



جامعة الفيصل
Alfaisal University

Electrical Engineering Program

Alfaisal University, College of Engineering

Curriculum Structure and Study Plan

The Electrical Engineering curriculum is composed of **139** Credit Hours (CRHs) divided as follows:

- I. General Education Requirements (53 CRHs)**
 - 1. Mathematics & Statistics (21 CRHs)
 - 2. Basic Sciences (12 CRHs)
 - 3. Humanities (20 CRHs)
- II. Core Requirements (86 CRHs)**
 - 1. Electrical Engineering Courses (57 CRHs)
 - 2. College of Engineering Courses (11 CRHs)
 - 3. Technical Electives (18 CRHs)
 - 4. Summer Internship (0 CRHs)

I. General Education Requirements (53 CRHs)

1. Mathematics & Statistics (21 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
MAT 101	Calculus I	3	3	0	2		
MAT 112	Calculus II	3	3	0	2	MAT 101	
MAT 211	Calculus III	3	3	0	0	MAT 112	
MAT 212	Linear Algebra	3	3	0	0	MAT 112	
MAT 213	Differential Equations	3	3	0	0	MAT 112	MAT 212
MAT 224	Numerical Methods	3	3	0	0	MAT 212, CSC 112 or equivalent	
STA 212	Probability and Statistics for Engineers	3	3	0	0	MAT 112	

2. Basic Sciences (12 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
CHM 102	Introduction to Chemistry	3	3	0	1		
CHM 102 L	Introduction to Chemistry Lab	1	0	2	0		CHEM 102
PHU 103	Mechanics and Waves for Engineers	3	3	0	1		MAT 101
PHU 103 L	Mechanics and Waves for Engineers Lab	1	0	2	0		PHU 103
PHU 124	Electromagnetism and Optics for Engineers	3	3	0	1	PHU 103 & MAT 101	
PHU 124 L	Electromagnetism and Optics for Engineers Lab	1	0	2	0	PHU 103 & MAT 101	PHU 124

3. Humanities (20 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
ENG 101	Freshman English I	3	3	0	0		
ENG 112	Freshman English II	3	3	0	0	ENG 101	
ENG 222	Technical Writing	3	3	0	0	ENG 112	
PHL 101	Engineering Ethics	3	3	0	0		
ISL 101	Islamic Studies I	2	2	0	0		
ISL 112	Islamic Studies II	2	2	0	0	ISL 101	
ARB 101	Arabic Language and Literature I	2	2	0	0		
ARB 112	Arabic Language and Literature II	2	2	0	0	ARB 101	

II. Core Requirements (86 CRHs)

1. Electrical Engineering Courses (57 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
EE 202	Introduction to Electronics	3	3	0	0	EE 207	EE 208
EE 202 L	Introduction to Electronics Lab	1	0	2	0		EE 202
EE 207	Foundations of Electrical Engineering	3	3	0	1	PHU 124	MAT 213
EE 207 L	Foundations of Electrical Engineering Lab	1	0	2	0		EE 207
EE 208	Electric Circuits	3	3	0	0	EE 207	
EE 208 L	Electric Circuits Lab	1	0	2	0		EE 208
EE 210	Digital Logic Systems	3	3	0	0	EE207	
EE 210 L	Digital Logic Systems Lab	1	0	2	0		EE 210
EE 301	Signals and Systems	3	3	0	0	EE 208, MAT 224	
EE 302	Communications Theory	3	3	0	0	EE 301, STA 212	
EE 302 L	Communications Theory Lab	1	0	2	0		EE 302
EE 304	Microelectronics	3	3	0	0	EE 202	
EE 304 L	Microelectronics Lab	1	0	2	0		EE 304
EE 305	Computer Networks	3	3	0	0	EE 210, SE 100, STA 212	
EE 305 L	Computer Networks Lab	1	0	2	0		EE 305
EE 306	Control and Feedback System Design	3	3	0	0	EE 301	
EE 306 L	Control and Feedback System Design Lab	1	0	2	0		EE 306

