FACULTY OF ENGINEERING (FE)

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	
CHEM 207/CHEM 405	Environmental Chemistry/Solid State Chemistry	2	
MATH 281	Linear Algebra	3	
MATH 282	Calculus	3	
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	

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.

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.

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.

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.

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.

Program Requirements

Requirements for the Bachelor of Engineering degree are program-specific. They encompass three categories: Major specific core courses, major specific elective courses, and engineering courses chosen from outside the major. The program requirements for the bachelor degrees in the different engineering majors are given hereafter. Details and titles of relevant courses are included in the Student's Study Plan (SSP) that is distributed to all engineering students.

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

2- 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:

a. An ability to apply knowledge of mathematics, science, and engineering
b. An ability to design and conduct experiments, as well as to analyze and interpret data
c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. An ability to function on multi-disciplinary teams
e. An ability to identify, formulate, and solve engineering problems
f. An understanding of professional and ethical responsibility
g. An ability to communicate effectively
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. A recognition of the need for, and an ability to engage in life-long learning
j. A knowledge of contemporary issues
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Degree Requirements

The undergraduate curriculum for the degree of Bachelor of Engineering in Computer Engineering consists of 150 credit-hours of course work + ICDL, where the standard duration of study is 10 semesters.

Career Opportunities

The computer engineering career encompasses opportunities in a wide range of environments such as industrial, military, communications, aerospace, business, scientific, and medical. Specific jobs include the functions of designing, installing, modifying, maintaining, repairing, and overhauling computer systems, digital control subsystems, logic circuits, and microprocessor-based interfaces. Furthermore, the graduates are able to analyze, design, test, and evaluate network systems, including local area networks (LAN), wide area networks (WAN), Internet, intranet, sensor networks, and other data communications systems. Additionally, they can develop, create, and modify general security schemes, including cryptography, intrusion detection and prevention, counter attacks for phishing, snooping, sniffing, and viruses, as well as computer applications software or specialized utility programs at large. Also, they are capable of doing research, design, development, and testing

of operating systems-level software, compilers, and network distribution. Moreover, they have the competencies to design, develop, administer large-scale database systems and set standards for operations, programming, and security. Finally, they can supervise the manufacturing and installation of computer or computer-related equipment and components.

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	12
II. CE Program-Specific Requirements	**Credits**
A. Engineering topics from outside the program	6
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 6 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	
INME 423	Project Planning and Management	3	
		6	

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 211	Introductory Web Programming	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 328*	CPU Design	3	Pre: COMP 226
COMP 333**	Computer Algorithms	3	Pre: COMP 231
COMP 344**	Database Systems	3	Pre: COMP 232
COMP 361	Control Systems for Computer Engineers	3	Pre: MATH 283
COMP 423	Computer Architecture	3	Pre: COMP 226 or COMP 326
COMP 431	Queuing and Modeling	3	Pre: MATH 381
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 521	Microprocessor-based Systems	3	Pre: COMP 328
COMP 543	Cryptography and Information Security	3	Pre: COMP 333
COMP 543L	Cryptography and Information Security Lab	1	Co: COMP 543
COMP 533	Computer Graphics	3	Pre: COMP 311
		74	

*: The following table lists the credits that are common with the CE and EE programs.

Course	Title	Credits
ENGR 002	Introduction to Engineering	2
COMP 210	Programming II	3
COMP 225	Digital Systems I	3
COMP 226	Digital Systems II	3
COMP 328	CPU Design	3
		14

**: The following table lists the credits that are equivalent to courses offered by the Computer Science program.

Course	Title	Credits	Equivalent to courses offered by CS program
COMP 232	Data Structures	3	CMPS 347
COMP 311	Object Oriented Programming	3	CMPS 242
COMP 333	Computer Algorithms	3	CMPS 441
COMP 344	Data Base Systems	3	CMPS 342
COMP 442	Software Engineering	3	CMPS 344
COMP 443	Operating Systems	3	CMPS 442
COMP 452	Compilers	3	CMPS 348
		21	

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. The tools and software covered could be

COMP 210 PROGRAMMING II (3Crs.: 2Lec, 2Lab): Recursion. Arrays, 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 211 INTRODUCTORY WEB PROGRAMMING (3Crs.: 2Lec, 2Lab): Introduction to HTML, CSS and JavaScript. Packages for web-page design. ***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 226 DIGITAL SYSTEMS II (3Crs.: 2Lec, 2Lab): Latches and flip-flops. Synchronous and

