	Digital Communication Systems 2	2-3-3	ECE 320L
ECE 434 L	Mobile Communication Systems	2-3-3	ECE 320L
ECE 441	Digital Control Systems	3-0-3	ECE 340L
ECE 442L	Instrumentation and Process Control	2-3-3	ECE 340L
ECE 443L	Robot Dynamics and Control	2-3-3	ECE 340L
ECE 445L	Computer Network Architecture	2-2-3	ECE 356
ECE 452	Advanced Digital Computer Architecture	3-0-3	ECE 356
ECE 446L	CAD for Mixed-Signal Circuits	2-3-3	ECE 212L
ECE 457	Information Security	3-0-3	ECE 356
ECE 459L	Embedded Systems Design	2-3-3	ECE 252L
ECE 458	Synthe. & Verific. of VLSI Systems	3-0-3	ECE 361L
ECE 460	VLSI System Testing	3-0-3	ECE 458
ECE 465	Electric Drives	3-0-3	ECE 361L
ECE 466	Power System Control	3-0-3	ECE 460
ECE 470L	Antenna Theory and Design	2-3-3	ECE 370L
ECE 472	Radar Systems	3-0-3	ECE 320L & ECE 363L
ECE 473	Adaptive Filter Theory	3-0-3	ECE 370L
ECE 480L	Advanced Digital Signal Processing	2-3-3	ECE 363L
ECE 481	Signal Detection and Extraction Theory	3-0-3	STAT 321
ECE 483	Digital Speech Processing	3-0-3	ECE 363L
ECE 491	ECE Capstone Design Project I	1-2-2	Senior standing & Dept. approval
ECE 492	ECE Capstone Design Project II	1-2-2	ECE 491
ECE 494	Advanced Topics in Computer Engineering	3-0-3	Dept. approval
ECE 495	Advanced Topics in Communication and Signal Processing	3-0-3	Dept. approval
ECE 496	Advanced Topics in Microelectronics	3-0-3	Dept. approval
ECE 497	Advanced Topics in Power and Control	3-0-3	Dept. approval
ECE 498	Summer Internship II	0-4-2	ECE 398 & Dept. approval
ECE 499	Co-op in Electrical and Computer Engineering	0-8-4	Dept. approval & Completion of 65 credit hours

Course descriptions for ECE General requirements and ECE Concentration requirements

ECE 103L: Introduction to C++ with Engineering Applications (2-3-3) Prerequisite(s): GCS 150

This course introduces undergraduate students to the fundamental principles of programming for solving engineering problems, using the C++ programming language. It familiarizes students with the process of computational thinking and the translation of real-life engineering problems to computation problems. It further describes the basic techniques of systematic software design. It provides fundamental knowledge in basic programming concepts such as program flow control, memory management, and elementary data structure and algorithm designs.

ECE 106L: Introduction to ECE (1-2-2) Prerequisite(s): None

In this course, students are introduced to the basic concepts of ECE through laboratory experiments. Students get familiar with the basic measurement instruments in the labs in the ECE department. Simple experiments include: DC circuits, electromagnets, DC motors, and electronic devices such as diodes, LEDs, transistors, operational amplifiers, sensors, feedback control circuits, digital-logic circuits, pulse-width modulation and communication circuits, and basic computer organization.

ECE 107L: Computing Methods for Engineers (2-2-3) Prerequisite(s): ECE 103L & MATH 128

In this course, students are introduced to computational methods in engineering such as programming flowcharts, an introduction to MATLAB, MATLAB commands, and applications of MATLAB in solving the engineering and mathematical problems such as of finding the roots of equations, solving simultaneous linear equations, and matrix operations.

ECE 201L: Electric Circuit Analysis I (3-2-4) Prerequisite(s): PHYS 113L

Circuit variables and elements; simple resistive circuits with the use of Ohm's law and Kirchhoff' laws; techniques for analyzing linear circuits: Nodal and mesh analysis, superposition and linearity, star-delta and delta-star transformations, Thevenin and Norton equivalent circuits, source transformation and the concept of maximum power transfer; operational amplifiers; energy-storage elements: inductance, capacitance and mutual inductance; response of first-order RL and RC circuits; natural and step response of RLC circuits; introduction to phasors and impedances, sinusoidal steady-state analysis. Simulating circuits using available software as LabView or multisim.

ECE 203: Electric Circuit Analysis II (3-0-3) Prerequisite(s): ECE 201L

This course focuses on electric circuit techniques for the analysis of linear AC electric circuits, and measurements of their properties. Topics include AC sources, RMS, Average value, sinusoids and phasors, sinusoidal steady-state analysis using Node, mesh, The venin's methods, AC power analysis, single-phase and three phase circuit analysis, frequency response and filter applications, Laplace and Fourier series application in circuit analysis involving non-sinusoidal sources, two-port-network analysis.

ECE 204: Signals and Systems (3-1-3) Prerequisite(s): ECE 201L

This course provides an introduction to continuous, discrete signal representation and classification, system classification and response, and transfer functions. Topics include Fourier series, Fourier transform, Laplace transform, and Z transform. Applications include convolution, stability, phasors, frequency response, modulation, sampling, filtering, and Fund. of Digital Signal Proc. with applications to active filters, and AM radio.

ECE 211L: Introduction to Electronic Devices (3-2-4) Prerequisite(s): ECE 201L

Fundamentals of semiconductor physics, device modelling, basic device operation, I-V characteristics, temperature effects, capacitance effects, equivalent circuit and simulation programs with integrated circuit emphasis SPICE based models, high frequency and switching properties of PN junction diodes, bipolar-junction transistors, metal oxide semiconductor (MOS) capacitors, and metal oxide semiconductor field effect transistors (MOSFETs). Application to basic electronic circuits.

ECE 212L: Introduction to Electronic Circuits (2-3-3) Prerequisite(s): ECE 211L

Analog-circuits: amplifier models, frequency response, differential amplifiers, and feedback amplifiers. Digital-circuits: basic inverter operation, static logic circuits and gates, dynamic logic circuits and gates, combinational and sequential circuits, static memory circuits, dynamic memory circuits, and non-volatile memories. Extensive use of SPICE for circuit simulation.

ECE 251L: Digital Logic Design (3-2-4) Prerequisite(s): ECE 106L & GPHY112L

Introduction to digital concepts and number systems. Representation of functions using canonical forms: sum of minterms and product of maxterms. Boolean algebra and switching theory. Manipulation and minimization of completely and incompletely specified Boolean functions. Timing diagram and propagation delay. Implementations of functions using universal gates such NAND and NOR gates. Design of combinational networks: adder/subtracter, code converter, magnitude comparator, decoder, encoder, and multiplexer. Design of combinational circuits using MSI devices. Sequential circuit analysis and design: basic flip-flops, clocking and timing diagrams. Registers, shift registers, counters and their applications. ROMs, PALs and PLAs. Computer simulation will be used to validate designs. Prototypes will be constructed to demonstrate design functionality.