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EE 307	Computer Architecture	3	3	0	0	EE 210, SE 100	
EE 307 L	Computer Architecture Lab	1	0	2	0		EE 307
EE 308	Electrical Energy Conversion	3	3	0	0	EE 202, EE 309	
EE 308 L	Electrical Energy Conversion Lab	1	0	2	0		EE 308
EE 309	Applied Electromagnetics	3	3	0	0	EE 208, MAT 211	
EE 405	Electric Power Systems	3	3	0	0	EE 308, MAT 224	
EE 413	Digital Communications	3	3	0	0	105 CRHs passed, EE 302	
EE 413 L	Digital Communications Lab	1	0	2	0		EE 413
EE 490	Electrical Engineering Capstone Project	4	0	8	0	105 CRHs passed	

2. College of Engineering Courses (11 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
SE 100	Programming for Engineers	3	3	0	0		
SE 100 L	Programming for Engineers Lab	1	0	2	0		SE 100
ME 201	Materials Science and Engineering	3	3	0	1	CHM 102	
ME 201 L	Materials Science and Engineering Lab	1	0	2	0		ME 201
IE 315	Engineering Economy and Cost Analysis	3	3	0	0		

3. Technical Electives (18 CRHs)

Select three courses with their labs and two courses without labs from the following list:

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
EE 401	Special Topics in Electrical Engineering	3	3	0	0	105 CRHs passed	
EE 403	Wireless Communications	3	3	0	0	105 CRHs & EE413	
EE 403 L	Wireless Communications Lab	1	0	2	0		EE 403
EE 406	Digital Electronics	3	3	0	0	105 CRHs passed	
EE 406 L	Digital Electronics Lab	1	0	2	0		EE 406
EE 408	Communication Electronics	3	3	0	0	105 CRHs passed	
EE 412	Nanoelectronics	3	3	0	0	105 CRHs passed	
EE 412 L	Nanoelectronics Lab	1	0	2	0		EE 412
EE 417	Digital Signal Processing	3	3	0	0	105 CRHs passed	
EE 417 L	Digital Signal Processing Lab	1	0	2	0		EE 417
EE 418	Digital Image Processing	3	3	0	0	105 CRHs passed	
EE 418 L	Digital Image Processing Lab	1	0	2	0		EE 418
EE 420	Power Electronics	3	3	0	0	105 CRHs passed	
EE 420 L	Power Electronics Lab	1	0	2	0		EE 420
EE 422	Antennas and Wave Propagation	3	3	0	0	105 CRHs passed	
EE 423	Optical Fiber Communication Systems	3	3	0	0	105 CRHs & EE422	
EE 424	Optoelectronics	3	3	0	0	105 CRHs passed	
EE 424 L	Optoelectronics Lab	1	0	2	0		EE 424
EE 425	Microwave Engineering	3	0	0	0	105 CRHs & EE422	

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EE 426	Renewable Energy	3	3	0	0	105 CRHs passed	
EE 426 L	Renewable Energy Lab	1	0	2	0		EE 426
EE 427	Digital Control	3	3	0	0	105 CRHs passed	
EE 428	Modern Control Theory	3	3	0	0	105 CRHs passed	
EE 435	Undergraduate Research in Electrical Engineering	3	0	6	0	Department Chair approval, a min. 3.0 GPA, & a signed research contract.	

4. Summer Internship (0 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)	Pre-Requisite Course Code	Co-Requisite Course Code
EE 390	Electrical Engineering Summer Internship	0	105 CRHs passed and department approval	

Typical Study Plan-Electrical Engineering Program

4-Year Curriculum: 139 Credit Hours Total

Each course below follows the following format:

Course code, Course Title, and Course Credit Hours (Lecture contact hours – Lab contact hours – Tutorial contact hours)

