FACULTY OF ENGINEERING (FE)

Faculty Administration

Dr. Adel El-Kordi	***Dean***
Dr. Yehya Temsah	***Assistant Dean***
Dr. Ahmed El-Lakany	***Director, Tripoli Branch***
Sereen El Hariri	***Executive Administrator***

The most promising eligible applicants are admitted to first year of engineering. Special attention is given to the following factors:

- Lebanese Secondary Certificate (Baccalaureate)
- Entrance exam to measure the level of proficiency in English, mathematics, physics and logical thinking. The Petroleum Engineering exam also includes a chemistry component.

Graduation Requirements

To receive a Bachelor of Engineering Degree in any of the engineering programs a student must satisfactorily complete 150 credit hours with an overall minimum grade point average (GPA) of 2.0. Additionally s/he must attain at least a "C" average in specific courses set by each program. The following table summarizes the number of credits required for each Bachelor granting program in the FE.

Program	**Common Requirements**			**Program Requirements**			**Total Credit Hours**
	General Education	**Basic Sciences / Mathematics**	**General Engineering**	**Major Core**	**Free Engineering and Major Technical Electives**	**Internship & FYP***	
CVLE	20	26	14	73	12	5	150
COME	20	26	12	75	12	5	150
COMP	20	26	12	75	12	5	150
POWE	20	26	16	71	12	5	150
BIME	20	26	7	80	12	5	150
INME	20	26	15	72	12	5	150
MCHE	20	26	15	72	12	5	150
PTRE	20	30	15	68	12	5	150
CHME	20	39	15	59	12	5	150
CVLE: Civil Engineering COME: Communications and Electronics Engineering COMP: Computer Engineering POWE: Electrical Power and Machines Engineering BIME: Biomedical Engineering INME: Industrial Engineering MCHE: Mechanical Engineering PTRE: Petroleum Engineering CHME: Chemical Engineering							
*FYP: Final Year Project							

Common Requirements

The following are the descriptions of the curricular components that are common to all programs offered in the Faculty of Engineering.

I. General Education

Student working for a BE degree in an engineering program must complete a total of 20 credit hours of general education (university and faculty) requirements distributed as follows:

I.A. General Education Core (12 credits)

This curricular component includes 6 courses comprising 12 credits; 3 courses (total of 5 credits) are University Requirements (UR) and 4 courses (total of 7 credits) are Faculty requirements (FR) as listed in the following table:

Course	Title	Credits	Prerequisite
University Requirement			
ARAB 001	Arabic Language	2	
BLAW 001	Human Rights	1	
ENGL 001	English Language	2	
Faculty Requirement			
ENGL 211	Advanced Writing	2	ENGL 001
ENGL 300	Speech Communications	2	ENGL 211
MGMT 002	Entrepreneurship I	2	
ENGR 001	Engineering Ethics	1	Finish ≥ 90 Crs

Descriptions of the General Education core courses are given below.

ARAB 001 Arabic Language (2Crs.: 2Lec,0Lab):
تقديم إطار عام للغة العربية لغير المتخصصين، وتتناول الموضوعات التالية: العربية بين لغات العالم، النظام الصوتي، النظام الصرفي، النظام النحوي والنظام الكتابي، كما تتناول العربية والتعريب، والعربية والحاسوب، ثم كيف تكتب مقالاً علمياً.

BLAW 001 Human Rights (1Cr.: 1Lec,0Lab): This course aims at introducing students to the principles of human rights and its foundations. The importance of human rights in our societies, not only from a theoretical point of view but rather more from a practical one, is highlighted. Special attention is given to certain global themes on human rights, which touch on critical topics related to our society. It also covers the following topics: Human rights, key values of human rights and other values, characteristics of human rights, history of human rights, some problematic cases, the evolution of human rights, the implementation of human rights and NGOs, human rights in Lebanon, children, citizenship, democracy, discrimination and xenophobia, education, and gender equality. Lectures are in English.

ENGL 001 English Language (2Crs.: 2Lec,0Lab): A general course that enhances the language skills and provides coverage of basic grammar, vocabulary, reading, and writing for foundation students. It deals with basic competence in reading, through exercises on getting main ideas, guessing meaning from context, understanding details, predicting and inferencing. Writing development from paragraph to composition, proceeding through writing is the focus of the course. Writing and reading build vocabulary through exercises and dictionary use and clause exercises. The latter develop grammar where the use of nouns, verbs, adjectives, and adverbs, transition signals, the reconstructing of sentences and main and subordinating clauses is practiced.

ENGL 211 Advanced Writing (2Crs.: 2Lec,0Lab): Students write essays on different topics related to argumentation or presentation of concepts and ideas in an organized manner. This is in addition to descriptive, narrative, reflective, and creative writing. Topics chosen are related to the students' culture diagram as well as current affairs. The ability of students to write academically and classify and organize ideas is stressed. ***Pre-req.: ENGL 001.***

ENGL 300 Speech Communications (2Crs.: 2Lec,0Lab): Basic oral communication principles and theories; body, intonation, and stress language considerations; speaker-listener relationship; speech topic, context and audience; planning, preparing and delivering of platform speeches; showcase and spotlight ideas; group interactions; projects and formal presentations. ***Pre-req.: ENGL 211.***

MGMT 002 Entrepreneurship I (2Crs.: 2Lec, 0Lab): An introductory course designed around the development of business plan. The course examines how to formulate business ideas, select a location, select a legal form of organization, locate financing source, assess the market, and develop a human resources management system.

ENGR 001 Engineering Ethics (1Crs.: 1Lec, 0Lab): Ethical issues in the practice of engineering, corporate responsibility; personal rights; honesty, ethical aspects of safety, risk and liability and conflicts of interest; environmental issues and sustainability; codes of ethics; emphasis on developing the capacity for independent ethical analysis of real cases. ***Pre-req.*: earned 90 crs.**

I.B. General Education Electives (8 credits)

This component encompasses 8 Credits of General Elective courses selected from the University Elective Courses listed in the University Section of this catalog.

II. Basic Sciences and Mathematics Courses

The Basic Sciences and Mathematics component for all engineering majors except the PTRE program consists of 26 credits (27 credits for the PTRE program and 36 credits for the CHEM program) distributed as follows:

Course	Title	Credits	Prerequisite
CHEM 241	Principles of Chemistry	3	CHEM110
CHEM 207/CHEM 405	Environmental Chemistry/Solid State Chemistry	2	
MATH 281	Linear Algebra	3	Pre: MATH 112
MATH 282	Calculus	3	MATH111
MATH 283	Differential Equations	3	MATH 281, 192
MATH 284	Numerical Analysis	3	MATH 283
MATH 381	Probability and Statistics	3	MATH 282
PHYS 281	Electricity and Magnetism	3	PHYS120
PHYS 282	Materials Properties and Heat	3	

Instead of the CHEM 207/CHEM405 and the CHEM 241 courses, the PTRE program requires the following three 9-credits chemistry courses instead:

- CHEM 281: Principles of Chemistry I (3 Credits)
- CHEM 282: Principles of Chemistry II (3 Credits)
- CHEM 331: Organic Chemistry (3 Credits)

Instead of the CHEM 207/CHEM405 and the CHEM 241 courses, the CHME program requires the following six 18-credits chemistry courses instead:

- CHEM 248: Physical Chemistry I (3 Credits)
- CHEM 281: Principles of Chemistry I (3 Credits)
- CHEM 282: Principles of Chemistry II (3 Credits)
- CHEM 331: Organic Chemistry (3 Credits)
- CHEM 345: Inorganic Chemistry (3 Credits)
- CHEM 358: Surface and Colloid Chemistry (3 Credits)

Descriptions of the required mathematics and basic sciences courses are given below.