ECE 252L: Microprocessor Systems (2-3-3) Prerequisite(s): ECE 251L

Introduction to microcomputer systems, microprocessor architecture, assembly language programming, instruction formats and types, addressing modes, memory and I/O subsystems, memory interfacing, basic I/O interfacing, practice of the design of a microprocessor system design, testing, debugging.

ECE 253L: Data Structures and Algorithmic Design(2-3-3) Prerequisite(s): ECE 103L

Logic designs of programs (i.e. how to program with a focus on data abstractions). Algorithmic analysis and concepts of data, linear lists, strings, arrays, trees, graphs, and the related storage of representations and structures. Applications include expression conversion, sorting, searching, and dynamic storage allocation. Use of C++ to implement the algorithms.

ECE 308L: Analog Integrated Circuits (2-3-3) Prerequisite(s): ECE212L

Analog integrated circuits biasing and active loads; differential amplifiers; ideal operational amplifier structures, circuits, applications and building blocks for analog signal processing including operational trans conductance amplifiers; application and design of integrated circuits: active filters, oscillators, comparators, voltage regulators, Schmitt trigger and timers; Extensive use of industry-standard computer aided design (CAD) tools., Schmitt trigger and timers; Extensive use of industry-standard computer aided design (CAD) tools.

ECE 309L: Digital Integrated Circuits (2-3-3) Prerequisite(s): ECE 212L

Characteristics of ideal and practical digital integrated circuits; IC logic families; Switching characteristics, power consumption, noise margin, propagation delay, fan in, and fan out in metal oxide semiconductor (MOS) and bipolar devices; interconnect between different families; analysis of digital circuits implemented in n-channel metal oxide semiconductor (NMOS); Complementary metal oxide semiconductor (BiCMOS); analysis of logic (inverters, gates) and memory circuits such as static random access memory (SRAM) and dynamic random access memory (DRAM); influence of technology and device structure on performance and reliability of digital integrated circuits; simulation programs with integrated circuit emphasis (SPICE) are considered.

ECE 313: Semiconductor Devices (3-0-3) Prerequisite(s): ECE 309L

Solid state physics, energy bands, fundamental semiconductor device physics associated with semiconductor materials and devices with an in-depth coverage of p-n, Schottky diodes, LEDs, bipolar junction transistors, phototransistor, solar cells, CCDs, metal-oxide-semiconductor and junction field effect transistors.

ECE 315: Optics and Modern Physics (3-0-3) Prerequisite(s): PHYS 113L

Geometric Optics, Physical Optics, Paraxial Theory, Lenses, Mirrors, Prism, Fiber-optics, Analytical way tracing, Superposition of Waves, Polarization, Interference, Diffraction, Coherence Theory, Particle properties of waves, Wave properties of Particles, atomic Structure, Bohr Model of the Atom, Schrödinger's Equation, Atomic Spectra, Molecular Spectra, Quantum Statistics, Applications of Quantum Mechanics.

ECE 320L: Digital Communication Systems 2 1 (2-3-3) Prerequisite(s): ECE 204

Basic components of a Communication System, Digital Low-pass, band-pass and high-pass filters. Continuous-time Fourier Transform and its properties. Sine wave Amplitude modulation, Suppressed Carrier and Double side band Amplitude modulation, Frequency modulation and Phase modulation. Frequency division Multiplexing. Phase synchronization issues with Carrier. Frequency shift keying and pulse amplitude modulation. Concept of digital modulation.

ECE 340L: Analog Control Systems (2-3-3) Prerequisite(s): ECE 204

Introduction to feedback control system , Block diagram and signal flow graph system models, servomechanism characteristics, steady-state errors, sensitivity to parameter variations and disturbance signals, Time domain performance specifications, stability, root locus, Nyquist, Bode diagram analysis, design of compensation circuits, closed loop frequency response determination, Introduction to time domain analysis and design.

ECE 332L: Optical Communication Systems (2-3-3) Prerequisite(s): ECE 320L

This course deals with the operating principles of optical communications systems and fiber optic communication technology. Topics covered include: overview of optical fibers and light transmission, attenuation and dispersion in fibers, optical sources (LED), optical modulators, optical receivers, optical amplifier (EDFA), wavelength division multiplexing concepts, and Optical Networks.

ECE 334L: Microwave and RF Communication Systems (2-3-3) Prerequisite(s): ECE 320L

RF filter design, active microwave diode and transistors, S-parameters, microwave amplifier design, microwave oscillator, microwave receiver and transmitter. Microwave mixer and modulator.

ECE 349: Modern Control (3-0-3) Prerequisite(s): ECE 340L

Mathematical description of linear Systems- structure of linear systems-state variable formulation and solution-transition matrix, diagonalization, canonical forms and minimal realization, Lyapunov's theorem, state feedback and decoupling, optimal control and observers.

ECE 353L: Advanced Digital System Design (2-3-3 Prerequisite(s): ECE 251L

Designing of digital circuits and systems. Logic minimization techniques, hazards, design of clocked sequential circuits, analysis and design of asynchronous circuits, Finite state machines. The use of modern EDA tools in the design, simulation, synthesis and implementation is explored. Application of a hardware description language such as Verilog or VHDL to model digital systems at Behavior and RTL level is studied. Field programmable gate arrays (FPGA) are used in the laboratory exercises as a tool to understand complete design-flow.

ECE 356: Computer Organization and Architecture (3-0-3) Prerequisite(s): ECE 252L

Introduction to computer organization, instruction set, integer and floating-point arithmetic, CPU performance and metrics, non-pipelined and pipelined processor design, data path and control unit, pipeline hazards, memory system and cache memory.

ECE 357L: Object Oriented Programming in C++ (2-3-3) Prerequisite(s): ECE 103L

This course presents the C++ programming language. The language constructs discussed include classes, inheritance, encapsulation, polymorphism, class derivation, abstract classes, interfaces, static class members, object construction and destruction, namespaces, exception handling, function overloading and overriding, function name overload resolution, container classes, template classes.

ECE 358L: Operating Systems (2-2-3) Prerequisite(s): ECE 356

This course introduces the fundamentals of operating systems design and implementation. Topics include history and evolution of operating systems; Types of operating systems; Operating system structures; Process management: processes, threads, CPU scheduling, process synchronization; Memory management and virtual memory; File systems; I/O systems; Security and protection; Distributed systems; Case studies.