<i>1st Year</i>			
Fall	Course Code	Course-Title	CRHs
	ENG 101	Freshman English I	3 (3-0-0)
	MAT 101	Calculus I	3 (3-0-2)
	PHU 103	Mechanics and Waves for Engineers	3 (3-0-1)
	PHU 103 L	Mechanics and Waves for Engineers Lab	1 (0-2-0)
	SE 100	Programming for Engineers	3 (3-0-0)
	SE 100 L	Programming for Engineers Lab	1 (0-2-0)
	CHM 102	Introduction to Chemistry	3 (3-0-1)
	CHM 102 L	Introduction to Chemistry Lab	1 (0-2-0)
	Total		
Spring	Course Code	Course-Title	CRHs
	PHL 101A	Engineering Ethics	3 (3-0-0)
	ENG 112	Freshman English II	3 (3-0-0)
	MAT 112	Calculus II	3 (3-0-2)
	PHU 124	Electromagnetism and Optics for Engineers	3 (3-0-1)
	PHU 124 L	Electromagnetism and Optics for Engineers Lab	1 (0-2-0)
	ME 201	Materials Science and Engineering	3 (3-0-1)
	ME 201 L	Materials Science and Engineering Lab	1 (0-2-0)
Total			17

<i>2nd Year</i>			
Fall	Course Code	Course-Title	CRHs
	EE 207	Foundations of Electrical Engineering	3 (3-0-1)
	EE 207 L	Foundations of Electrical Engineering Lab	1 (0-2-0)
	MAT 211	Calculus III	3 (3-0-0)
	MAT 212	Linear Algebra	3 (3-0-0)
	MAT 213	Differential Equations	3 (3-0-0)
	ISL 101	Islamic Studies I	2 (2-0-0)
Total			15
Spring	Course Code	Course-Title	CRHs
	EE 202	Introduction to Electronics	3 (3-0-0)
	EE 202 L	Introduction to Electronics Lab	1 (0-2-0)
	EE 208	Electric Circuits	3 (3-0-0)
	EE 208 L	Electric Circuits Lab	1 (0-2-0)
	EE 210	Digital Logic Systems	3 (3-0-0)
	EE 210 L	Digital Logic Systems Lab	1 (0-2-0)
	MAT 224	Numerical Methods	3 (3-0-0)
	STA 212	Probability and Statistics for Engineers	3 (3-0-0)
Total			18

<i>3rd Year</i>			
Fall	Course Code	Course-Title	CRHs
	EE 301	Signals and Systems	3 (3-0-0)
	EE 305	Computer Networks	3 (3-0-0)
	EE 305 L	Computer Networks Lab	1 (0-2-0)
	EE 307	Computer Architecture	3 (3-0-0)
	EE 307 L	Computer Architecture Lab	1 (0-2-0)
	EE 309	Applied Electromagnetics	3 (3-0-0)
	ARB 101	Arabic Language and Literature I	2 (2-0-0)
	ISL 112	Islamic Studies II	2 (2-0-0)
Total			18
Spring	Course Code	Course-Title	CRHs
	EE 302	Communications Theory	3 (3-0-0)
	EE 302 L	Communications Theory Lab	1 (0-2-0)
	EE 304	Microelectronics	3 (3-0-0)
	EE 304 L	Microelectronics Lab	1 (0-2-0)
	EE 306	Control and Feedback System Design	3 (3-0-0)
	EE 306 L	Control and Feedback System Design Lab	1 (0-2-0)
	EE 308	Electrical Energy Conversion	3 (3-0-0)
	EE 308 L	Electrical Energy Conversion Lab	1 (0-2-0)
	IE 315	Engineering Economy and Cost Analysis	3 (3-0-0)
Total			19
Summer	Course Code	Course-Title	CRHs
	EE 390	Electrical Engineering Summer Internship	0
Total			0

<i>4th Year</i>			
Fall	Course Code	Course-Title	CRHs
	EE 405	Electric Power Systems	3 (3-0-0)
	EE 413	Digital Communications	3 (3-0-0)
	EE 413 L	Digital Communications Lab	1 (0-2-0)
	EE 4**	Technical Elective	3 (3-0-0)
	EE 4**	Technical Elective	3 (3-0-0)
	EE 4** L	Technical Elective Lab	1 (0-2-0)
	ENG 222	Technical Writing	3 (3-0-0)
Total			17
Spring	Course Code	Course-Title	CRHs
	EE 490	Electrical Engineering Capstone Project	4 (0-8-0)
	EE 4**	Technical Elective	3 (3-0-0)
	EE 4**	Technical Elective	3 (3-0-0)
	EE 4** L	Technical Elective Lab	1 (0-2-0)
	EE 4**	Technical Elective	3 (3-0-0)
	EE 4** L	Technical Elective Lab	1 (0-2-0)
	ARB 112	Arabic Language and Literature II	2 (2-0-0)
Total			17

