DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

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Communications and Electronics Engineering Program

Mission

The educational mission of Communications & Electronics Engineering (CEE) Program is to deliver high quality undergraduate education which combines balanced theoretical and practical topics in Communications & Electronics Engineering. Graduates of the program will have a mastery of fundamental knowledge in a variety of Communications & Electronics Engineering fields, management, and entrepreneurial skills. Graduates will be qualified to pursue successful careers in their profession or graduate studies in different areas.

Objectives

The educational objectives of the program are determined to support career advancement of the graduates as they pursue their career goals. The graduates will:

1. Design, optimize and maintain communication systems in tune with community needs and environmental concerns
2. Be able to develop and integrate new technologies as they emerge
3. Engage in a technical/managerial role in diverse teams
4. Pursue entrepreneurial initiatives and launch startup companies
5. Communicate effectively and use resources skillfully in projects development

Learning Outcomes

UPON COMPLETION OF THE PROGRAM GRADUATES SHALL HAVE:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Degree Requirements

The undergraduate curriculum for the degree of Bachelor of Engineering in Communications and Electronics Engineering consists of 150 credit-hours of course work + 30 credits transferred from Lebanese Baccalaureate or equivalent.

Career opportunities

The Communications and Electronics Career Field encompasses the functions of installing, modifying, maintaining, repairing, and overhauling ground television, telephone and mobile equipment, ground weather equipment, air traffic control, aircraft control and warning, automatic tracking radar equipment, simulator and training systems, microwave, fixed and mobile radio equipment, space communications systems equipment, high-speed general and special purpose data processing equipment, automatic communications and cryptographic machine system, electromechanical equipment, and electronic equipment associated to all the previous mentioned systems. Most of these applications find place in several companies in Lebanon, the Arab world and the whole world in general, providing, hence, the possibility for the CEE program students to find jobs in the field they like most and almost everywhere in the world.

Program Overview

The **Student's Study Plan** is given to every CEE student upon his/her enrollment. The CEE curriculum consists of the following components:

I. Common Requirements	**Credits**
General Education Requirements	16
Basic Sciences and Mathematics	30
General Engineering topics	11
II. CEE Program-Specific Requirements	**Credits**
A. Engineering topics from outside the program	21
B. CEE Core	55
C. CEE Technical Electives	12
D. Final Year Project	4
E. Internship	1

I. Common Requirements

The list of the Common Requirement courses and their descriptions are presented in the introductory pages of the Faculty of Engineering section in this catalog. In particular, the CEE curriculum includes 11 credits offered as general engineering topics. These courses are listed in the table below.

Code	**Name**	**Crs.**
MCHE 213	Dynamics	3
COMP 208	Programming I	3
INME 221	Engineering Economy	3
ENGR 500	Research Methodology	2

II. CEE Program-Specific Requirements

A. Engineering Topics from outside the major

This part of the CEE curriculum includes 21 credits courses offered by other engineering programs. These courses are listed in the table below.

Course	Title	Credits	Pre-/Co-requisites
COMP 215	Programming for Engineers	3	Pre: COMP 208
COMP 225	Digital Systems I	3	
COMP 321	Introduction to Microcomputers	3	COMP 225
COMP 426	Microprocessor Interfacing	3	COMP 226
POWE 212	Electric Circuits I	3	
POWE 271	Electromagnetic Fundamentals	3	Pre: PHYS 281
POWE 425	Introduction to Electrical Power Systems	3	Pre: POWE 271

Descriptions of this group of courses are given below:

COMP 215 PROGRAMMING FOR ENGINEERS (3Crs.: 2Lec, 2Lab): Programming in Python for engineers: language, use of external libraries, runtime analysis, applications from data analysis and engineering. Topics include: Control statement and program development, functions, sequences: list and tuples, dictionaries and sets, a deeper look on strings, Array-Oriented Programming with NumPy, and plotting using Matplotlib. ***Pre-req.: COMP 208.***

COMP 225 DIGITAL SYSTEMS I (3Crs.: 2Lec, 2Lab): Number systems and coding, Binary systems. Conversion from decimal to other bases. BCD numbers. Boolean algebra. Logic gates. Function minimization, Tabular method, Karnaugh mapping. Arithmetic functions and circuits designs (HA, FA, and ALU). Combinational functions and circuits design (decoder, encoder, multiplexer and de-multiplexer). Sequential circuits definitions and designs (Latches, RS-FF, D-FF, JK-FF, T-FF). Several laboratory experiments will be based on the simple logic gates.