ECE 361L: Electromechanical Systems (2-3-3) Prerequisite(s): ECE 203

Application of fundamental laws (Faraday, Ampere, Gauss) to magnetic circuits, Permanent magnets, Equations of motion and the thermodynamics of electromechanical coupling. Transformers, Induction machines, Synchronous machines, DC machines, Reluctance machines, Electromechanical actuators and transducers.

ECE 362L: Basic Electrical Machines and Transformers (2-2-3) Prerequisite(s): ECE 211

This course deals with various types of electric machines and transformers. It includes the following topics: Review of electric circuits; theory of rotating magnetic field; DC machines: construction, equivalent circuit, operation as a generator and as a motors: operating characteristics, starting procedure, and speed control; single phase transformers. 3-phase systems; Synchronous generator: construction, equivalent circuit, operation. Induction motors: construction, equivalent circuit, operation operating characteristics and starting procedure.

ECE 364: Renewable Electrical Energy (3-0-3) Prerequisite(s): PHYS 113L

Energy conversion, utilization and storage for renewable technologies such as wind, solar, biomass, fuel cells and hybrid systems, thermodynamics concepts (including the first and second law) will form the basis for modelling the renewable energy systems. The course also touches upon the environmental consequences of energy conversion and how renewable energy can reduce air pollution and global climate change.

ECE 365L: Power Electronics (2-2-3) Prerequisite(s): ECE 212L

Power electronics device characteristics and their applications, important circuit component design and analysis concepts, uncontrolled and phase controlled rectifier circuits, DC to DC converters, switching power supply, pulse width modulation, AC to DC Converter, utility interference and harmonic issues for power electronics Circuits.

ECE 370L: Introduction to Electromagnetic Fields (2-2-3) Prerequisite(s): MATH 322 & PHYS 113L

Vector analysis, coordinate systems, Coulombs law, electrostatic field, Gauss's law, electrostatic potential, and capacitance. Biot savart law, magneto static field, Ampere's law, magnetic vector potential and inductance. Maxwell's equation, solution of Maxwell's equations and wave propagation in different media. Electromagnetic wave reflection and transmission from boundaries between two different media at normal and oblique incidence.

ECE 375: Advanced Electromagnetic Fields (3-0-3) Prerequisite(s): ECE 370L

This course is the second course in electromagnetic fields. Topics include: Electromagnetic Wave Theory, Electromagnetic theory applied to microwave propagation in waveguides, coaxial lines, Microstrip lines, and Striplines. Microwave circuit theory applied to matching networks and passive microwave devices. S-parameters, ABCD parameters, couplers, and equivalent circuits.

ECE 363L: Fund. of Digital Signal Proc. (2-3-3) Prerequisite(s): ECE 204

Introduction to Discrete-time Signals and Systems. Sampling Issues and Shannon Sampling Theorem. Continuous-time Fourier series and Discrete-time Fourier Transform. LTI systems and Discrete convolution. Finite Impulse Response (FIR) Filters. Frequency Response of FIR filters. Z-transform. Infinite-Impulse Response Filters. Application of DSP in noise removal.

ECE 381L: Digital Image Processing (2-3-3) Prerequisite(s): ECE 363L

This course deals with the study of image formation, perception and processing. Image acquisition and display, properties of the digital image, types of noise, color representations, image sampling and quantization, point operations, linear image filtering and correlation, image transforms and sub-band decompositions, edge detection, contrast and color enhancement, image segmentation, image restoration, image matching, image compression and coding.

ECE 394: Special Topics in Computer Engineering (3-0-3) — Prerequisite(s): Dept. approval

This course in to present special topics of study related to the Computer Engineering Concentration tailored to fit the needs of small groups. Consent of instructor is required. An overview of CAD tools for system design, implementation and analysis, Determine requirements for engineering and scientific problems solutions.

ECE 395: Special Topics in Communications and Signal Processing (3-0-3) — Prerequisite(s): Dept. approval

This course is to present special topics of study related to the Communication and Signal Processing Concentration tailored to fit the needs of small groups. Consent of instructor is required. The course topics may include any materials related to the Communication and Signal Processing Concentration. This includes, but not limited to, the following topics: optimization in communications and signal processing, MIMO systems, advanced digital communications, information theory, multiuser communication, stochastic processes, detection and estimation, error-control coding, etc.

ECE 396: Special Topics in Microelectronics (3-0-3) — Prerequisite(s): Dept. approval

This course in to present special topics of study related to the Microelectronics Concentration tailored to fit the needs of small groups. Consent of instructor is required. The course topics can include any material correlated to the concentration. Sophisticated software package is utilized in the analysis and design phase of the scientific related problems.

ECE 397: Special Topics in Power and Control (3-0-3) — Prerequisite(s): Dept. approval

Recent power Selected topics related to the Power and Control as: current and smart-grid implementation – Transient stability – Three-phase improved power quality ac-dc and dc-ac – Power quality mitigation devices – FACTS devices- (High voltage direct current) system- Design advanced controllers for engineering systems

ECE 398: Summer Internship I (0-4-2) — Prerequisite(s): Dept. approval & Completion of 65 credit hours

This course requires the completion of 180 hours of training in industry where the students will experience a real job environment while being involved in a ECE-related project. They apply their academic knowledge and acquired skills by working on ECE-related tasks. This course requires students to document and report on their work experience.

ECE 411L: VLSI Design (2-3-3) — ECE 212L

CMOS Dynamic & Other Logic: Dynamic CMOS Logic (Recharge/Evaluate), Charge Sharing, Domino logic, NORA CMOS logic, True Single-Phase Clock (TSPC) logic. Second-Order Considerations: MOS transistor scaling, Small geometry & second order effects. VLSI Design Styles: Custom vs. Semicustom techniques, Standard Cells, Gate Arrays, and FPGAs.

ECE 412L: Microwave Electronics (2-3-3) — Prerequisite(s): ECE 308L

This course reviews transmission-line theory and analysis. Topics include: waveguides typically used in microwave circuit design, network theory of circuits and transmission lines (Z,Y,ABCD, and S-Parameters), network Analysis (signal flow graphs), design and analyze matching networks using transmission line analysis, design and analyze power dividers, combiners, and directional couplers, design and analyze passive microwave filters using the image parameter method and the insertion loss method, transform filter designs into actual waveguide circuits, the design of microwave amplifiers and oscillators.

ECE 413L: Optoelectronics (2-3-3) — Prerequisite(s): ECE 308L

Basic knowledge of theoretical and methodological problems of optoelectronics; application of this knowledge in the design and operation of basic types of optoelectronic systems; Basic Physics of Light, Light Sources, Natural Light Sources, Gas Discharge Lamps, Light Emitting Diodes, Photodiodes, Solar Cells, Photo-Transistor, Infrared Detectors. Opto-isolators, Displays, Digital Display Technology, LED Displays and Liquid Crystal Displays; Gas and Ruby Lasers, Semiconductor Injection Lasers; Fiber Couplers; Wavelength Division Multiplexers, Optoelectronic Integrated Circuits. Fiber Optic Communication Systems, Optical Fiber Sensor Technology, Optical Signals Processing, Optical Information Processing, Optical Computing.