Technical Electives

Course Code	Course Title	CRHs	Pre-Requisite Course Code	Co-Requisite Course Code
EE 401	Special Topics in Electrical Engineering	3 (3-0-0)	105 CRHs passed	
EE 403	Wireless Communications	3 (3-0-0)	105 CRHs & EE413	
EE 403 L	Wireless Communications Lab	1 (0-2-0)		EE 403
EE 406	Digital Electronics	3 (3-0-0)	105 CRHs passed	
EE 406 L	Digital Electronics Lab	1 (0-2-0)		EE 406
EE 408	Communication Electronics	3 (3-0-0)	105 CRHs passed	
EE 412	Nanoelectronics	3 (3-0-0)	105 CRHs passed	
EE 412 L	Nanoelectronics Lab	1 (0-2-0)		EE 412
EE 417	Digital Signal Processing	3 (3-0-0)	105 CRHs passed	
EE 417 L	Digital Signal Processing Lab	1 (0-2-0)		EE 417
EE 418	Digital Image Processing	3 (3-0-0)	105 CRHs passed	
EE 418 L	Digital Image Processing Lab	1 (0-2-0)		EE 418
EE 420	Power Electronics	3 (3-0-0)	105 CRHs passed	
EE 420 L	Power Electronics Lab	1 (0-2-0)		EE 420
EE 422	Antennas and Wave Propagation	3 (3-0-0)	105 CRHs passed	
EE 423	Optical Fiber Communication Systems	3 (3-0-0)	105 CRHs & EE422	
EE 424	Optoelectronics	3 (3-0-0)	105 CRHs passed	
EE 424 L	Optoelectronics Lab	1 (0-2-0)		EE 424
EE 425	Microwave Engineering	3 (3-0-0)	105 CRHs & EE422	
EE 426	Renewable Energy	3 (3-0-0)	105 CRHs passed	
EE 426 L	Renewable Energy Lab	1 (0-2-0)		EE 426
EE 427	Digital Control	3 (3-0-0)	105 CRHs passed	
EE 428	Modern Control Theory	3 (3-0-0)	105 CRHs passed	
EE 435	Undergraduate Research in Electrical Engineering	3 (3-0-0)	Department Chair approval, a min. 3.0 GPA, & a signed research contract.	

Course Descriptions

In this section we give the course descriptions of Electrical Engineering courses of the program.

Each course below follows the following format:

Course code: Course Title Course credit hours (Lecture contact hours – Lab contact hours – Tutorial contact hours)

Course Description

Pre-requisites

Co-requisites

Core Courses

EE 202: Introduction to Electronics 3 (3-0-0)

The course teaches the fundamentals of electronic circuits, including diode characteristics and diode circuits, transistors and applications, switches and MOS transistors, amplifiers, energy storage elements, digital circuits and applications. Design and laboratory exercises are also significant components of the course.

Pre-requisites: EE 207

Co-requisites: EE 208

EE 202 L: Introduction to Electronics Lab 1 (0-2-0)

Laboratory experiments dealing with Introduction to Electronics.

Pre-requisites: None.

Co-requisites: EE 208

EE 207: Foundation of Electrical Engineering 3 (3-0-1)

The course teaches fundamental concepts of electrical circuits, students will be familiarized with the essential principles of electrical circuit analysis composition of components into systems and networks, and understanding the trade-offs and limits imposed by energy and noise. Students learn to apply the concepts during laboratory design.

Pre-requisites: PHU124

Co-requisites: MAT 213

EE 207 L: Foundation of Electrical Engineering Lab 1 (0-2-0)

Laboratory experiments dealing with Foundation of Electrical Engineering.

Pre-requisites: None.

Co-requisites: EE 207

EE 208: Electric Circuits 3 (3-0-0)

The course teaches the design and analysis of interconnected networks of lumped circuit elements.

Pre-requisites: EE 207

Co-requisites: None.