CHEM 207 Environmental Chemistry (2Crs.: 2Lec,0Lab): Chemistry of ozone layer in the atmosphere; particulate matter and control of air pollution; global warming; waste management, treatment and disposal; mass-energy transfer; risk, dose response and human exposure assessment; hazard identification; risk characterization; water resources and pollutants; BOD and waste water.

CHEM 241 – PRINCIPLES OF CHEMISTRY (3Cr.:3 Lec): A study of the fundamental concepts of chemistry including matter and measurement, atoms, molecules, ions, moles, nomenclature, atomic and molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, and solid states of matter. Properties of

solutions, aqueous reactions and solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases and ionic equilibria, and nuclear chemistry. .***Pre-eq.:CHEM110.***

CHEM 248 Physical Chemistry I (3Crs.:3Lec): The course covers principles and applications of the first and second laws of thermodynamics. Third Law of Thermodynamics, entropy and free energy changes in chemical reactions, Thermodynamic of solutions. Phase equilibria in heterogenous systems. Phase rule and its application in one, two and three component systems. Pre-req.: CHEM 282.

CHEM 281 Principles of Chemistry I (3Crs.: 3Lec,0Lab): Introduction to the basic concepts and principles of chemistry including: Atoms, molecules, mole concept, chemical reactions and calculations, stoichiometry. Periodic table and properties of the elements, nomenclature. Theories of atomic structure, atomic spectra. Theories of chemical bonding. Covalent bonding and molecular structure: molecular geometry, VSEPR theory, valence bond theory, hybrid orbital and molecular orbital theory.

CHEM 282 Principles of Chemistry II (3Crs.: 3Lec,0Lab): Topics discussed are the three physical states of matter (gases, liquids and solids). Properties of solutions. Chemical equilibrium. Ionic equilibria. Rates of chemical reactions. Introduction to the basic chemical thermodynamics and thermo-chemistry. ***Pre-req.:CHEM281.***

CHEM 331 Organic Chemistry (3Crs.:2Lec,2Lab): Introduction to organic chemistry. A new mechanistic approach to the study of the chemical reactions and a survey of hydrocarbons, alcohols and ethers. Detailed study of aromatic compounds, aldehydes, ketones, carboxylic acids and their derivatives, and amines. The course also introduces students to spectroscopic identification of organic compounds. Applied experiments related to the above topics. ***Pre-req.: CHEM281.***

CHEM 345 – Inorganic Chemistry I (3Crs.:3Lec,0Lab): Brönsted and Lewis acid and base. Chemistry of main group elements. Basic concepts of coordination compounds: nomenclature, bonding, structure, stability, magnetic properties, stereochemistry. Crystal and ligand field theories. ***Pre-req.: CHEM 282.***

CHEM 358 Surface And Colloid Chemistry (3Crs.:3Lec): Basic terms in surface and colloid chemistry, the kinetic properties of disperse systems, interfacial phenomena, the optical and electrical properties of colloids, the preparation and stability of colloids, properties of gels, emulsion, foams and aerosol. ***Pre-req.: CHEM248***

CHEM 405 Solid State Chemistry (2Crs.: 2Lec,0Lab): Bonding in solids; crystal structures; x-ray diffraction; electron models; band theory; crystal defects; electrical, thermal, optical and magnetic properties of solid state materials from a chemical perspective; fabrication techniques and modern applications.

MATH 281 Linear Algebra(3Crs.: 3Lec,0Lab): Partial fractions; binomial theorem; roots of polynomial equations; convergence of series; Matrices: Determinants, rank, eigen values, eigenvectors, block decomposition, axes transformation solution of linear system of equations; introduction to complex analysis; conic sections; engineering applications. ***Pre-req.: MATH112***

MATH 282 Calculus (3Crs.: 3Lec,0Lab): Hyperbolic functions; implicit and logarithmic differentiation; derivatives of higher order functions; Leibniz theorem; mean value theorem; partial differentiation and applications; Taylor expansion; methods of integration; improper integrals; multiple Integrals; engineering applications. ***Pre-req.: MATH111***

MATH 283 Differential Equations (3Crs.: 3Lec,0Lab): First- and second-order differential equations with constant and variable coefficients; simultaneous system of differential equations; series solution; Introduction to partial differential equations; Fourier series; Laplace transforms; shifting theorems; convolution theorem; engineering applications. ***Pre-req.: MATH 281, MATH 282.***

MATH 284Numerical Analysis (3Crs.: 3Lec, 0Lab): Curve fitting; function approximation; iterative method for finding roots; solution of systems of linear equations; numerical differentiation and integrations; numerical solution for ordinary differential equations (first order, simultaneous system, second order); special functions; numerical analysis software; engineering applications. ***Pre-req.: MATH 283.***

MATH 381 Probability And Statistics (3Crs.: 3Lec, 0Lab): Probability space, conditional probability and independence, and probability theorems; Random variables, and density functions, joint probability; expectation, variance and covariance, moments and moment generating functions: Discrete and continuous distributions; statistical measures: mean, mode, variance, standard deviation; statistical distribution: t- distribution, chi- distribution; sampling theory; Theory of estimation, confidence intervals; probability and statistical software. ***Pre-req.: MATH 282.***

PHYS 281 Electricity and Magnetism (3Crs.: 3Lec, 0Lab):

Electric charges and Coulomb's Law; Electric field and potential of various charge distributions; electric dipoles; Gauss's Law in electricity; Capacitance and Dielectrics; Electric conduction current; Resistance and Temperature; Magnetic field of a solenoid; Gauss's Law in Magnetism; Electromotive force; Electromagnetic induction; Faraday's law; Self induction and inductance. ***Pre-req.: PHYS120***

PHYS 282 Material Properties and Heat (3Crs.: 2Lec,2Lab): Properties of materials: units, dimensions, experimental errors, circular motion of rigid bodies, moment of inertia, compound pendulum, elasticity of materials, Hook's law, relations between stresses and strains, elastic energy, torsion, gravitation and gravity, satellite motion, pressure measurements, flow of ideal fluids, streamlines and equation of continuity, Bernoulli's equation and its applications, viscosity of fluids, flow in capillary tubes; Heat: heat and temperature, temperature measurements, specific heat and latent heat, heat transfer by conduction, heat convection, heat transfer by radiation and black body radiation.