ECE 416L: Microcontrollers Interfacing and applications (2-3-3) — Prerequisite(s): ECE 308L

Advanced concepts in programming and interfacing microcontrollers for a variety of engineering applications. Architecture and operation of modern PIC microcontrollers and I/O peripherals. Design methodology for software and hardware applications. Design and interfacing of microcontroller with digital input/output/parallel I/O devices and analog devices as ADC/DAC/sensors. Applications and implementation of time-based I/O. Protocols based serial I/O. High-level languages are used to interface the microcontrollers to various applications.

ECE 432L: Digital Communication Systems 2 (2-3-3) — Prerequisite(s): ECE 320L

System level analysis and design for digital communications systems: analog-to-digital conversion, quantization, pulse code modulation, differential pulse code modulation, delta modulation, digital baseband communications, carrier modulation formats, matched filters, bandwidth efficiency, receiver design, link budgets, signal-to-noise ratio, bit error rates in additive-white-noise Gaussian (AWGN) channels, and code division multiple access.

ECE 434L: Mobile Communication Systems (2-3-3) — Prerequisite(s): ECE 320L

Wireless Propagation, shadowing, multipath fading, Multiple access schemes: FDMA, TDMA, CDMA, Cellular communications, Diversity, Equalization, Channel coding, Performance Analysis, Error Probability, Wireless systems and standards (1G/2G/3G/4G systems).

ECE 441: Digital Control Systems (3-0-3) — Prerequisite(s): ECE 340L

Introduction to discrete time systems, Signal conversion & processing, the z-transform, Transfer function, block diagrams, & signal flow graphs, The state variable technique, Time-domain and z-domain analysis, Digital simulation and digital redesign, Design of discrete-data control systems.

ECE 442L: Instrumentation and Process Control (2-3-3) — Prerequisite(s): ECE 340L

This course presents the application of automatic control in industrial processes. topics include; control loop hardware; mathematical modelling of industrial processes for control purposes; dynamic behavior of processes; development of dynamic models from experimental data for control purposes; basic components of control systems; design of single-loop control systems; controller tuning techniques; introduction to frequency domain methods; experimental rigs on process control.

ECE 443L: Robot Dynamics and Control (2-3-3) — Prerequisite(s): ECE 340L

Fundamental concepts in robotics, basic configurations of manipulator arm design; coordinate transformations, forward and inverse kinematics; velocity kinematics; motion planning; trajectory generation; sensing, vision; feedback control.

ECE 445L: Computer Network Architecture (2-2-3) — Prerequisite(s): ECE 356

Introduction to Computer Network Architecture and digital communications with a focus on Internet protocols, Application layer architectures (client/server, peer-to-peer) and protocols (HTTP-web, SMTP-mail, etc), Transport layer operation: (reliable transport, congestion and flow control, UDP, TCP); Network layer operation – (routing, addressing, IPv4 and IPv6), Data Link layer operation (error detection/correction, access control, Ethernet, 802.11, PPP), Layer 2/3 protocols (ATM and MPLS); selected current topics such as: security, multimedia protocols, Quality of Service, mobility, wireless networking, emerging protocols, network management.

ECE 452: Advanced Digital Computer Architecture (3-0-3) — Prerequisite(s): ECE 356

It covers the architecture and organization of modern computing systems including: pipelined machines, multiprocessing, superscalar architectures, Very Large Instruction Word architecture, Architectures for Parallel Computation, and Architectures for Low Power Consumption, Cache mapping and replacement algorithms, Cache coherence, techniques and tools for quantitative analysis and evaluation of modern computing systems and their components.

ECE 446L: CAD for Mixed-Signal Circuits (2-3-3) — Prerequisite(s): ECE 356

It covers modern mixed signal system design methodologies. The focus is on the industrial CAD based mixed signal electronics design and verification along with the mixed signal conditioning and processing concept building. It covers system description, components choice, system schematic design and CAD based electric simulations for the functional verification. Structural design of the system analog and digital modules. System modules design with the analog mixed signal hardware description language and industrial CAD tools that automatically simplify and synthesize the design. The system, analog and digital modules, integration strategies and testing methodologies will also be covered.

ECE 457: Information Security (3-0-3) — Prerequisite(s): ECE 356

Introduction to computer security (concepts, threats, attacks, assets, scope, trends). Cryptographic protocols and standards. Integrity verification mechanisms. Wireless network security and associated protocols. Software tools to apply security in user environments. Access Control models and mechanisms. Database security, Intrusion detection systems, Firewalls. Malicious software, DoS attacks, Trusted computing and multilevel security.

459L: Embedded Systems Design (2-3-3) — Prerequisite(s): ECE 252L

Introduction to Embedded Systems, Microcontroller Hardware, FPGAs, CPU Programming. Memory and I/O, Interfacing: Parallel and Serial Communication, A/D and D/A conversion, Embedded system design methodologies, Specifications, hardware and software co-design for embedded systems, basics of the RTOS features.

ECE 458: Synthe. & Verific. of VLSI Systems (3-0-3) — Prerequisite(s): ECE 361L

Electrical power system, generators, transformers, transmission line, mechanical design of transmission line, overhead line insulators, underground cables, grounding and safety techniques.

ECE 460: Power Systems Analysis (3-0-3) — Prerequisite(s): ECE 458

Analysis of power flow (using Gauss Seidel and Newton Raphson methods), balanced fault, fault analysis, symmetrical components and unbalanced fault, power system stability (using equal area criterion), optimal dispatch of generation. Simulation using MATLAB and SIMULINK is used through the course.

ECE 465: Electric Drives (3-0-3) Prerequisite(s): ECE 361L

DC machine control, variable frequency operation of induction and synchronous machines, unbalanced operation, scaling laws, adjustable speed drives, adjustable torque drives, coupled circuit modelling of ac machines.

ECE 466: Power Systems Control (3-0-3) Prerequisite(s): ECE 460

Modern power-system operation, control problems, solution techniques, active and reactive power, voltage control, unit commitment and economic dispatch, computer control of power systems, load-frequency control and automatic generation control, load flow analysis and external equivalents for steady-state operations.

ECE 470L: Antenna Theory and Design (2-3-3) Prerequisite(s): ECE 370L

This course is focused on wave propagation in free-space, polarization, antenna parameters, directive gain, power gain; effective area, effective length; input impedance, radiation resistance; antenna temperature, basic antenna types: dipole antenna; reflector antenna; dielectric rod antenna, antenna array, broadband antenna design: spiral antenna, log-periodic antenna. Microstrip-patch antenna, antenna measurements.