COMP 321 INTRODUTION TO MICROCOMPUTERS (3Crs.:2Lec, 2Lab): Registers and Counters. Cache memory concept. Serial data transfer for multiple registers. RAM, ROM and their types. Memory organizations. Cache memory concept. The design of a generic central processing unit (CPU), focusing on its role as the core of computer systems. Control unit design. System buses include address, data, and control. Hardware and software correlations. Instruction format including Op-Code and Operands. Instruction set. Machine and assembly language programming of a standard microprocessor. ***Pre-requisite.: COMP 225.***

COMP 426 MICROPROCESSOR INTERFACING (3 Crs.: 2Lec,2Lab): Extended registers design, Binary multiplication programming. BCD functions and its programming. Stack. Microprocessor software applications, PPI and interfacing techniques: I/O port design and handshaking protocols; I/O programming, I/O interface design, Direct Memory Access, data communications, interrupt control systems; parallel and serial interfaces; timers. Pipelining, Single and multi-core processors architectures. ***Pre-requisite: COMP 321.***

POWE 212 ELECTRIC CIRCUITS I (3 Crs.: 3Lec, 0Lab): Circuit variables: voltage, current, power, and energy. Circuit elements: resistors, inductors, capacitors, voltage sources, and current sources. Circuit reduction techniques: series and parallel resistors and delta-to-wye transformation. Ohm's law. Kirchhoff's laws. DC and AC circuit analysis techniques: node-voltage and mesh-current methods, source transformations, Thévenin and Norton equivalent circuits, and maximum power transfer. Self and mutual inductances. AC steady-state power calculations. Balanced three-phase circuits.

POWE 271 ELECTROMAGNETIC FUNDAMENTALS (3 Crs.: 3Lec,0Lab): Three-dimensional orthogonal coordinate systems: Cartesian, Cylindrical and Spherical. Vector Analysis: Gradient, Divergence and Curl of fields, Divergence theorem, Stokes's theorem. Fundamental Postulates of Electrostatics in free

space, Coulomb's Law in space, Gauss's Law in space. Material Media: Conductors and Dielectrics, Polarization, Electric Flux Density. Boundary Conditions. Capacitors and Electrostatic Energy. Poisson's Equation, Laplace's Equation, Method of Images, Boundary Value Problems, Steady Electric Currents: conduction and convection currents, equation of continuity, boundary conditions for current density. Resistance and Power calculations. Fundamental Postulates of Magnetostatics in free space, Biot-Savart law in space, Ampere's Law in space. Magnetic materials: Magnetization, Inductance and Magnetostatic Energy. Magnetic circuit analysis. Introduction to Magnetic Forces and Torques. Time varying fields: Faraday's Law for Electromagnetic Induction (stationary circuit in a time-varying magnetic field, Transformers, moving circuit in steady and time-varying magnetic fields), Maxwell's Equations, Electromagnetic boundary conditions***. Pre-requisite.: PHYS 281***.

POWE 425 INTRODUCTION TO ELECTRICAL POWER SYSTEMS (3 Crs.: 3 Lec): Overview of power system structure, single-phase and three-phase transformers, synchronous generators, transmission lines and induction motors. Low-voltage power distribution in residential buildings. ***Pre-req: POWE 271.***

B. Communications and Electronics Engineering Program Core

The CEE program core courses are listed in the table below:

Course	Title	Credits	Pre-/Co-requisites
ENGR 002	Introduction to Engineering	2	
COME 214	Electric Circuits II	3	Pre: POWE 212
COME 212L	Electric Circuits Lab	1	Pre or Co: COME 214
COME 221	Electronic Circuits I	3	Pre: POWE 212 ,ENGR002
COME 222	Electronic Circuits II	3	Pre: COME 221
COME 222L	Electronic Circuits Lab	1	Pre or Co: COME 222
COME 216	Fundamentals of Artificial Intelligence	3	Pre: COMP 215,MATH 380
COME 372	Propagation and Antennas I	4	Pre: POWE 271
COME 381	Signals and Systems	3	
COME 380	Communication Theory and Systems I	3	Pre: COME 381, MATH 381
COME 384	Digital Signal Processing	3	Pre: COME 381
COME 322	Introduction to IoT	3	Pre: COME 221
COME 473	Propagation and Antennas II	3	Pre: COME 372
COME 473L	Propagation and Antennas Lab	1	Pre or Co: COME 473
COME 485	Communication Theory and Systems II	3	Pre: COME 380
COME 485L	Communication Lab	1	Pre or Co: COME 485
COME 576	Optical Communications	3	Pre: POWE 271
COME 484	Telecommunication Networks	3	Pre: COMP 225
COME 475	Special Topics in RF	1	
COME 484L	Telecommunication Networks Lab	1	Pre or Co: COME 484
COME 592	Wireless Communication Systems	3	Pre: COME 380
COME 592L	Wireless Communications Lab	1	Pre or Co: COME 592
COME 488	Cybersecurity Fundamentals	3	Pre: COME 484 and COME484L

Description of Core Courses

ENGR 002 INTRODUCTION TO ENGINEERING (2 Crs.: 2Lec, 0Lab): Introduction the student to the engineering profession in general and the learning objectives that new students should attain, as aligned with the ABET requirements. Covering the basics of the engineering profession and engineering ethics. Introduction to the different engineering majors and to the learning objectives as specified by ABET. Insight into different engineering courses that are not technical in nature (e.g., engineering economy).

Engineering design tasks that allow the student to start thinking as engineers: problem definition, specification of constraints, investigation of different solution alternatives, implementation of best solution, writing technical reports. Fundamental tools and numerical software used in engineering. The tools and software covered could be generic or specific to a major.

COME 214 ELECTRIC CIRCUITS II (3 Crs.: 3Lec, 0Lab): Transient analysis, Laplace transform and its application to circuit analysis, two-port networks, frequency selective passive and active circuits. ***Pre-requisite: POWE 212.***

COME 212L ELECTRIC CIRCUITS LAB (1 Cr.: 0Lec, 2Lab): The content of this lab is directly related to the courses POWE 212, COME 214. ***Pre or Co-requisite.: COME 214***.

COME 221 ELECTRONIC CIRCUITS I (3 Crs.: 3Lec, 0Lab): Introduction to semiconductor physics, junction diodes: construction, I-V characteristics, circuit models, applications, special purpose diodes: Zener diodes. Bipolar junction transistors (BJT) and field effect transistors (FET): types, physical structures, basic configurations, characteristic curves, circuit models, biasing circuits, small-signal amplifiers. ***Pre-requisite.: POWE 212,ENGR002***.

COME 222 ELECTRONIC CIRCUITS II (3 Crs.: 3Lec, 0Lab): BJT and FET amplifiers: Types, circuit models, frequency response, differential and multistage amplifiers, large signal analysis and power amplifiers, operational amplifiers: Characteristics, applications, imperfections, feedback amplifiers, sinusoidal oscillators and multi-vibrators. ***Pre-requisite: COME 221***.

COME 222L ELECTRONIC CIRCUITS LAB (1Cr.: 0Lec, 2Lab): The content of this lab is directly related to the courses COME 221, COME 222. ***Pre or Co-requisite: COME 222***.