EE 208 L: Electric Circuits Lab 1 (0-2-0)

Laboratory experiments dealing with Electric Circuits.

Pre-requisites: None.

Co-requisites: EE 208

EE 210: Digital Logic Systems

3 (3-0-0)

The course teaches theoretical foundations and concepts of digital systems and applies these concepts with design problems and projects. Students are exposed to the design and engineering of digital computers and subsystems.

Pre-requisites: EE 207

Co-requisites: None.

EE 210 L: Digital Logic Systems Lab

1 (0-2-0)

Laboratory experiments dealing with Digital Logic Systems.

Pre-requisites: None.

Co-requisites: EE 210

EE 301: Signals and Systems

3(3-0-0)

The course teaches fundamental concepts of signals and systems analysis, with applications drawn from filtering, audio and image processing, communications, and automatic control. The objective of the course is to allow students to develop a thorough understanding of time-domain and frequency domain approaches to the analysis of continuous and discrete systems. To provide students with necessary tools and techniques to analyze electrical networks and systems.

Pre-requisites: EE 208, MAT 224

Co-requisites: None.

EE 301 L: Signals and Systems Lab

1 (0-2-0)

Laboratory experiments dealing with Signals and Systems.

Pre-requisites: None.

Co-requisites: EE 301

EE 302: Communications Theory

3 (3-0-0)

The course teaches communication systems and information theory. Topics covered include the classification of signals and systems, Fourier series and transform applications, power spectra and spectral density, band-limited signals and noise, sampling theory and digital transmission, modulation techniques and pulse code modulation.

Pre-requisites: EE 301, STA 212

Co-requisites: None.

EE 302 L: Communications Theory Lab

1 (0-2-0)

Laboratory experiments dealing with Communications Theory.

Pre-requisites: None.

Co-requisites: EE 302

EE 304: Microelectronics

3 (3-0-0)

This course teaches analog circuit analysis and design, including an introduction to the tools and methods necessary for the creative design of practical circuits using active devices.

Pre-requisites: EE 202

Co-requisites: None.

EE 304 L: Microelectronics Lab

1 (0-2-0)

Laboratory experiments dealing with Microelectronics.

Pre-requisites: None.

Co-requisites: EE 304

EE 305: Computer Networks

3 (3-0-0)

Electrical Engineering - CoE

The course teaches the fundamental concepts of communication networks, and is concerned specifically with network architectures and protocols. The objective of the course is to allow students to develop a thorough understanding of the architectures of networks and the basic principles that allow the transmission of data over networks.

Pre-requisites: EE 210, SE 100, STA 212

Co-requisites: None.

EE 305 L: Computer Networks Lab

1 (0-2-0)

Laboratory experiments dealing with Computer Networks.

Pre-requisites: None.

Co-requisites: EE 305

EE 306: Control and Feedback System Design

3 (3-0-0)

The course teaches the analysis and synthesis of continuous and sampled-data linear feedback control systems, and its application to a variety of physical systems

Pre-requisites: EE 301

Co-requisites: None.

EE 306 L: Control and Feedback System Design Lab

1 (0-2-0)

Laboratory experiments dealing with Control and Feedback System Design.

Pre-requisites: None.

Co-requisites: EE 306

EE 307: Computer Architecture

3 (3-0-0)

The course introduces the architecture of digital systems, with an emphasis on the structural principles common to a wide range of computer technologies. Multilevel implementation strategies, the definition of new primitives (e.g., gates, instructions, procedures, and processes) and their mechanization using lower-level elements, the organization and operation of digital computers and the hardware/software interface are addressed.

Pre-requisites: SE 100, EE 210

Co-requisites: None.

EE 307 L: Computer Architecture Lab

1 (0-2-0)

Laboratory experiments dealing with Computer Architecture.

Pre-requisites: None.

Co-requisites: EE 307

EE 308: Electrical Energy Conversion

4 (3-2-0)

The course teaches the basic concepts of electrical machines and power semiconductor converters and their application within modern power systems.

Pre-requisites: EE 202, EE 309

Co-requisites: None.

EE 308 L: Electrical Energy Conversion Lab

1 (0-2-0)

Laboratory experiments dealing with Electrical Energy Conversion.