ECE 472: Radar Systems (3-0-3) Prerequisite(s): ECE 320L and ECE 363L

This course introduces the principles of radar systems. Topics include radar equation and definition of RCS, basic concepts and measurements, radar equation, examples of simple radar systems, analysis of system noise rejection (SNR), detection theory, parametric description of antennas, range and range ambiguity, Doppler and velocity measurements, images from range-Doppler mapping, imaging with SLR and SAR, signal coding in imaging, ambiguity function.

ECE 473: Adaptive Filter Theory (3-0-3) Prerequisite(s): ECE 370L

Adaptive Fund. of Digital Signal Proc. with emphasis on theory and design of finite-impulse response adaptive filters. Stationary discrete-time stochastic processes, Wiener filter theory, the Method of steepest descent, adaptive transverse filters using gradient-vector estimation, analysis of the LMS algorithm, least-squares methods, recursive least squares and least squares lattice adaptive filters. Application examples in noise cancelling, channel equalization, and array processing.

ECE 480L: Advanced Digital Signal Processing (2-3-3) Prerequisite(s): ECE 363L

Approximation of filter specifications. Advanced digital filter design techniques. Implementation issues for digital filters, sensitivity and quantization noise. Decimation and interpolation of discrete-time signals. Fourier analysis of signals using Discrete Fourier transform. Parametric signal modeling. Discrete Hilbert transforms. Comprehensive use of software tools (e.g. MATLAB).

ECE 481: Signal Detection and Extraction Theory (3-0-3) Prerequisite(s): STAT 321

Introduction to signal-detection and information-extraction. Topics include: vector spaces of random variables; Bayesian and Neyman-Pearson hypothesis testing; Bayesian and non-random parameter estimation; minimum-variance unbiased estimators and the Cramer-Rao bounds; representations for stochastic processes, shaping and whitening filters, and detection and estimation from waveform observations.

ECE 483: Digital Speech Processing (3-0-3)Prerequisite(s): ECE 363L

Theory and practice of recognition technology: pattern classification, pattern recognition, automatic computer decision-making algorithms. Bayesian Decision Theory, Linear Discriminant Functions, Support vector Machines, Neural Networks, Applications covered include medical diseases, severe weather, industrial parts, biometrics, animal behaviour patterns, image processing, and human visual systems. Perception as an integral component of intelligent systems. This course prepares students for advanced study of data fusion, data mining, knowledge base construction, problem-solving methodologies of intelligent agents, and the design of intelligent control systems.

ECE 491: ECE Capstone Design Project I (1-2-2) Prerequisite(s): Senior standing & Dept. approval

Students will design, document, and analyze a proposed prototype. Topics include: Iteration in design, design review, reviewing previous design, communicating with other instruction and/or industry, making effective presentations, project management, ethics and standards, written proposal, and oral presentations.

Students are required to complete a design project that complements the technical content of the curriculum. This project will prepare for engineering practice through a demonstration of the integration of knowledge and skills acquired in earlier coursework. This project will incorporate appropriate and identified engineering standards using multiple realistic constraints outlined in the specifications of the project. The formal design will be presented to the class for review and evaluation. In ECE 492, students are required to produce a prototype of their design.

ECE 494: Advanced Topics in Computer Engineering (3-0-3) Prerequisite(s): Dept. approval

This course is to present advanced topics of study related to the Computer Engineering Concentration tailored to fit the needs of small groups. Consent of instructor is required. An overview of computer hardware and software, Programming tools, Behavioral and structural modeling technique, Problem solving and algorithm development, Determine requirements for engineering and scientific problems solutions.

ECE 495: Advanced Topics in Communications and Signal Processing (3-0-3) Prerequisite(s): Dept. approval

This course is to present advanced special topics in the fields of Communication and Signal Processing tailored to fit the needs of small groups. Consent of instructor is required. The course topics may include any materials related to the Communication and Signal Processing Concentration. This includes, but not limited to, the following topics: Convex optimization in communications and signal processing, multiuser information theory, MIMO systems, advanced modulation techniques, green communications, free-space optical communications, etc.

ECE 496: Advanced Topics in Microelectronics (3-0-3) Prerequisite(s): Dept. approval

This course is to present advanced topics of study related to the Microelectronics Concentration tailored to fit the needs of small groups. Consent of instructor is required. The course topics may include any materials related to the microelectronics concentration. This includes, but not limited to, the following topics: RF integrated circuits, nano technology, MEMS, etc.

ECE 497: Advanced Topics in Power and Control (3-0-3) Prerequisite(s): Dept. approval

Modelling of generators, transmission lines and loads, energy conversion using power electronics devices, active and reactive power control using Flexible AC Transmission Systems (FACTS), renewable energy sources (wind and solar), integration of renewable with conventional electric sources (microgrid and smart grid), conventional and evolutionary optimization techniques for control design.

ECE 498: Summer Internship II (0-4-2) Prerequisite(s): ECE 390 & Dept. approval

This course requires the completion of 180 hours of training in industry of summer work in electrical and computer engineering design area. The students have to work on a project design which is related to their field of study and benefits the hosting company. The writing of a field experience report is required. The report should emphasize duties assigned and completed during the period.

ECE 499: Co-op in Electrical and Computer Engineering (0-8-4) Prerequisite(s): Dept. approval & Completion of 65 credit hours

This course offers students the opportunity to spend one full semester in industry or research settings where she develops skills related to team work, responsibility and work ethics. The student is expected to work in a team on a project where she demonstrates a substantial contribution.

Course descriptions for collateral basic Sciences and Mathematics courses

BIO 113L: Principles of Biology (2-3-3) — Prerequisite(s): None

This course is designed to present and encourage the mastery of terms and concepts related to the basic facts of life, the structure and function of cell and tissue types and heredity principles. Emphasis is put on evolutionary aspects of the kingdoms of organisms and the diversity of life.

CHEM 113L: Principles of Chemistry (2-3-3) — Prerequisite(s): None

The main themes of chemistry – the study of materials and the study of the changes that materials can be made to undergo – are discussed. As these themes are developed, a considerable emphasis is placed on a variety of simple laboratory investigations.

MATH 127: Calculus for Engineers I (2-2-3) — Prerequisite(s): GMTH 141E

Functions, limits, continuity, trigonometric functions, tangents, instantaneous rates of change, velocities and, derivatives, the chain rule, implicit differentiation, higher derivatives, exponential functions, inverse functions, the mean value theorem, monotonic functions, concavity, points of inflection, applied maximum and minimum problems, definite and indefinite integrals, and the fundamental theorem of calculus.