COME 216 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE (3 Crs.: 3Lec, 0Lab): Introduction to AI and historical milestone. Introduction to statistics and machine learning basic methods; regression, classification, clustering, exploratory data analysis, and data visualization. Basics of supervised and unsupervised learning. Introduction to neural networks concepts: backpropagation and different network configurations. Ethical and social implications of AI. AI in various industries and engineering sectors**.** ***Pre-requisites: COMP215, MATH380***

COME 372 ANTENNAS & PROPAGATION I (4 Crs.: 4Lec, 0Lab): Review of Maxwell's equations. Plane waves in material media. Polarization of waves. Poynting vector. Reflection and transmission of waves. Normal and oblique incidence. Propagation of electromagnetic waves in the atmosphere. High frequency transmission lines. Smith chart. Matching techniques. Rectangular and cylindrical waveguides. Antennas: propagation mechanism. Antennas parameters and radiation potentials. Linear antennas (elementary dipole, short dipole, linear dipole), antenna arrays**.** ***Pre-requisite.: POWE 271***.

COME 381 SIGNALS AND SYSTEMS (3 Crs.: 3Lec, 0Lab): Signals and systems properties and classifications. Continuous Linear Time-Invariant systems. Analytical and graphical convolution and correlation. Fourier series and Fourier Transform. Laplace transform. Frequency spectra, energy and power spectra. Frequency response and transfer function, impulse response and step response. Analog Filter response.

COME 380 COMMUNICATION THEORY AND SYSTEMS I (3 Crs.: 3Lec, 0Lab): Transmission and reception of analog signals (AM, FM, PM). Performance of analog modulation schemes in the presence of noise. Building block of a digital transmission system and the differences with analog transmission. Digital

communication concepts: analog to digital conversion, pulse coded modulation, transmission and reception of digital signals; pulse shaping and digital modulation. Spectral and power efficiency of digital modulation schemes and their performance in the presence of noise. ***Pre-requisite.: COME 381, MATH 381***.

COME 384 DIGITAL SIGNAL PROCESSING (3 Crs.: 2Lec, 2Lab): Sampling, Quantization and SQNR. Signal Reconstruction and anti-aliasing filter. Discrete time signals. Difference equations and impulse responses. BIBO stability. Digital convolution. Discrete Fourier Transform and Fast Fourier Transform. Z-transform. Digital filter frequency response and transfer function. Z-plane stability. Realization of digital filters. Methods of FIR and IIR filter designs. Digital Butterworth and Chebyshev filter designs**.** ***Pre-requisite: COME 381***.

COME 322 INTRODUCTION to IoT (3 Crs. : 2 lec, 2 Lab) : This course provides a comprehensive introduction to the Internet of Things (IoT). It covers the fundamental concepts, key enabling technologies, and diverse real-world applications of IoT, exploring the essential architecture of IoT systems, sensors and actuators for data acquisition and control, various connectivity options for seamless data transmission, and foundational data processing techniques. ***Pre-requisite: COME 221***.

COME 473 ANTENNAS & PROPAGATION II (3 Crs.: 3Lec,0Lab): Coaxial transmission lines, Microstrip transmission lines. Cavity resonators. Special Antennas: Loop antenna, Traveling wave antenna. Helical antenna. Yagi antenna, Aperture principles. Microwave antennas: Horn, parabolic and microstrip antennas. Introduction to radar systems. Introduction to line of sight radio links. Introduction to satellite systems. ***Pre-requisite: COME372***.

COME 473L PROPAGATION AND ANTENNAS LAB (1 Cr.: 0Lec, 2Lab): The contents of this lab are directly related to the courses COME 372, COME 473. ***Pre or Co-requisite: COME 473***.

COME 485 COMMUNICATION THEORY AND SYSTEMS II (3 Crs.: 3Lec, 0Lab): Data transmission through information theoretic concepts: entropy and its use in the design of source coding algorithms, mutual information and its use in the definition of channel capacity, channel coding. Design of Spectral and power efficient digital communication systems. Spread spectrum methods. Advanced intersymbol interference mitigation techniques (e.g., equalizers). ***Pre-requisite: COME 380***.

COME 485L COMMUNICATION LAB (1 Cr.: 0Lec, 2Lab): The contents of this lab are directly related to the courses COME 380, COME 485. ***Pre or Co-requisite: COME 485***.