III. General Engineering

The general engineering component includes 15 credits (12 credits for the ECE programs) distributed as follows:

Course	Title	Credits	Prerequisite
COMP 208	Programming I	3	
CVLE 210	Statics*	3	
INME 221	Engineering Economy	3	
MCHE 201	Engineering Drawings and Graphics*	3	
MCHE 213	Dynamics**	3	

*Not included in the curriculum of ECE programs, replaced by INME 423 Project Planning and Management (3 credits)

COMP 208 Programming I (3Crs.: 2Lec,2Lab): Computer fundamentals. Computer system components: hardware and software. Problem solving and flowcharts/pseudocode. High level programming: data types, structured programming constructs, input and output, expressions and assignments, selection, repetition, arrays.

CVLE 210 Statics (3Crs.: 3Lec,0Lab): Force vectors (analytical and graphical methods), free-body diagrams; equilibrium of particles and rigid bodies in two and three dimensions; structural elements and supports; plane and space trusses; axial, shear, and moment diagrams of beams; Cable-supported structures. Friction; center of gravity and centroid; moment of inertia. Applications.

INME 221 Engineering Economy (3Crs.: 3Lec,0Lab): Basics principles and techniques of economic analysis of engineering project, time value of money, cost allocation and estimation, evaluation of engineering projects and investments, depreciation, inflation, bond and loan financing, after tax cash flow analysis, sensitivity analysis, selection among mutually exclusive alternatives using present worth, annual worth, internal rate of return, benefit-cost.

MCHE 201 Engineering Drawing and Graphics (3Crs.: 1Lec,4Lab): Constructional Geometry-constructing tangents. Plane curves and polygons. Orthographic drawing and theory of sketching shapes and surface identification. Orthographic projection of views. Sectional views and conventions. Pictorial drawing. Applications of Auto-CAD software for 2D drawings.

MCHE213 Dynamics (3Crs.: 3Lec,0Lab): Dynamics of a particle, system of particles, and planar rigid bodies using Newton's law of motion. Work and energy principle, impulse and momentum principle. Free-body diagram and concept of equilibrium. Inertia properties of rigid bodies.

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

Chairperson	*Ziad Osman*
Professors	*Soubhi Abou Chahine, Ali Haidar*
Associate Professors	*Issam Damaj, Hamza Issa, Mohamad Tarnini, Wassim Itani, Chadi Nohra*
Assistant Professors	*Rola Kassem, Hiba Abdallah, Khaled Chahine, Hilal El Misilmani, Ahmad El Hajj, Youmni Ziadeh, Bilal Youssef, Abdul Rahman El Falou*

3- Computer Engineering Program

Mission

The mission of the Computer Engineering (CE) Program is to prepare students for rewarding careers and higher education, engage in scientific research pushing the frontiers of the field even further, and get involved in local community issues requiring specialist participation.

Objectives

The Computer Engineering Program is designed such that its students upon graduation will:

1. Possess the highest level of technical robustness in the field of computer engineering that will earn them recognition and esteem among their colleagues.
2. Have the knowledge and skills to invent novel technology, provide creative designs, and suggest innovative solutions to challenging problems.
3. Stay abreast of emerging technologies, continually learning new theory and skills to nourish ever-developing careers.
4. Demonstrate good citizenship, fulfilling their professional responsibilities towards their communities, Lebanon, and the World at large.
5. Excel on multi-disciplinary and multi-cultural teams, and effectively employ their oral and written communication skills to resolve problems.

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 Computer Engineering consists of 150 credit-hours of course work + IC003, where the standard duration of study is 10 semesters.

Career Opportunities

The Computer Engineering career encompasses opportunities in a wide range of areas such as industry, military, communications, aerospace, business, government, medicine, to name but a few. Computer engineering is in steady progress with an ever-expanding job market. Specific jobs include the functions of designing, analyzing, and maintaining computer systems. Furthermore, graduates can analyze, design, test, and evaluate network systems. In addition, they can develop, create, and modify general information security schemes. In addition, they can develop, and test systems and application software programs. Trending areas in computer engineering comprise artificial intelligence and machine learning, cybersecurity, smart cities, autonomous driving, vehicular networks, and more. Indeed, computer engineers enjoy high job satisfaction as reflected in market studies. In modern terms, computer engineers are digital transformation and world smartification leaders, believers in sustainable development, technology entrepreneurs and professionals with an engineering mindset!

Program Overview

The Bachelor of Computer Engineering consists of 150 credit-hours of course work. The **Student's Study Plan** is given to every CE student upon his/her enrollment. The CE curriculum consists of the following components:

I. Common Requirements	**Credits**
General Education Requirements	20
Basic Sciences and Mathematics	26
General Engineering topics	9
II. CE Program-Specific Requirements	**Credits**
A. Engineering topics from outside the program	9
B. CE Core	74
C. Technical Electives	12

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.

II. CE Program-Specific Requirements

A. Engineering Topics from outside the major

This part of the CE curriculum includes 9 credits courses offered by other engineering programs. These courses are listed in the table below.

Course	Title	Credits	Pre-/Co-requisites
POWE 212	Electric Circuits I	3	
COME 223	Digital Electronics	3	POWE 212
COME 411	Instrumentation	3	COME 221 or COME 223
		9	

Description of the Courses:

POWE 212 ELECTRIC CIRCUITS I (3 Crs.: 3 Lec, 0 lab): 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.

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.***

COME 411 INSTRUMENTATION (3 Crs.: 2 lec, 2 lab): Different types of transducers and their applications. Instruments used in measuring electrical quantities. Display instruments. Signal generators. Digital to analog and analog to digital conversion. Data acquisition systems components, hardware and software. ***Pre-requisite: COME 221 or COME 223***

B. Computer Engineering Program Core

The CE program core courses are listed in the following table:

Course	Title	Credits	Pre-/Co-requisites
ENGR 002	Introduction to Engineering	2	
COMP 210	Programming II	3	Pre: COMP 208
COMP 215	Programming for Engineers	3	Pre: COMP 208
COMP 225	Digital Systems I	3	
COMP 226	Digital Systems II	3	Pre: COMP 225
COMP 231	Discrete Structures	3	Pre: MATH 282
COMP 232	Data Structures	3	Pre: COMP 210, COMP 231
COMP 311	Object Oriented Programming	3	Pre: COMP 210
COMP 325	Microprocessor Organization and Design	3	Pre: COMP 226
COMP 337	Analysis and Design of Algorithms	3	Pre: COMP 231
COMP 344	Database Systems	3	Pre: COMP 232
COMP 361	Control Systems for Computer Engineers	3	Pre: MATH 283, POWE 212
COMP 364	Introduction to Artificial Intelligence and Machine Learning	3	COMP 215
COMP 423	Computer Architecture	3	Pre: COMP 325 or COMP 326
COMP 428	Digital Systems Design	3	Pre: COMP 325
COMP 442	Software Engineering	3	Pre: COMP 311
COMP 443	Operating Systems	3	Pre: COMP 423
COMP 452	Compilers	3	Pre: COMP 311
COMP 453	Transmission and Processing of Digital Signals	3	Pre: COMP 231
COMP 454	Computer Networks	3	Pre: COMP 225
COMP 454L	Computer Networks Lab	1	Co: COMP 454
COMP 499	Internship	1	
COMP 500	Research Methodology	2	ENGL 300
COMP 501	Final Year Project I	1	Pre/Co: COMP 500
COMP 502	Final Year Project II	3	Pre: COMP 500
COMP 525	Embedded and Microprocessor Systems	3	Pre: COMP 325
COMP 543	Cryptography and Information Security	3	Pre: COMP 337
COMP 543L	Cryptography and Information Security Lab	1	Co: COMP 543
		74	

C. Computer Engineering Tracks

The CE program provides the following track options:

1. Artificial Intelligence and Machine Learning (19 Credits):
    a. Mandatory track base (10 Credits): COMP 215, COMP 364, and COMP 501 and COMP 502 (A Capstone Design Project in Machine Learning and Artificial Intelligence)
    b. Track cap (9 Credits): Select three elective courses rom the following mandatory list: COMP 460, COMP 477, COMP 534, COMP 560, COMP 562, COMP 564, COMP 565, COMP 568.

2. Networks and Cybersecurity (19 Credits):
    a. Mandatory track base (10 Credits): COMP 454, COMP 543, and COMP 501 and COMP 502 (A Capstone Design Project in Networks and Cybersecurity)
    b. Track cap (9 Credits), select three elective courses from the following mandatory list: COMP 431, COMP 455, COMP 477, COMP 510, COMP 512, COMP 529, COMP 554, COMP 555, COMP 556, COMP 559, and COMP 567.

Students not joining a track can freely select their major elective courses.

Description of Core Courses

ENGR 002 INTODUCTION TO ENGINEERING (2Crs.: 2Lec, 0Lab): Introducing 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.

COMP 210 PROGRAMMING II (3Crs.: 2Lec, 2Lab): Recursion. Arrays, basic sorting and searching. Pointers. Functions (call by reference). Character and strings. Structures, union, and bit manipulation. File operations, sequential and random. Preprocessing directives. ***Pre-req.: COMP 208.***

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. ***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 circuit design (HA, FA, and ALU). Combinational functions and circuit design (decoder, encoder, multiplexer and de-multiplexer). Sequential circuits components (Latches, RS-FF, D-FF, JK-FF, T-FF). Introduction to VHDL. Several laboratory experiments will be based on simple logic gates.

COMP 226 DIGITAL SYSTEMS II (3Crs.: 2Lec, 2Lab): Latches and flip-flops. Synchronous and asynchronous sequential systems. Design of sequential circuits using state diagrams. Registers and Counters. Programmable logic devices (PAL and PLA). Control and Datapath units. Cache memory concept. Serial data transfer for multiple registers. Types of RAM and ROM. Cache memory concept. ALU functions and circuits. Binary multipliers. BCD functions and circuits. Several laboratory experiments and projects will be based on course topics. ***Pre-req.: COMP 225.***

COMP 231 DISCRETE STRUCTURES (3Crs.: 3Lec, 0Lab): Logic and predicates. Mathematical induction. Sets and Power sets. Functions and Relations. Partial and total orders. Sequences. Counting. Multinomial theorems. Inclusion/exclusion principle. Recurrence relations and generating functions. Hardness of problems. Tress and Graphs. Groups, Rings and Fields. Lattices. ***Pre-req.: MATH 282.***

COMP 232 DATA STRUCTURES (3Crs.: 2Lec, 3Lab): Elementary data types. Arrays. Study of complexity of algorithms. Linked lists. Queues. Stacks. Trees: traversal, Binary search trees. Binary heaps, Balanced trees: AVL trees, B trees. Binomial queues. Fibonacci queue. Hashing. File Structure ***Pre-req.: COMP 210, COMP 231.***

COMP 311 OBJECT ORIENTED PROGRAMMING (3Crs.: 2Lec, 2Lab): Object–oriented design versus structured design. Classes and objects. Inheritance. Polymorphism. Information hiding and abstract data types. Overloading. Abstract classes. Exception handling. ***Pre-req.: COMP 210.***

COMP 325 MICROPROCESSOR ORGANIZATION AND DESIGN (3Crs.: 2Lec, 2Lab): This course introduces the organization and gradual design of generic central processing units (CPUs), focusing on the role of a CPU as the core of computer systems. Topics include arithmetic logic unit design; control unit design; registers; and address, data and control buses. Organization of single and multi-core processors. Machine and assembly languages of a standard microprocessor are used to illustrate the design and its interface with upper layers such as operating systems. Labels. Flags. Masking. Time Delays. Serial versus parallel I/O. Handshaking. Several laboratory experiments will be based on microcontrollers. ***Pre-req.: COMP 226.***

COMP 337 DESIGN AND ANALYSIS OF ALGORITHMS (3Crs.: 2Lec, 3Lab): Sorting and searching. Algorithm design and analysis; theory of NP completeness; tools for analyzing efficiency; design of algorithms, including recurrence, divide-and-conquer, dynamic programming, greedy algorithms, and graph algorithms. An introduction to geometric algorithms and algorithms on matrices and polynomials. ***Pre-req.: COMP 231.***

COMP 344 DATABASE SYSTEMS (3Crs.: 2Lec, 3Lab): Components of database systems: DBMS functions. Database architecture and data integrity. Data modeling: conceptual models, relational data model, conceptual schema, relational schema, relational algebra and relational calculus. Database query languages: SQL functional dependency, decomposition, normal forms. Higher normal forms. Transaction processing: Transactions; Failure and recovery systems; Physical database design: Storage and file structure; Indexed files; Hashed files; Signature files; B-trees. Query processing. Query optimization. Practical implementations using modern tools. ***Pre-req.: COMP 232.***

COMP 361 CONTROL SYSTEMS FOR COMPUTER ENGINEERS (3Crs.: 2Lec, 2Lab): Types of control systems. Advantages and limitations of using digital processors in control systems. System representation: transfer function, block diagram, signal-flow-graph. Time domain analysis: steady state and transient analysis. Frequency domain analysis. Practical implementations using MATLAB. ***Pre-req.: MATH 283, POWE 212***

COMP 364 INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (3Crs.: 3Lec, 0Lab): Rule-based systems and frequent pattern mining, logic programming, machine learning, supervised and unsupervised learning, search and constraint satisfaction. search algorithms. Knowledge representation and reasoning, knowledge representation for diagnosis. Introduction to neural networks. Implementation using various machine learning and data mining tools. ***Pre-req.: COMP 215***