Pre-requisites: None.

Co-requisites: EE 308

EE 309: Applied Electromagnetics

3 (3-0-0)

The course teaches the application of electromagnetic principles to classical and modern devices. The concepts of work and energy and electromagnetic fields are addressed.

Pre-requisites: EE 208, MAT 211

Co-requisites: None.

EE405: Electric Power Systems

3 (3-0-0)

Electrical Engineering - CoE

The course teaches the components, analysis, and modeling of large scale electric power systems. This includes the review of single and three phase circuit variables and parameters and the per unit system. The components of the system are studied including the transformers and the transmission line parameters. In addition, the operation in terms of modeling and analysis of electric power systems is studied in steady state and transient state, with a particular focus on power flow solution methods. Case studies are introduced to prepare for more advanced topics. A project accompanies the course to introduce practical aspects of measurements and operation, with simulations addressing large scale problems.

Pre-requisites: EE308, MAT 224

Co-requisites: None.

EE 413: Digital Communications

3 (3-0-0)

The course teaches the principles of digital communication systems. Topics include sampling, quantization and encoding of analog signals, pulse code modulation (PCM), delta modulation (DM), noise analysis in PCM and DM systems, base-band digital systems (matched filter, probability of error, inter-symbol interference, equalization, distortionless transmission, and M-ary transmission), line codes and their power spectra, pass-band digital systems (ASK, FSK PSK, DPSK, and M-ary), bandwidth and power requirements of modulation schemes, coherent and non-coherent detection, error rate analysis, and introduction to information theory.

Pre-requisites: 105 CRHs passed, EE302.

Co-requisites: None.

EE 413 L: Digital Communications Lab

1 (0-2-0)

Laboratory experiments dealing with Digital Communications.

Pre-requisites: None.

Co-requisites: EE 413

EE 490: Electrical Engineering Capstone Project

4 (0-8-0)

Students work in teams as professional engineering consultants on an independent engineering project under the supervision of a project advisor. The design process is emphasized, encompassing project definition, feasibility analysis, evaluation of alternative designs, and design computations. For each project, the scope of work is developed and negotiated between client and student consultants. The scope of work may also include fabrication, device testing, and field-testing. Projects are arranged by the students with approval of the instructor. Progress reports and a final written report are submitted to the student's project advisor. Oral presentations of reports are made before the faculty and students. A student who selects a project suggested by industry has the opportunity of working with an industry sponsor in an actual engineering experience.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

Elective Courses

EE401 Special Topics in Electrical Engineering

3 (3-0-0)

This course provides instruction and experience in timely topics related to Electrical Engineering major.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 403: Wireless Communications

3 (3-0-0)

Electrical Engineering - CoE

The course teaches wireless communications for voice, data, and multimedia. Topics include wireless systems and standards, characteristics of the wireless channel, including path loss for different environments, random log-normal shadowing due to signal attenuation, and the flat and frequency-selective properties of multipath fading.

Pre-requisites: 105 CRHs passed, EE413

Co-requisites: None.

EE 403 L: Wireless Communications Lab

1 (0-2-0)

Laboratory experiments dealing with Wireless Communications.

Pre-requisites: None.

Co-requisites: EE 403

EE 406: Digital Electronics

3 (3-0-0)

This course aims to familiarize students with the basic concepts and mechanisms of operation and design of digital electronic circuits, both discrete and integrated. Topics covered include an overview of MOS and BJT types, structures and operation, digital logic inverters (voltage transfer characteristic, digital integrated circuit technologies and logic-circuit families), CMOS inverters (dynamic operation of the CMOS inverter, inverter sizing, power dissipation), logic-gate circuits (NOR, NAND, XOR), propagation delay analysis, pseudo-NMOS logic circuits, gate circuits, pass-transistor logic circuits (NMOS transistors as switches, CMOS transmission gates as switches), dynamic MOS logic circuits (Emitter-coupled logic (ECL) and families), BiCMOS inverters and logic gates, latches, flip-flop circuits, multivibrators, and an overview of memory circuits types and architectures, and A/D and D/A converters.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 406 L: Digital Electronics Lab

1 (0-2-0)

Laboratory experiments dealing with Digital Electronics.