COME 499 INTERNSHIP (1Cr): This is a professional training which should not be less than four weeks. The training is followed by a presentation session where the students are supposed to present what they have learned. *Refer to the department policy for further details*.

COME 501 FINAL YEAR PROJECT I (1Cr) / COME 502 FINAL YEAR PROJECT II (3Crs): After completing 120 credits of course work, the student becomes eligible to sign up for the Final Year Project (FYP) that extends over two semesters; beginning in Fall-semester and ending in the following Spring-semester. The FYP experience requires students to work in teams to complete a specific project, submit a technical report, and give a presentation on a significant, relevant, and comprehensive engineering problem. The FYP is intended to stimulate student creativity and critical thinking, and build skills in formulating, designing, developing, building, communicating, and managing engineering projects. The project aims to provide students with a transitional experience from the academic world to the professional world. ***COME 501: Pre ENGR500, COME502: Prereq COME 502.***

COME 576 OPTICAL COMMUNICATIONS (3 Crs.: 3Lec, 0Lab): Review of basic communication systems. Introduction to optical communication systems. Fiber characteristics. Impact of different types of dispersion on bit rates. Optical transmitters and receivers. Lasers. Optical amplifiers. Long haul and multi-channel systems. ***Pre-requisite: POWE 271***.

COME 484 TELECOMMUNICATION NETWORKS (3 Crs.: 3Lec, 0Lab): This course covers a comprehensive foundation in modern communication networks, focusing on core principles, protocols, and security mechanisms. Students will examine network topologies, architectures, and the TCP/IP protocol stack (application, transport, network, data link, and physical layers). The course also explores cryptographic fundamentals, secure transport and network layer protocols (like SSL/TLS and IPsec), and email security (PGP, S/MIME), along with emerging trends in networking technologies. **Pre-requisite: COMP 225**

COME 484L TELECOMMUNICATION NETWORKS LAB (1 Cr.: 0Lec, 2Lab): This lab covers topics discussed in COME 484. ***Pre or Co-requisite: COME 484***.

COME 592 WIRELESS COMMUNICATION SYSTEMS (3 Crs.: 3Lec, 0Lab): Fundamental theoretical concepts in wireless communication systems. Characterization and modeling of the wireless channel, Performance of digital communication schemes over wireless fading channels, spread spectrum techniques, diversity techniques, orthogonal frequency division multiplexing (OFDM). multiple-input multiple output (MIMO). Security challenges in wireless, mobile (3G/4G/5G), and Ad Hoc networks. Introduction to emerging topics in wireless communications. ***Pre-requisite: COME 380.***

COME 592L WIRELESS COMMUNICATIONS LAB (1 Cr.: 0Lec, 2Lab): This lab covers topics discussed in COME 592. ***Pre or Co-requisite: COME 592***.

COME 488 Cybersecurity Fundamentals (3Crs.: 2Lec, 2Lab): The Cyber Security course identifies the networking and computer systems vulnerabilities, to recognize digital exploitation and also prevent damage such as loss of data. The course covers topics such as Cyber Security Essentials, various threats, and the importance of awareness. Additionally, the course includes different types of malwares, as well as methods for detecting/preventing intrusions, implementing Backup & Recovery Solutions, setting up firewalls, VPNs, and proxies. ***Pre-req.: COME 484 and COME484L***

COME 475 SPECIAL TOPICS IN RF (1 Cr.: 1Lec, 0Lab): This course covers a wide range of topics in RF such as RF circuit design, signal propagation and measurement techniques, while also discussing emerging trends in RF technologies.

C. Communications and Electronics Engineering Program Technical Electives

The CEE program provides one track option based on the 12-credit technical elective courses:

Artificial Intelligence and Telecommunication Networks Track

The technical elective courses are listed in the table below.