MATH 128: Calculus for Engineers II (2-2-3) — Prerequisite(s): MATH 127

Techniques and applications of integrations, integration by parts, trigonometric substitution, and partial fractions methods. Improper integrals. Sequences, series, absolute convergence and convergence tests. Power series, Taylor and Maclaurin series.

MATH 222: Calculus for Engineers III (3-1-3) — Prerequisite(s): MATH 128

Introduction to Vectors and the geometry of space. Differential calculus in higher dimensions, limits, Continuity, partial differentiation, optimization, chain rule, gradients. Multiple integrals. Double integrals, area, volume, triple integrals, integration in other coordinate systems, and change of variables. Vector calculus, vector fields, line integrals, Green's theorem, surface integrals, divergence theorem, and Stokes' theorem.

MATH 321: Discrete Mathematics for Engineers (3-0-3) — Prerequisite(s): MATH 222

This course introduces students to the basic concepts in discrete mathematics. The topics included are: Logic, Propositional Logic, Predicates and Quantifiers, Proof Methods, Mathematical Induction, Linear Recurrence Relations, Sets and Functions. Counting techniques, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Number Theory. Relations. Graphs and graph Models, Graph Terminology and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Planar Graphs, Graph Colouring. Introduction to Trees, Applications of Trees, Spanning Trees.

MATH 322: Linear Algebra (3-1-3) — Prerequisite(s): MATH 321

System of linear equations, matrix operations, vector space, linear transformations, orthogonality, determinants, eigenvalues and eigenvectors, diagonalization, linear differential equations and systems with constant coefficients and applications, and Iterative methods for solving linear systems

MATH 421: Differential Equations (3-1-3) — Prerequisite(s): MATH 322

First and second order ordinary differential equations with applications, Laplace transform, series solutions of linear equations. Partial differential equations, boundary value problems, Sturm-Louisville Theory.

PHYS 113L: Principles of Electricity and Magnetism (2-3-3) — Prerequisite(s): GPHY 112

Topics covered include principles and applications of electrostatics, current, electromotive force, potential difference, resistance, DC circuits, series and parallel circuits, principles of magnetic field and electromagnetic induction, magnetic properties of matter, AC circuits, electromagnetic waves, the nature of light, geometrical optics, interference of light waves, diffraction and polarization.

STAT 321: Probabilistic Methods in Engineering (3-0-3 — Prerequisite(s): GSTA 140

Basic Concepts of Probability Theory, Random Variables, Special probability distributions such as Binomial, Geometric, Poisson, exponential Weibull and Normal distributions, Multiple Random Variables, Sums of Random Variables. Some sampling distributions. Point and interval parameter estimations. Testing hypothesis. Regression and Random Processes.

Course descriptions for ECE general electives

MATH 422: Numerical Analysis (3-1-3) — Prerequisite(s): MATH 421

Numerical Solution of Non-linear Equations: Bisection method, Newton-Raphson method, Secant method, Convergence. Interpolation: Lagrange, Newton divided difference formula. Numerical Differentiation: First Derivatives, Higher Derivatives. Numerical Integration: Trapezoidal Rule, Gaussian Integration. Numerical solution of initial value problems: Euler's method, Taylor's method, Ruge-Kutta method.

PHYS 311: Modern Physics (3-0-3) — Prerequisite(s): PHYS 113L

The course covers Modern Physics Principles, topics include: Special Relativity, the Nature of Matter, Electricity and Radiation, origins of Quantum Mechanics, Quantum Structure of atoms, molecules and solids, applications to Lasers and Microelectronics, X-ray and X – ray Spectra.

PHYS 411: Quantum Mechanics (3-0-3) — Prerequisite(s): PHYS 311

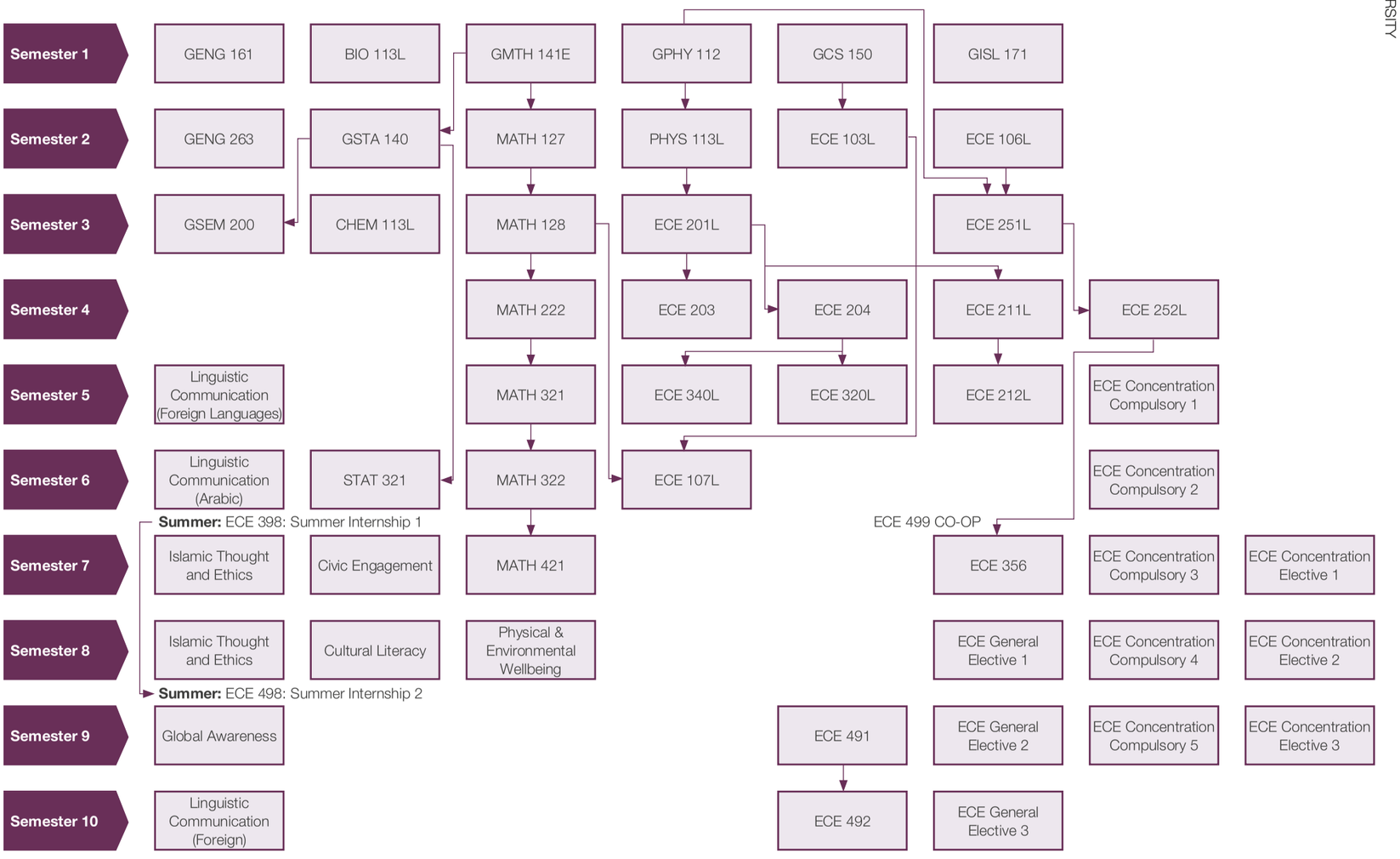
Wave equation, formulation of time independent Schrödinger equation, behavior of systems with a potential to predict the decay and scattering of particles, quantized angular momentum and its relationship to spin, the energy states of atoms, and the properties of materials, approximation methods such as Perturbation Theory and the Variation Technique.