Pre-requisites: None.

Co-requisites: EE 406

EE 408: Communication Electronics

3 (3-0-0)

This course is designed for senior-level undergraduate students in Electrical Engineering. It builds upon prerequisite courses on signal and systems, communications, control systems, and electronics to further enhance the understanding of communication circuits operation and physical implementation. The course focuses on the field of communication electronics at levels from block diagram to circuit analysis for physical implementation. It aims to cover topics as radio frequency amplifiers, oscillators, signal spectra, noise, modulation and AM systems, transmitter and receiver circuits, sideband systems, frequency and phase modulation, phase-locked loops, and pulse and digital modulation.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 412: Nanoelectronics

3 (3-0-0)

The course teaches an introduction to the electronic properties of molecules, carbon nanotubes, crystals and other nanodevices.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 412 L: Nanoelectronics Lab

1 (0-2-0)

Laboratory experiments dealing with Nanoelectronics.

Pre-requisites: None.

Co-requisites: EE 412

EE 417: Digital Signal Processing

3 (3-0-0)

This course presents an introduction to the techniques and algorithms of digital processing for signals and information data. It is designed for senior-level undergraduate students in electrical and computer engineering. The theory and practice covered in this course can be applied in wide range of science fields, such as image processing, communications, satellite systems, biomedical, power and electronic devices, and programmable units. The proposed content covers a review of discrete-time sequences and systems, sampling of continuous-time signals and aliasing effect, discrete Fourier transform: properties and applications; fast Fourier transform (FFT): implementation and computations, finite impulse response (FIR) filters design and analysis: low-pass, band pass, highpass, phase response etc., and infinite impulse response (IIR) filters design methods and cascaded structures. The course involves extensive software and programming experience to enrich the understanding of the covered material.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 417 L: Digital Signal Processing Lab

1 (0-2-0)

Laboratory experiments dealing with Digital Signal Processing.

Pre-requisites: None.

Co-requisites: EE 417

EE 418: Digital Image Processing

3 (3-0-0)

The course teaches an introduction to image processing and its applications, including the fundamental concepts of visual perception and image acquisition, the basic techniques of image manipulation, segmentation and coding, and a preliminary understanding of pattern recognition and computer vision.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 418 L: Digital Image Processing Lab

1 (0-2-0)

Laboratory experiments dealing with Digital Image Processing.

Pre-requisites: None.

Co-requisites: EE 418

EE 420: Power Electronics

3 (3-0-0)

The course teaches the principles of designing power electronic circuits. Power electronics design has applications in several fields from motor drives to consumer electronics to electric power transmission over HVDC lines. Therefore, the course reviews the fundamentals before covering generic power electronic circuit topologies. This entails a review of the switching devices, e.g., diodes, thyristors, BJTs, and the review of the fundamentals of electric circuit design and magnetism. Building on the fundamentals, the course covers AC to DC, DC to DC, DC to AC, and AC to AC electric power conversion topologies. The lab component is simultaneously administered to offer a practical perspective including the selection of components vis-à-vis the application, the instrumentation. In addition, the lab goes over the prototyping and testing aspects of power electronic circuit design.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 420 L: Power Electronics Lab

1 (0-2-0)

Laboratory experiments dealing with Power Electronics.

Pre-requisites: None.

Co-requisites: EE 420

EE 422: Antennas and Wave Propagation

3 (3-0-0)

This course introduces the characteristics of electromagnetic waves and their behavior during the propagation through different media. The wave equation is derived using the Maxwell's equations for time varying fields. The electromagnetic wave propagation in different media as well as their reflection at normal and oblique angle of incidence is discussed. The concept of transmission line theory and its parameters, smith chart and its application are introduced. Waveguide and TM & TE modes are discussed. In addition the course includes Antenna characteristics, antenna types such as dipole, loop and antenna array.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 423: Optical Fiber Communication Systems **3 (3-0-0)**

The course teaches the introduction to the optical fiber communications. Topics discusses dielectric slab waveguide, step-index and graded-index optical fibers, single mode and multimode fiber, attenuation and dispersion, light sources (LED and Laser diode), optical modulation and detection, noise modeling in optical receivers, and error rate analysis.