COMP 423 COMPUTER ARCHITECTURE (3Crs.: 2Lec, 2Lab): Design principles associated with modern computer architectures; performance and cost considerations. Architectural features influenced by operating systems, high level languages, etc. Floating point arithmetic. Processor implementation strategies, micro-programming, pipelining, CISC and RISC, vector processors. Modern RISC processors. Memory hierarchy, cache, virtual memory organization for high performance machines. Special purpose components and devices; simple demonstrations provide experience in the designs and operations of different types of computer architecture such as memory architectures, I/O and bus subsystems, special purpose architectures, parallel processing, and distributed systems; explore hardware and software issues and trade-offs in the design, implementation, and simulation of working computer systems. ***Pre-req.: COMP 325 or COMP 326.***

COMP 428 DIGITAL SYSTEMS DESIGN (3Crs.: 2Lec, 2Lab): Introduction: design metrics, design technologies, hardware accelerators, systems-on-a-chip, intellectual property (IP) cores. Advanced Hardware design tools and technologies: hardware-description languages, high-level synthesis tools, FPGA implementation tools. Design of custom single-purpose processors: design, optimization, implementations under VHDL, applications on computationally intensive algorithms. Application-Specific Instruction-Set Processor (ASIP) design. This course has a project component that targets applications from computer, communications, power and biomedical engineering. This course has practical assignments with focus on high-level synthesis tools and FPGAs. ***Pre-req.: COMP 325.***

COMP 442 SOFTWARE ENGINEERING (3Crs.: 3Lec, 0Lab): Concepts of software development. Lifecycle of software. Requirements and specification. Data models. Process models. Design and coding. Verification, validation and testing. Software evolution. ***Pre-req.: COMP 311.***

COMP 443 OPERATING SYSTEMS (3Crs.: 2Lec, 2Lab): Basic operating systems and their components; concurrency, scheduling and dispatch, memory and device management, file systems and performance evaluation, real-time operating systems, operating systems for mobile devices. Practical experience with state-of-the-art Linux/Unix kernels. ***Pre-req.: COMP 423.***

COMP 452 COMPILERS (3Crs.: 2Lec, 2Lab): Introduction to language translation. Language translation phases. Generators. Lexical analysis: Regular expressions; NFA; DFA. Syntactic analysis: Formal definition of grammars; BNF and EBNF; bottom-up vs. top-down parsing; Tabular vs. recursive-descent parsers; Error handling; Models of execution control. Declaration, modularity, and storage management. Code generation. Emphasis on automatic compiler generation and compiler-compiler tools. ***Pre-req.: COMP 311.***

COMP 453 TRANSMISSION AND PROCESSING OF DIGITAL SIGNALS (3Crs.: 2Lec, 2Lab): Sampling and discrete time signals. The z-transform. Quantization. Histograms. Recursive and non- recursive digital filters. Frequency response and the Discrete Fourier Transform. Processing in 2 dimensions. Finite precision implementation errors. Encoding digital signals. Modulation. Multiplexing. The physical layer of the OSI model. Synchronous and asynchronous transmission. ***Pre-req.: COMP 231.***

COMP 454 COMPUTER NETWORKS (3Crs.: 3Lec, 0Lab): The OSI Model. The TCP/IP stack. Application Layer protocols. Transport Layer protocols. Network Layer protocols. Data Link Layer protocols. Frame format: character stuffing, bit stuffing. Error control. Automatic-repeat request and sliding-window protocols. Local area networks: Ethernet, token ring and FDDI, wireless LANs. Circuit switching versus packet switching. Routing and forwarding algorithms. Network Address Translation (NAT). SSH Port Forwarding/Tunneling. ***Pre-req.: COMP 225.***

COMP 454L COMPUTER NETWORKS Lab (1Cr.: 0Lec, 3Lab): The lab materials cover topics discussed in COMP 454. ***Co-req.: COMP 454.***

COMP 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.

COMP 500 RESEARCH METHODOLOGY (2Crs.: 2Lec, 0Lab): Why to Conduct Scientific Research, Stepping in: Research Methodology, Formulating a research problem, conceptualizing a research design, constructing an instrument for data collection, Selecting samples, writing a research proposal, collecting data, processing & displaying data, writing a research report. Conducting Scientific Research at the faculty of Engineering. ***Pre-req.: ENGL 300***

COMP 501 FINAL YEAR PROJECT I (1Cr) / COMP 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. ***Pre/Co-req.: COMP 500***

Refer to the Final Year Project Policy for more details.

COMP 525 EMBEDDED AND MICROPROCESSOR SYSTEMS (3Crs.: 2Lec, 2Lab): Microprocessor-based embedded systems, synchronous and asynchronous serial communication, interfacing, interrupt handling, data acquisition, real-time processing. Several laboratory experiments will be based on microprocessors and microcontrollers. ***Pre-req.: COMP 325.***

COMP 543 CRYPTOGRAPHY AND INFORMATION SECURITY (3Crs.: 3Lec, 0Lab): Measures of information. Elementary ciphers. Complexity measures. Designing a generic block cipher. Modes of operation. Attacks against block ciphers. Message digests. Cryptographic hash functions. Public key. cryptography. Diffie-Hellman key exchange. RSA. Digital signature schemes. Pseudo-random bit generators. Authentication techniques. Applications. ***Pre-req.: COMP 337.***

COMP 543L CRYPTOGRAPHY AND INFORMATION SECURITY LAB (1Cr.: 0Lec, 2Lab): The lab materials cover topics discussed in COMP 543. ***Co-req.: COMP 543.***

A. Computer Engineering Program Technical Electives

The CE curriculum includes 12 credits as technical electives. The courses are chosen from the courses listed in the following table:

Course	Title	Credits	Pre-/Co-requisites
COMP 431	Queuing and Modeling	3	Pre: MATH 381
COMP 438	Performance Evaluation	3	Pre: COMP 325 and MATH 283
COMP 444	System Programming	3	Pre: COMP 443
COMP 455	Mobile Computing	3	Pre: COMP 210
COMP 464	Operations Research for Computer Engineering	3	Pre: COMP 231
COMP 477	Emerging Trends in Computer Engineering	3	Pre: COMP 325 or COMP 232
COMP 510	Internet Engineering	3	Pre: COMP 454
COMP 512	Web Programming	3	Pre: COMP 344
COMP 529	Hardware Security	3	Pre: COMP 428
COMP 530	Hardware/Software Co-Design	3	Pre: COMP 428
COMP 532	Information Theory & Coding	3	Pre: COMP 337, MATH 381
COMP 533	Computer Graphics	3	Pre: COMP 311
COMP 534	Pattern Recognition	3	Pre: COMP 231
COMP 535	Digital Image Processing	3	Pre: COMP 453
COMP 541	Software Development	3	Pre: COMP 442
COMP 554	IoT Platform Design and Implementation	3	Pre: COMP 454
COMP 555	Wireless Security	3	Pre: COMP 454
COMP 556	Sensor Networks	3	Pre: COMP 454
COMP 559	Internet Security	3	Pre: COMP 454
COMP 560	Deep Learning	3	Pre: COMP 364
COMP 561	Digital Control	3	Pre: COMP 361
COMP 562	Applied AI and Deep Learning	3	Pre: COMP 364
COMP 564	Natural Language Processing	3	Pre: COMP 364
COMP 565	Computer Vision	3	Pre: COMP 364
COMP 567	Blockchain Network Programming	3	Pre: COMP 454
COMP 568	Soft Computing	3	Pre: COMP 232
INME 482	Engineering Project Management	3	Pre: ENGL 300