MATH 423: Partial Differential Equations (3-0-3) — Prerequisite(s): MATH 421

Classification of linear second order PDEs. Separation of variables. The one-dimensional wave equation, its solution and characteristics. Cauchy problem for the wave equation. Heat equation. Laplace's equation, the maximum principle, uniqueness theorems. Green's function.

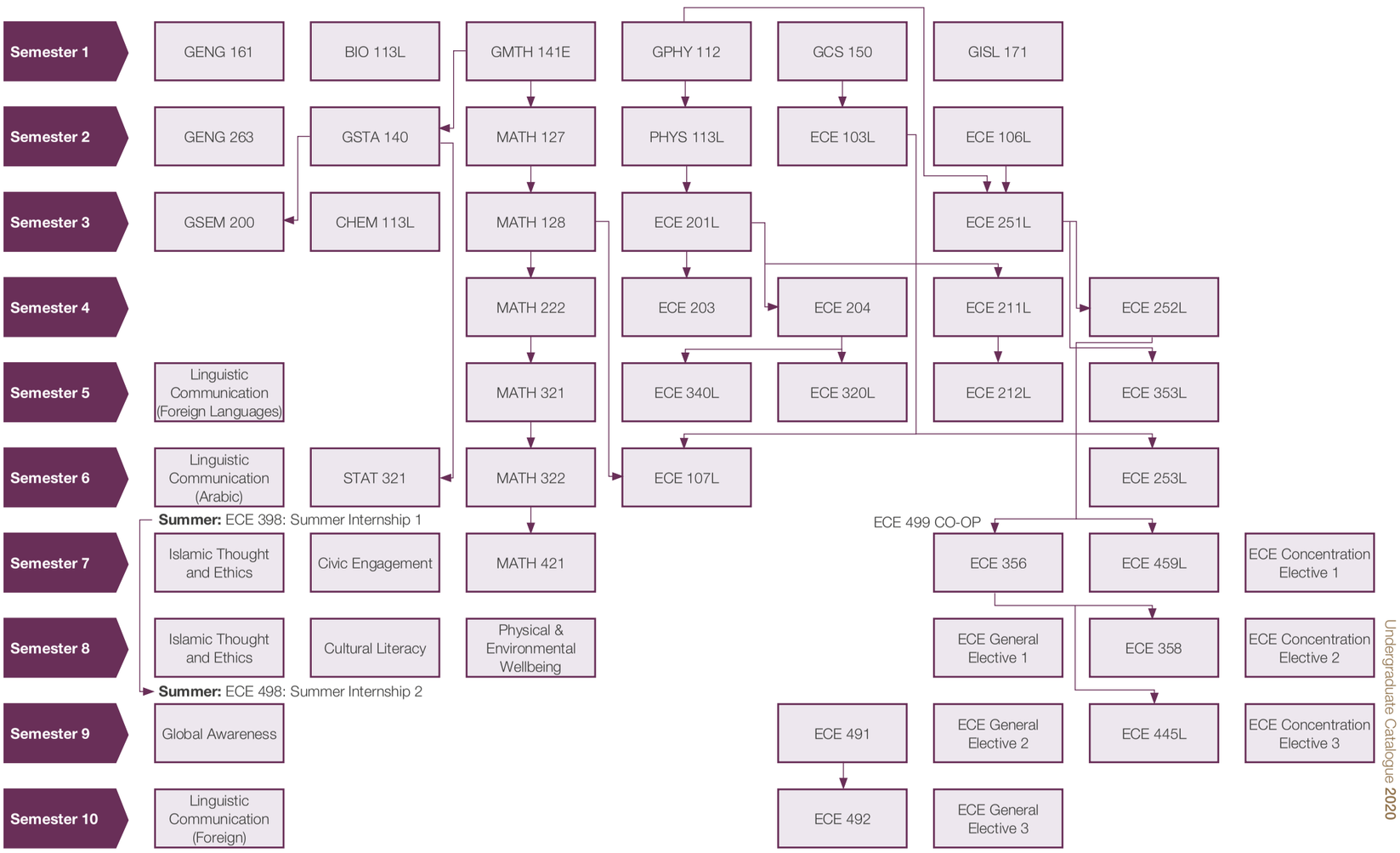
Electrical and Computer Engineering – General plan