- Technical Electives for the Artificial Intelligence and Telecommunication Networks Track

Course	Title	Credits	Pre-requisites
COME 413	Datascience & Machine Learning	3	COME 216
COME 594	Introduction to Telco Cloud	3	COME592
COME 577	Radio Frequency Components	3	COME 473
COME 589	Cellular Communications	3	COME 380

Description of Technical Elective Courses of the Artificial Intelligence and Telecommunication Networks Track

COME 413 DATASCIENCE & MACHINE LEARNING (3 Crs.: 2Lec, 2Lab): Data science pipeline.

Types of data. Data cleaning and preparation. Feature engineering and selection. Data leakage. Data science versus machine learning. Learning problem. Linear and logistic regression, non-linear transformations. Overfitting, underfitting and regularization. Model selection and validation. Error analysis and evaluation metrics. Different classification methods. Support vector machines and kernels. Real-world engineering applications: predictive maintenance in IoT devices, anomaly detection in IoT networks, RF signal classification, wireless network optimization, and RFID data analytics. ***Pre-requisite: COME216.***

COME 594 INTRODUCTION to TELCO CLOUD (3 Crs,: 2Lec, 2 Lab): This course introduces the transition from traditional telecom systems to cloud-native architectures, driven by 5G, edge computing, and network slicing. It covers core concepts of Telco Cloud, including virtualization (KVM, OpenStack), containerization (Docker, Kubernetes), and key components like CNFs and VNFs. It also covers telco cloud architecture models, hardware requirements, SDN tools, and storage solutions, while comparing public and private cloud strategies. Practical examples include 4G/5G mobile core functions and Kubernetes telco operators. ***Pre-requisite: COME592***

COME 589 CELLULAR COMMUNICATIONS (3 Crs.: 3Lec, 0Lab) : Cellular concept, cellular architecture and terminology, cellular network dimensioning, radio network planning and optimization. Cellular handover types that occur in real cellular systems. Drivers and advanced techniques for cellular evolution. Properties of current and future cellular technologies. Fixed Wireless Access (FWA) deployment strategies for 4G/5G networks. ***Pre-requisite: COME 380.***

COME 577 RADIO FREQUENCY COMPONENTS (3 Crs.: 3Lec,0Lab): Topics include scattering parameters, microwave passive components (T-junctions, attenuators, isolators, and circulators), and microstrip components (power dividers, couplers, and filters). The course also covers antenna measurements, antenna arrays and their feeding networks. ***Pre-requisite: COME 473***.

Description of Technical Electives Courses for students with no track preference

Note: Students with no track preference can take any combination of courses, with a maximum of 6 credits from outside the program.

COME 423 DIGITAL INTEGRATED CIRCUITS (3 Crs.: 3Lec, 0Lab): Overview of switching characteristics of bipolar and field effect transistors. BJT digital ICs: TTL, Schottky TTL, ECL, IIL. MOS digital ICs: NMOS, CMOS. A/D and D/A converters**.** ***Pre-requisite: COME 221***.

COME 470 ACOUSTICS (3 Crs.: 3Lec, 0Lab): Fundamentals of sound. Acoustic wave equation. Sound levels and Decibel. Perception of sound. Loudness. Reverberation. Control of interfering noise. Absorption of sound. Reflection, diffraction, and refraction of sound. Acoustics design of enclosed spaces. ***Pre-requisite: COME 372***.

COME 528 RADIO FREQUENCY COMMUNICATION CIRCUITS (3 Crs.: 3Lec, 0Lab): Radio frequency (RF) passive integrated circuit components: resistors, capacitors, inductors. Noise in electronic circuits. Low noise amplifier (LNA) design. RF mixers. RF power amplifiers. RF phase locked loops. RF oscillators and synthesizers. Use of computer aided design tools for RF design and simulation. ***Pre-requisite: COME 222 and COME 473***.

COME 535 EMBEDDED SYSTEMS (3 Crs.: 3Lec, 0Lab): Overview of embedded systems: architecture, custom single purpose processors. Peripherals: Digital I/O, timers, counters, watchdog timers, interrupts, real time clocks, Serial protocols, interfacing, programming, interrupt driven routines, Applications. ***Pre-requisite: COMP 426***.