Computer Engineering Program Technical Electives

The CE curriculum includes 12 credits as technical electives. The courses are chosen from the courses listed in the following table:

COMP 431 QUEUING AND MODELING (3Crs.: 2Lec, 2Lab): Random variables, Performance measures. Markov processes. Birth/death processes. Solving Markov models. Continuous and discrete queuing models: M/M/1, M/M/m, M/M/m/m, M/M/1/K, M/G/1. Little's law. Networks of queues. Burke's theorem. Jackson's theorem. Stochastic Petri nets. GSPN. ***Pre-req.: MATH 381.***

COMP 438 PERFORMANCE EVALUATION (3Crs.: 2Lec, 2Lab): Workload performance indices. Single and multiple job processing models. Scheduling policies. Paging techniques. Performance of computing systems: hardware and software implementations. Performance of computer system applications: networks (scheduling, protocols, etc.), signal processing, machine learning, cryptography, etc. Benchmarks. Classification performance metrics: statistical and machine learning models. ***Pre-req.: COMP 325 and MATH 283.***

COMP 444 SYSTEM PROGRAMMING (3Crs.: 2Lec, 2Lab): introduce the student to the process of writing low-level programs that interact directly with a computer's operating system and hardware: Programming under UNIX : File I/O, makefiles, advanced debugging (gdb), Signal handling, and Scripting, Concurrent programming. ***Pre-req.: COMP 443.***

COMP 455 MOBILE COMPUTING (3Crs.: 2Lec, 2Lab): A general introduction to mobile computing with a strong focus on application development for the Android operating system. Students will complete a major project with the objective of publishing an application/service on the Google Play store. Android development environment, user interfaces, activities, intents, persistence, networking, location, sensors, graphics, and other Android features, tools, and capabilities. ***Pre-req.: COMP 210.***

COMP 464 OPERATIONS RESEARCH FOR COMPUTER ENGINEERS (3Crs.: 3Lec, 0Tut): Linear programming: Graphical solution; Simplex method; Duality and sensitivity analysis; Polynomial-time solutions. Decision making and game theory. Network flows. Optimization techniques. Non-linear programming. Transportation Model, PERT/CPM. ***Pre-req.: COMP 231.***

COMP 477 EMERGING TRENDS IN COMPUTER ENGINEERING (3Crs.: 2Lec, 2Lab): This course covers current technology in computer Engineering. Topics will vary every year. ***Pre-req.: COMP 325 or COMP 232***.

COMP 510 INTERNET ENGINEERING (3Crs.: 2Lec, 2Lab): This course provides a comprehensive coverage of the major advancements in the Internet architecture with a focus on routing protocols and their design and a deep analysis of the internals of the Transmission Control Protocol (TCP) and the Internet Protocol (IP). The course also discusses recent developments on the Internet such as software-defined networking. ***Pre-req.: COMP 454***.

COMP 512 WEB PROGRAMMING (3Crs.: 2Lec, 2Lab): Introduction to HTML, CSS and JavaScript. Server-side programming: Web Servers, Web-Server Scripting language (PHP/ASP/JSP), Website development using Content Management Systems. ***Pre-req.: COMP 344.***

COMP 529 HARDWARE SECURITY (3Crs.: 3Lec, 0Lab): Hardware perspective of security and trust: vulnerabilities in modern digital system design flow, physical attacks, building secure and trusted hardware. Development of hardware security cores (special purpose processors, ASIPs, pipelined, and partitioned implementations) with optimized performance characteristics (area, speed, power consumption, etc.). Provably correct hardware security and formal engineering methods. ***Pre-req.: COMP 428***.

COMP 530 HARDWARE/SOFTWARE CO-DESIGN (3Crs.: 2Lec, 2Lab): Design models: state machines, concurrent process models, dataflow diagrams, communicating sequential processes (CSP) notation, etc. Co-design principles: partitioning, co-synthesis, co-simulation, modern tools. Methodologies: transformational derivation, formal models, testing, verification, correctness, functional programming in hardware design, concurrency frameworks, synthesis of parallel algorithms. Rapid prototyping: hardware compilers, code generators and IDE design. Review of state-of-the-art published research. This course has a project component that targets applications from computer, communication, power, and biomedical engineering. ***Pre-req.: COMP 428*.**

COMP 532 INFORMATION THEORY AND CODING (3Crs.: 3Lec, 0Lab): Zero-memory and Markov information sources. Entropy. Block codes. Minimum-redundancy codes. Bounds on the average length of the code. Information channels. Channel capacity. Error detection. Shannon's fundamental theorem. Hamming distance. Decoding schemes. Error correcting codes: parity check codes, cyclic codes. ***Pre-req.: COMP 337, MATH 381***.

COMP 533 COMPUTER GRAPHICS (3Crs.: 2Lec, 2Lab): Open GL, Computer graphics algorithms, global illumination. Ray tracing. The graphics pipeline. Transformations. Texture mapping. Shadows. Sampling. Hidden line and surface removal, clipping Splines. Coloring. Animation. ***Pre-req.: COMP 311.***

COMP 534 PATTERN RECOGNITION (3Crs.: 2Lec, 2Lab): Pattern recognition techniques are used to design automated systems that improve their own performance through experience. This course covers the methodologies, technologies, and algorithms of statistical pattern recognition from a variety of perspectives. Topics including feature extraction, Bayesian decision theory, nearest-neighbor rules, clustering, support vector machines, neural networks, classifier combination, and syntactic pattern recognition techniques such as stochastic context-free grammars will be presented. ***Pre-req.: COMP 231.***

COMP 535 DIGITAL IMAGE PROCESSING (3Crs.: 2Lec, 2Lab): Image formation and perception. Image representation. Transformations on digital images. Enhancement and restoration. Segmentation. Encoding and data compression. ***Pre-req.: COMP 453.***

COMP 541 SOFTWARE DEVELOPMENT (3Crs.: 1Lec, 4Lab): Covers current technology in computer software. Software engineering management, cost and quality metrics and estimation. Project team organization and management. Students will work in teams on a substantial programming project. ***Pre-req.: COMP 442***.