Advising flowchart



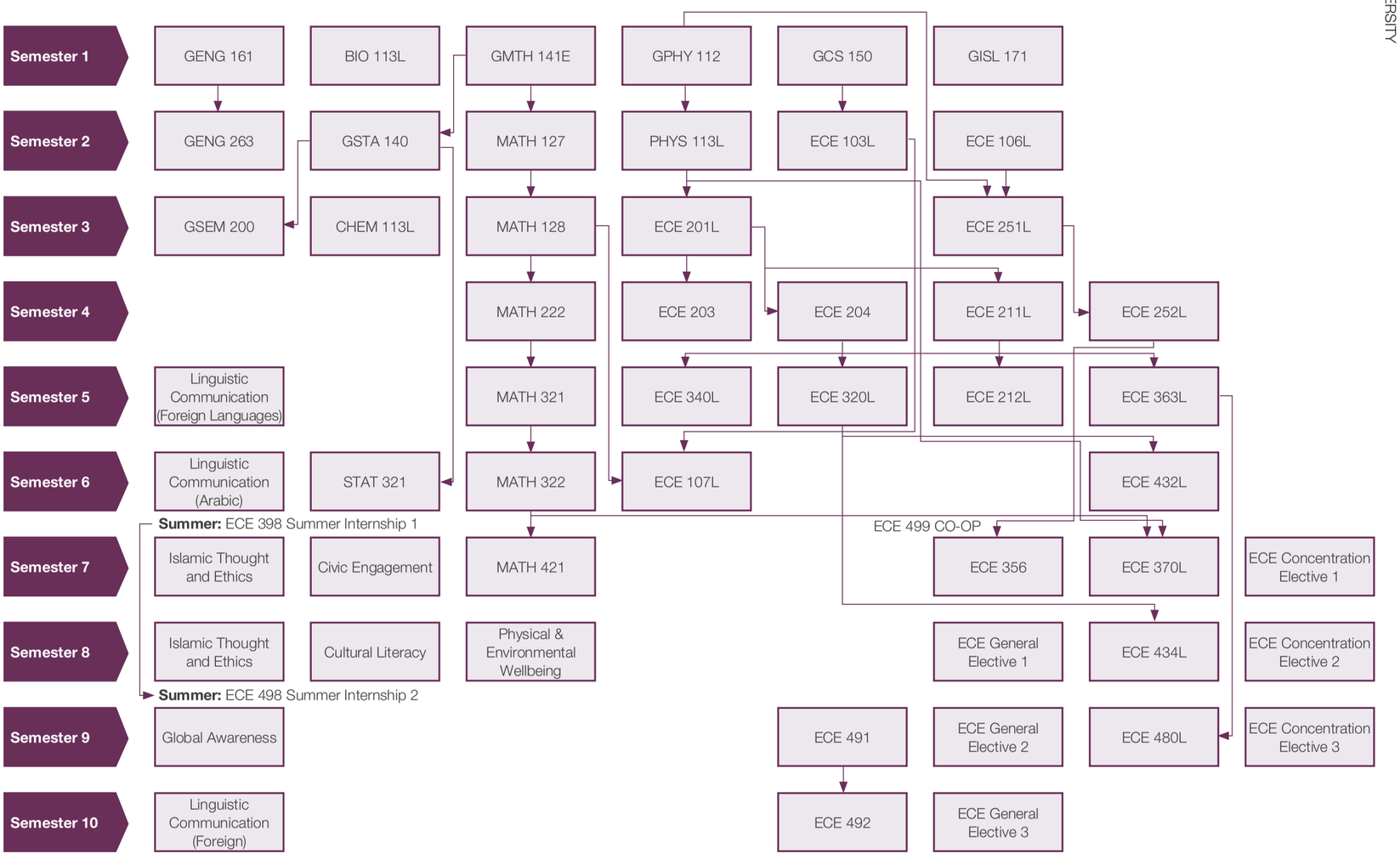
Electrical and Computer Engineering – Computer Engineering

Advising flowchart



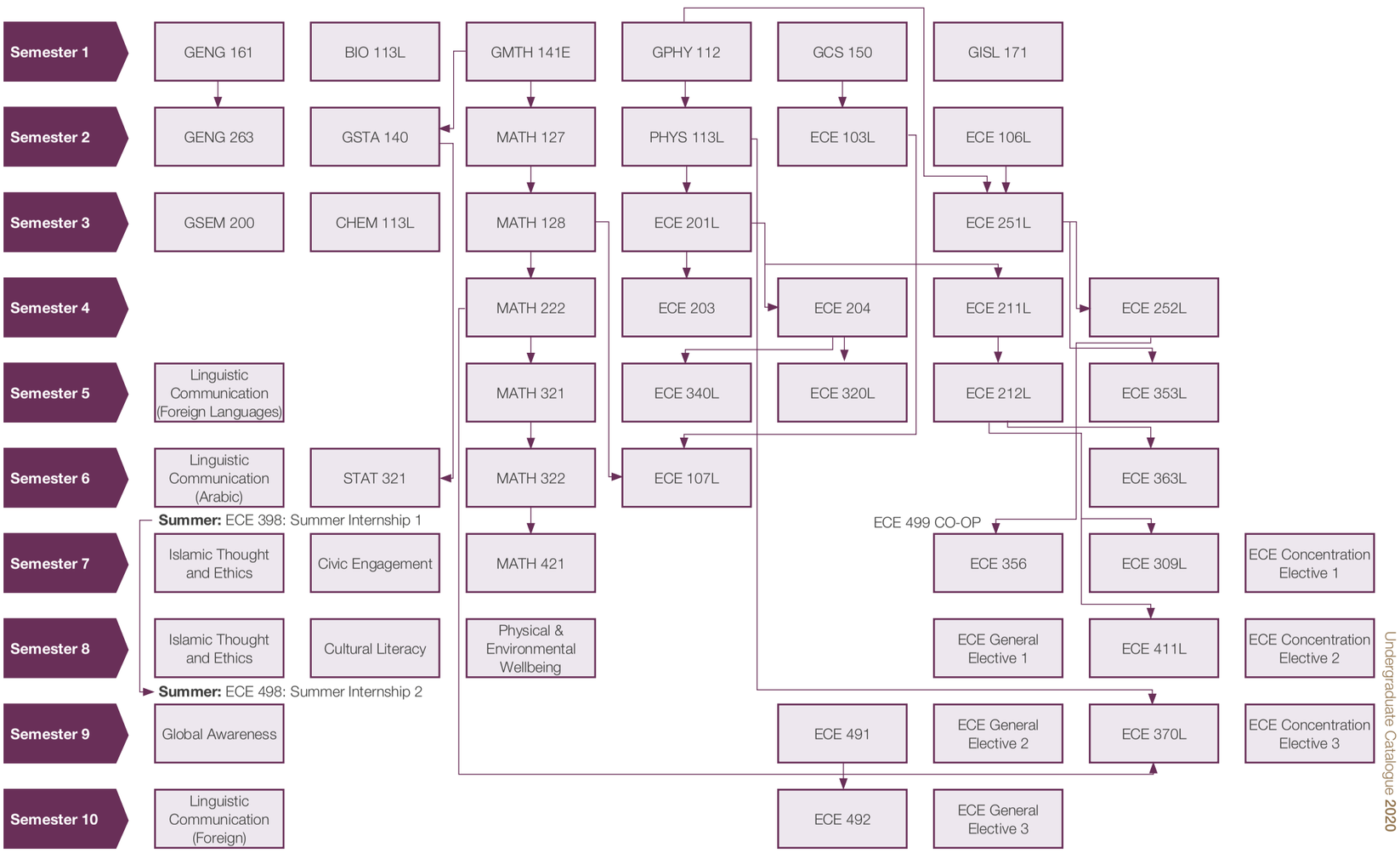
Electrical and Computer Engineering – Communication and Signal Processing

Advising flowchart



Electrical and Computer Engineering – Microelectronic

Advising flowchart



Electrical and Computer Engineering – Power and Control Systems

Advising flowchart