Pre-requisites: 105 CRHs passed , EE 422

Co-requisites: None.

EE 424: Optoelectronics **3 (3-0-0)**

The course teaches semiconductor light sources, such as different types of LEDs, Lasers (both gas and solid states), modulation techniques, photodetectors, PIN diode, avalanche Photo Diode (APD), the basics of optical waveguides and the principles of fiber optics

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 424 L: Optoelectronics Lab **1 (0-2-0)**

Laboratory experiments dealing with Optoelectronics.

Pre-requisites: None.

Co-requisites: EE 424

EE 425: Microwave Engineering **3 (3-0-0)**

The course teaches the fundamentals of Microwave Engineering. Topics include a review of electromagnetics theory, and discuss transmission lines and waveguides, microwave network analysis, impedance matching, passive microwave devices (power dividers and directional couplers), strip-line and micro-strip line circuits, microwave filters, and introduction to ferrimagnetic materials and components.

Pre-requisites: 105 CRHs passed , EE 422

Co-requisites: None.

EE 426: Renewable Energy **3 (3-0-0)**

This course covers fundamentals of renewable energy systems, Solar energy, Bio-energy, Wind energy, Hydro-power, Tidal power, Wave energy and Geothermal energy. Also integration of renewable energy systems will be covered in the course. The students will be exposed to technical aspects of mentioned topics; How to utilize renewable energy for domestic and industrial applications; requirements and obstacles of applications; how to integrated renewable energy systems.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 426 L: Renewable Energy Lab **1 (0-2-0)**

Laboratory experiments dealing with Renewable Energy.

Pre-requisites: None.

Co-requisites: EE 426

EE 427: Digital Control **3 (3-0-0)**

The course discusses digital control designs and methodologies for dynamic systems. It describes classical and state-space control methods, and applies them to selected applications. The course explores the advantages and limitations of each method, offers an overview of feedback control systems, and proposes to cover selected topics on multivariable and optimal control methods. The course involves Matlab experience to improve the understanding of the covered design methods. The topics include a review of continuous control (feedback, root locus, frequency response design, compensation, state-space design), basic digital control (digitization, sampling, PID), discrete systems (linear difference equations, z-transform, spectrum, block diagrams), discrete equivalents (design via numerical integration, zero-pole matching), transform techniques (root locus in z-plane, frequency response), state-space approaches (regulator design, integral control and disturbance estimation, controllability and observability), and an introduction to multivariable and optimal control (time-varying and LQR steady-state optimal control, multivariable design)

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 428: Modern Control Theory

3 (3-0-0)

The course covers the fundamentals of Matrix Theory including eigenvalues and eigenvectors, and the matrix representations of the Diagonal, Jordan, Controllable, and Observable forms. The student learns to represent systems in terms of their state variables and state diagrams, and then solve for their response in the time domain. The focus of the course is on linear time invariant or LTI systems. Furthermore, the controllability and observability of the LTI system is studied, before covering the design of state feedback and output feedback control techniques. In addition, observer design is covered, with the separation principle, to construct observer-based control systems.

Pre-requisites: 105 CRHs passed

Co-requisites: None.

EE 435: Undergraduate Research in Electrical Engineering

3 (0-6-0)

Students participate in supervised research with a faculty member. Supervised research can be: 1) independent research undertaken by the student (thesis, independent study), or 2) assistance on a faculty member's research project. Students must find a faculty member who is willing to supervise him/her as an assistant on an existing project or as the author of an individual project. The student and the faculty supervisor will complete and sign a research contract which will be turned in to the chair of the Electrical Engineering Department. Drafting the contract will allow the student to develop ideas about what should be accomplished and what the faculty supervisor's expectations are. All academic requirements are at the discretion of the supervising faculty member. Students should agree on a plan for the semester with the faculty mentor before the research begins. The plan should include academic requirements, the basis for grading the experience, and a plan for student/professor meetings for the semester. It is the student's responsibility to report progress and seek guidance when needed. Students are expected to be active and reliable participants in the research experience.

Pre-requisites: Department Chair approval, a GPA of at least 3.0/4.0, and a signed research contract.