COMP 554 IOT PLATFORM DESIGN AND IMPLEMENTATION (3Crs.: 2Lec, 2Lab): Overview of IoT prominent architectures and blueprint designs. Setting up IoT scenarios and workflow models. IoT sensor design with Arduino and Wi-Fi-controlled microchips. IoT and Cloud integration. Developing IoT applications with Raspberry Pi and Android. Python programming in IoT implementations. IoT Protocols: HTTP, CoAP, MQTT, AMQP, 6LoWPAN. Artificial Intelligence and machine learning models in IoT automation. Designing for Quality of Service and security in IoT architectures. ***Pre-req.: COMP 454.***

COMP 555 WIRELESS SECURITY (3Crs.: 2Lec, 2Lab): A course that discusses wireless network security protocols and applications. Security challenges in mobile and cellular networks. Security problems facing current and future wireless networks. Security attacks on mobile adhoc networks, vehicular networks, naming, addressing, and routing. Trust and privacy in the context of wireless networks. Wireless sensor network security challenges and solutions. ***Pre-req.: COMP 454.***

COMP 556 SENSOR NETWORKS (3Crs.: 2Lec, 2Lab): Wireless communication fundamentals, Short range radio communication standards (IEEE802.15.x protocols, e.g., Bluetooth, ZigBee), Architecture of wireless sensor networks (Node structure, types, network topologies), Operating systems for wireless sensor networks (TinyOS, Contiki), Network supported process measurements, MAC protocols for sensor networks, Routing protocols for sensor networks, Transport protocols for sensor networks. ***Pre-req.: COMP 454.***

COMP 559 INTERNET SECURITY (3Crs.: 3Lec, 0Lab): This course covers advanced concepts in network security and the different attack models at the 5 TCP/IP network layers. It comprehensively discusses the various security threats, the vulnerabilities in networking protocols and the attacks that exploit such vulnerabilities. The main topics covered in the course include the following: the security of Email and Web applications, the SSL protocol, the IPSec protocol, VPNs, SNMP security, intrusion detection mechanisms, intrusion backtracking, and firewalls. Practical attack generation, defense, and system hardening components will be considered in student projects as well as some Internet security research aspects. ***Pre-req.: COMP 454***.

COMP 560 DEEP LEARNING (3Crs.: 3Lec, 0Lab): Introduction to artificial neural networks. Data convolutional neural network architectures, invariance learning, deep unsupervised learning and non-convex optimization. Mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text. Practical implementations under Practical implementations under MATLAB and Python. ***Pre-req.: COMP 364***.

COMP 561 DIGITAL CONTROL (3Crs.: 2Lec, 2Lab): Compensation of control system. Design of compensators. Nonlinear control systems: phase-plane analysis and describing-function analysis. State-space representations. Linear state-space equations and their solutions. Computing the fundamental matrix. Properties of the state-space models: stability, controllability, observability. Pole placement and observers principles. Digital systems: advantages and disadvantages of using a digital processor. Sampling and reconstruction. Analysis of discrete-time systems. Design of digital controllers. ***Pre-req.: COMP 361.***

COMP 562 APPLIED AI AND DEEP LEARNING (3Crs.: 2Lec, 2Lab): Introduction to Deep Learning models used by experts. Overview on the practical aspects of Neural Networks and Deep Learning with applications using most popular Frameworks like Keras, TensorFlow, Apache System/ML and Deep Learning 4J. Applications include Anomaly Detection, Time Series Forecasting, Image Recognition and Natural Language Processing using Keras and TensorFLow. Models created include real life examples of IoT, Financial, medical, and other datasets. Scale those models using Kubernetes, Apache Spark and GPUs. ***Pre-req.: COMP 364.***

COMP 564 NATURAL LANGUAGE PROCESSING (3Crs.: 3Lec, 0Lab): Language modeling, part-of-speech tagging, speech recognition, speech synthesis, prosodic analysis, conversational dialogue, context-free grammars, syntactic parsing, coreference, text classification, sentiment analysis, and machine translation. Applications on Arabic, English and other languages. Programming in Python. ***Pre-req.: COMP 364***.

COMP 565 COMPUTER VISION (3Crs.: 3Lec, 0Lab): Computer vision fundamentals: image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, image classification, scene understanding, and deep learning with neural networks. Methods for applications: finding known models in images, depth recovery from stereo, camera calibration, image stabilization, automated alignment, tracking, boundary detection, and recognition. Practical implementations using tools, such as MATLAB and Python. ***Pre-req.: COMP 364***.

COMP 567 BLOCKCHAIN NETWORK PROGRAMMING (3Crs.: 2Lec, 2Lab): The course presents a general overview of Blockchain, from applications and administration to programming and infrastructure. Its main emphasis is on programming techniques for Blockchain decentralized distributed systems. The topics include overview of Blockchain, decentralized apps and smart contracts, Ethereum, IBM Hyperledger, Blockchain storage systems, Digital Currency systems. ***Pre-req.: COMP 454***.

COMP 568 SOFT COMPUTING (3Crs.: 3Lec, 0Lab): Soft computing techniques. Fuzzy sets, membership functions, fuzzy logic, fuzzy rules, fuzzy reasoning, fuzzification and defuzzification. Probabilistic reasoning, Bayesian network, evolutionary computation, genetic algorithms, simulated annealing, swarm intelligence, continuous optimization, combinatorial optimization, real-world problems. Practical implementations under MATLAB and Python. ***Pre-req.: COMP 232***.

Study Plan

Bachelor of Engineering in Computer Engineering (150 Credits)

First Semester (16 Credits)		**Crs.**	**Pre/Co-requisites**
MATH 281	Linear Algebra	**3**	MATH112
MATH 282	Calculus	**3**	MATH111
PHYS 281	Electricity and Magnetism	**3**	
ENGR 002	Introduction to Engineering	**2**	
MCHE 213	Dynamics	**3**	
ARAB 001	Arabic Language	**2**	

Second Semester (17 Credits)		**Crs.**	**Pre/Co-requisites**
PHYS 282	Material Properties and Heat	**3**	
MATH 283	Differential Equations	**3**	Pre: MATH 281, MATH 282
COMP 208	Programming I	**3**	
COMP 225	Digital Systems I	**3**	
POWE 212	Electric Circuits I	**3**	Pre: PHYS 281
ENGL 001	English Language	**2**	

Summer I (9 Credits)		**Crs.**	**Pre/Co-requisites**
ENGL 211	Advanced Writing	**2**	Pre: ENGL001
CHEM 241	Principles of Chemistry	**3**	
BLAW 001	Human Rights	**1**	
	General Elective	**3**	

Third Semester (17 Credits)		**Crs.**	**Pre/Co-requisites**
COMP 210	Programming II	**3**	Pre: COMP 208
COMP 215	Programming for Engineers	**3**	Pre: COMP 208
COME 223	Digital Electronics	**3**	Pre: POWE 212
COMP 226	Digital Systems II	**3**	Pre: COMP 225
COMP 231	Discrete Structures	**3**	Pre: MATH 282
ENGL 300	Speech Communications	**2**	Pre: ENGL211