COME 537 VLSI DESIGN (3 Crs.: 3Lec, 0Lab): MOS and BiCMOS technology. MOS and BiCMOS circuit design processes: MOS layers, Stick diagrams, design rules and layout. Basic VLSI circuit concepts: layer sheet resistance, layer area capacitance, delay unit, propagation delays, wiring capacitances. Structured design of combinational and sequential logic circuits. VLSI testability. Use of computer aided design tools

for VLSI design and simulation***. Pre-requisite: COME 221 and COMP 225***.

COME 564 SEMICONDUCTOR DEVICES (3 Crs.: 3Lec, 0Lab): Carrier transport phenomena in semiconductors. Operation principles and device modeling of p-n junctions, metal-semiconductor contacts, bipolar and MOS transistors, and related devices. Silicon device fabrication technology: crystal growth, oxidation, diffusion, lithography, contacts and interconnections.

INME 482 ENGINEERING PROJECT MANAGEMENT (3 Crs.: 3 Lec): The course covers the characteristics, techniques and challenges associated with initiating, planning, executing, controlling and closure of projects. Project management skills are discussed as they apply to projects, with special focus on leadership, teaming, and coordinating individual and group efforts. MS Project is introduced to provide hands-on practical skills with building a project plan, scheduling tasks, assigning resources, managing dependencies, monitoring progress and costs, keeping projects on track, and communicating project data through Gantt charts. ***Prerequisite: ENGL 300.***

POWE 435 ELECTRIC MACHINERY I (3 Crs.: 3 Lec): History of Electric Machinery. Magnetic circuits. Principles of energy conversion. Single-phase transformers: construction, theory of operation, equivalent circuit, power flow, regulation and testing, autotransformer, tap-change transformer. Three-phase transformers: connections, per-unit equivalent circuit and special connections. DC Machines: construction, theory of operation, armature reaction and commutation, induced voltage, developed torque and equivalent circuits for separately excited, series, parallel and compound DC generators and DC motors, starting methods of DC motors. PMDC motors and brushless DC motors: construction, theory of operation and applications. Introduction to DC motor drives. ***Pre-req.: POWE 271.***

POWE 433 POWER ELECTRONIC CIRCUITS I (3 Crs.: 3 Lec): Introduction to power switches: diode, thyristor, triac, diac, GTO, BJT, MOSFET, IGBT, characteristics, modes of operation, selection of switches, firing circuit design and application, analysis and design of suitable circuits and subsystems for practical applications such as dimmer circuit and dc motor control circuit, calculation of switching losses, evaluation of THD and associated power losses. Rectifying circuits: single-phase and three-phase, uncontrolled, halfcontrolled and fully-controlled rectifiers for different types of passive loads, evaluation and demonstration of steady state voltages and currents, calculation of efficiency, PF and THD of such converters. Circuit analysis software such as PSIM, PROTEUS or MATLAB. ***Pre-req.: COME 221.***

POWE 342 CONTROL SYSTEMS I (3 Crs.: 3 Lec): History and role of control systems. Transfer function models. Block diagram representation and reduction. Transient and steady-state response analyses. Rootlocus analysis and design. Frequency-response analysis and design. Simulation using MATLAB. ***Pre-req.: MATH 283, COME 214.***

Note: Regarding the no track preference, other courses can be added to the technical elective courses pool from outside the program as long as the pre-requisite of the specified course is already taken by the student.

Study Plan
Bachelor of Engineering in Communications and Electronics Engineering (150 Credits)

First Semester (17 Credits)		**Crs.**	
MATH 281	Linear Algebra	3	
MATH 282	Calculus	3	MATH 111
MCHE 213	Dynamics	3	
PHYS 281	Electricity and Magnetism	3	
ENGR 002	Introduction to Engineering	2	
COMP 208	Programming I	3	

Second Semester (17 Credits)		**Crs.**	
COMP 225	Digital Systems I	3	
MATH 283	Differential Equations	3	Pre: MATH 281, MATH 282
PHYS 280	Classical Physics	3	
COMP 215	Programming for Engineers	3	Pre: COMP208
POWE 212	Electric Circuits I	3	
ENGL001	General English	2	