Fourth Semester (18 Credits)		**Crs.**	**Pre/Co-requisites**
MATH 284	Numerical Analysis	**3**	Pre: MATH 283
MATH 381	Probability and Statistics	**3**	Pre: MATH 282
COMP 232	Data Structures and Algorithms	**3**	Pre: COMP 231
COMP 311	Object Oriented Programming	**3**	Pre: COMP 210
COMP 325	Microprocessor Organization and Design	**3**	Pre: COMP 226
INME 221	Engineering Economy	**3**	

Summer II (9 Credits)		Crs.	Pre/Co-requisites
MGMT 002	Entrepreneurship	2	
CHEM 405	Solid State Chemistry	2	
ENGR 001	Engineering Ethics	1	
	General Elective	4	

Fifth Semester (18 Credits)		Crs.	Pre/Co-requisites
COMP 337	Analysis and Design of Algorithms	3	Pre: COMP 231
COME 411	Instrumentation	3	COME 221 or COME 223
COMP 361	Control Systems for Computer Engineers	3	Pre: MATH 283, POWE 212
COMP 453	Transmission and Processing of Digital Signals	3	Pre: COMP 231
COMP 423	Computer Architecture	3	Pre: COMP 226 or COMP 326
	Technical Elective 1	3	

Sixth Semester (17 Credits)		Crs.	Pre/Co-requisites
COMP 364	Introduction to Artificial Intelligence and Machine Learning	3	Pre: COMP 215
COMP 428	Digital Systems Design	3	Pre: COMP 325
COMP 442	Software Engineering	3	Pre: COMP 311
COMP 454	Computer Networks	3	Pre: COMP 225
COMP 454L	Computer Networks Lab	1	Co: COMP 454
COMP 344	Database Systems	3	Pre: COMP 232
	General Elective	1	

Seventh Semester (14 Credits)		Crs.	Pre/Co-requisites
COMP 499	Internship (Approved Experience / Independent Study)	1	Pre: COMP 500
COMP 500	Research Methodology	2	Pre: ENGL 300
COMP 501	Final Year Project I	1	Pre/Co: COMP 500
COMP 543	Cryptography and Information Security	3	Pre: COMP 337
COMP 543L	Cryptography and Information Security Lab	1	Co: COMP 543
	Technical Elective 2	3	
	Technical Elective 3	3	

Eighth Semester (15 Credits)		Crs.	Pre/Co-requisites
COMP 452	Compilers	3	Pre: COMP 311
COMP 502	Final Year Project II	3	Pre: COMP 500
COMP 525	Embedded and Microprocessor Systems	3	Pre: COMP 325
COMP 443	Operating Systems	3	Pre: COMP 423
	Technical Elective 4	3	

Courses offered for other programs

The CE program offers four courses for other engineering majors. The courses are described below.

COMP 208 PROGRAMMING I (3Crs.: 2Lec, 2Lab): Computer fundamentals. Computer system components: hardware and software. Problem solving and flowcharts/pseudocode. High level programming: data types, structured programming constructs, input and output, expressions and assignments, selection, repetition, functions (call by value), introduction to arrays.

COMP 210 PROGRAMMING II (3Crs.: 2Lec, 2Lab): Recursion. Arrays, basic sorting and searching. Pointers. Functions (call by reference). Character and strings. Structures, union, and bit manipulation. File operations, sequential and random. Preprocessing directives. ***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 circuit design (HA, FA, and ALU). Combinational functions and circuit design (decoder, encoder, multiplexer and de-multiplexer). Sequential circuits components (Latches, RS-FF, D-FF, JK-FF, T-FF). Introduction to VHDL. Several laboratory experiments will be based on the simple logic gates.

COMP 226 DIGITAL SYSTEMS II (3Crs.: 2Lec, 2Lab): Latches and flip-flops. Synchronous and Asynchronous sequential systems. Design of sequential circuits using state diagrams. Registers and Counters. Programmable logic devices (PAL and PLA). Control and Datapath units. Cache memory concept. Serial data transfer for multiple registers. Types of RAM and ROM. Cache memory concept. ALU functions and circuits. Binary multipliers. BCD functions and circuits. Several laboratory experiments and projects will be based on course topics. ***Pre-req.: COMP 225.***

COMP 326 INTRODUCTION TO MICROPROCESSOR WITH APPLICATIONS (3Crs.: 3Lec, 0Lab): An introduction to basic computer organizations: Memory, Registers and Counters. Control and Data path units. Data transfer for multiple register. RAM and ROM. Instruction sets; assembly and machine languages. Detailed study of a microcomputer architecture and instruction set; assembly language programming and techniques; interrupt control systems; parallel and serial interfaces; the design of various types of digital as well as analog interfaces. ***Pre-req: COMP 225.***

COMP 326L INTRODUCTION TO MICROPROCESSOR WITH APPLICATIONS Lab (1Crs.: 0Lec, 2Lab): Laboratory provides practical hands-on experience with microprocessor and/or microcontrollers software application and interfacing techniques. ***Pre-req: COMP 225 & Co-req: COMP 226.***

COMP 426 MICROPROCESSOR INTERFACING (3Crs.: 2Lec, 2Lab): Topics include assembly language programming, 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. Several laboratory experiments will be based on microprocessors and/or microcontrollers. ***Pre-req: COMP 325.***

COMP 335 MICROPROCESSORS FOR BIOMEDICAL ENGINEERING (3Crs.: 2Lec, 2Lab): The course focuses on the principle of microprocessors and microcontrollers and their applications in Biomedical Engineering. Introduction to hardware system: CPU, Memory, Input/Output Interfacing, and System Bus. Instruction sets; assembly and machine languages. Fetch Cycle, Execution cycle, Instruction cycle. Detailed study of a particular Microprocessor or Microcontroller architecture: Instruction set; assembly language programming, Programming techniques, Loops, Delays, parallel and serial interfaces, interrupt control systems; Timers. Pre-req: COMP 226.

Courses offered as university electives

The CE program offers two courses as General (University) Electives. The courses are described below.

COMP 005 INTRODUCTION TO HEALTH INFORMATICS (2Crs.: 2Lec, 0Lab): Introduction to health informatics and its fields: biomedical informatics, public health informatics, consumer and informatics. Infrastructure and basic technological tools. Application of health informatics tools in public health. Emerging technologies.

COMP 007 WEBSITE DEVELOPMENT (2Crs.: 2Lec, 0Lab): This course covers the basic concepts needed to develop a website. The topics include: Internet and Web concepts, creating web pages, configuring images and multimedia on web pages, Web design best practices, Accessibility, usability and search engine optimizations, Obtaining a domain name and web host, Publishing to the Web.

COMP 008 PROGRAMMING BASICS (2Crs.: 2Lec, 0Lab): This course introduces the craft of computer basics: organization, architecture and programming. This course introduces newest developments of digital systems. Analyze problems, prepare flow charts and write, run and debug structured programs. Build application program for educational purposes.