Summer I (9 Credits)		**Crs.**	
CHEM 241	Principles of Chemistry	3	
ENGL 211	Advanced Writing	2	Pre: ENGL001
ARAB001	Arabic Language	2	
BLAW001	Human Rights	1	
CHEM 241L	Principles of Chemistry LAB	1	Pre or Co: CHEM 241

Third Semester (16 Credits)		**Crs.**	
MATH 380	Discrete Mathematics	3	Pre: MATH 282
COME 221	Electronic Circuits I	3	Pre: POWE 212,ENGR 002
COME 214	Electric Circuits II	3	Pre: POWE 212
COME 212L	Electric Circuits LAB	1	Pre or Co: COME 214
POWE 271	Electromagnetic Fundamentals	3	Pre: PHYS 281
COMP 321	Introduction to Microcomputers	3	Pre: COMP 225

Fourth Semester (18 Credits)		**Crs.**	
MATH 381	Probability and Statistics	3	Pre: MATH 282
MATH 284	Numerical Analysis	3	Pre: MATH 283
COME 216	Fundamentals of Artificial Intelligence	3	Pre: MATH 380,COMP 215
COME 222	Electronic Circuits II	3	Pre: COME 221
COME 222L	Electronic Circuits LAB	1	Pre or Co: COME 222
INME 221	Engineering Economy	3	
ENGL 300	Speech Communications	2	Pre: ENGL 211

Summer II (9 Credits)		**Crs.**	
CHEM 405	Solid State Chemistry	2	
ENGR 001	Engineering Ethics	1	
	Elective(General)	2	
	Elective(General)	1	
WRNL 200	Work Ready Now	3	

Fifth Semester (17 Credits)		**Crs.**	
COME 322	Introduction to IoT	3	Pre: COME 221
COMP 426	Microprocessor Interfacing	3	Pre: COMP 321
COME 372	Propagation and Antennas I	4	Pre: POWE 271
COME 381	Signals and Systems	3	
COME 484	Telecommunication Networks	3	Pre: COMP 225
COME 484L	Telecommunication Networks LAB	1	Pre or Co: COME 484

Sixth Semester (16 Credits)		**Crs.**	
COME 473	Propagation and Antennas II	3	Pre: COME 372
COME 473L	Propagation and Antennas Lab	1	Pre or Co: COME 473
COME 380	Communication Theory and Systems I	3	Pre: COME 381, MATH 381
ENGR 500	Research Methodology	2	Pre: ENGL 211
COME 384	Digital Signal Processing	3	Pre: COME 381
COME 475	Special Topics in RF	1	
COME 488	Cybersecurity Fundamentals	3	Pre: COME 484 and COME484L

Summer III (1 Credits)		**Crs.**
COME 499	Internship (Approved Experience / Independent Study)	1

Seventh Semester (15 Credits)		**Crs.**	
COME 485	Communication Theory and Systems II	3	Pre: COME 380
COME 485L	Communication LAB	1	Pre or Co: COME 485
COME 592	Wireless Communication Systems	3	Pre: COME 380
COME 592L	Wireless Communications LAB	1	Pre or Co: COME 592
POWE 425	Introduction To Electrical Power Systems	3	Pre: POWE 271
COME 501	Final Year Project I	1	Pre: ENGR500
	Technical Elective	3	

Eighth Semester (15 Credits)		Crs.	
COME 502	Final Year Project II	3	Pre: COME 501
COME 576	Optical Communications	3	Pre: POWE 271
	Technical Elective	3	
	Technical Elective	3	
	Technical Elective	3	

Courses offered to other majors

COME 223 DIGITAL ELECTRONICS (3 Crs.:2 Lec, 2 Lab): Characteristics of bipolar and field effect transistors. Switching mode of operation. BJT digital families: TTL, Schottky TTL, ECL. MOS digital families: NMOS, CMOS. A/D and D/A converters. ***Pre-req.: POWE 212, ENGR002.***