Asynchronous sequential systems. Registers and Counters. Control and Data path units. Serial data transfer for multiple register. Types of RAM and ROM. Cache concept. ALU functions and circuits (addition, subtraction, increment, decrement, transfer, AND, OR, XOR, NOT, etc.). Binary multiplier. BCD functions and circuits. Flags. Control unit. None binary logic. Several laboratory experiments and projects will be based on the simple logic gates to design micro-digital systems. ***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): Complexity measures and big O. Elementary data types. Arrays. 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 328 CPU DESIGN (3Crs.: 2Lec, 2Lab): This course introduces the design of a generic central processing unit (CPU), focusing on its role as the core of computer systems. Topics include arithmetic logic unit design, control unit design, registers, address, data, and control buses, with reference to standard implementations. 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, control drivers, and compilers. Several laboratory experiments will be based on microcontrollers. ***Pre-req.: COMP 226.***

COMP 333 COMPUTER ALGORITHMS (3Crs.: 2Lec, 3Lab): The P=NP question. Time complexity of algorithms. The classes PNP. Solving recurrences. Divide and-conquer. Greedy algorithms. Dynamic programming. Graph algorithms. Geometric algorithms. Algorithms on matrices and polynomials. Number theoretic algorithms. Reductions between problems. Theory of NP completeness. Examples of NP complete problems. Some approximation algorithms. ***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. ***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. Writing programs for solving problems in control systems. ***Pre-req.: MATH 283***.

COMP 423 COMPUTER ARCHITECTURE (3Crs.: 2Lec, 2Lab): Organization vs Architecture. Fundamentals of computer design, Von-Neuman machine. Computer evolution and performance. Computer function and interconnection. Memory systems (Internal, external and cache). Input/Output modules. Instruction Sets: Characteristics, functions, addressing modes and formats. RISC & CISC. Assembly and machine languages. Processor implementation techniques. Pipelining. Performance enhancements. ***Pre-req.: COMP 226 or COMP 326.***

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 442 SOFTWARE ENGINEERING (3Crs.: 2Lec, 3Lab): Concepts of software development. Life-cycle of software. Requirements and specification. Data model. Process model. Design and coding. Verification, validation and testing. Software evolution. ***Pre-req.: COMP 311.***

COMP 443 OPERATING SYSTEMS (3Crs.: 2Lec, 2Lab) : Overview, functionalities and characteristics of OS, CPU states, I/O channels, memory hierarchy, process, operations on processes, UNIX process control and management, PCB, signals, forks and pipes, Interrupt processing, operating system organization, OS kernel, Job and processor scheduling, scheduling algorithms, critical sections, mutual exclusion, synchronization, deadlock, Semaphores, Interprocess Communication (IPC), Message Passing, Deadlock: prevention, detection, avoidance,

banker's algorithm, Memory organization and management, storage allocation, Virtual memory concepts, paging and segmentation, address mapping, File organization. ***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. ***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. The RS232 interface. Modems. Error detection with checksums. Cyclic redundancy checks. ***Pre-req.: COMP 231.***

COMP 454 COMPUTER NETWORKS (3Crs.: 3Lec, 0Lab): The OSI Model. Data link layer. Frame format: character stuffing, bit stuffing. Error control. Automatic-repeat request and sliding-window protocols. Data-link protocols: HDLC, BSC, PPP. The MAC sublayer. Local area networks: Ethernet, token ring and FDDI, wireless LANs. Circuit switching versus packet switching. Routing algorithms. ***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 521 MICROPROCESSOR-BASED SYSTEMS (3Crs.: 2Lec, 2Lab): Interfacing microprocessors to memory and I/O devices. Supporting chips: buffers, decoders, system clock generator. Interfacing techniques: serial, parallel, timer, Interrupts and interrupt controller. DMA. I/O ports. Memory shadows and expending. Hardware software co-design. Computer applications. Several laboratory experiments will be based on microprocessors and/or microcontrollers. ***Pre-req.: COMP 328.***

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. Forging digital signatures. Pseudo-random bit generators. Authentication techniques. Applications. ***Pre-req.: COMP 333.***

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

COMP 533 COMPUTER GRAPHICS (3Crs.: 2Lec, 2Lab): Open GL, Computer graphique algorithmes, 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 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.

C. 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 438	Performance Evaluation	3	Pre: MATH 283
COMP 444	System Programming	3	Pre: COMP 328
COMP 455	Mobile Computing	3	Pre: COMP 210
COMP 462	Artificial Intelligence	3	Pre: COMP 231
COMP 464	Operations Research for Computer Engineering	3	Pre: COMP 231
COMP 477	Emerging Trends in Computer Engineering	3	Pre: COMP 226
COMP 510	Internet Engineering	3	Pre: COMP 454
COMP 511	Cloud Computing	3	Pre: COMP 454
COMP 512	Web Programming	3	Pre: COMP 211
COMP 532	Information Theory & Coding	3	Pre: COMP 333, MATH 381
COMP 534	Pattern Recognition	3	Pre: COMP 231
COMP 535	Digital Image Processing	3	Pre: COMP 333
COMP 541	Software Development	3	Pre: COMP 311
COMP 555	Wireless Security	3	Pre: COMP 454
COMP 556	Sensor Networks	3	Pre: COMP 454
COMP 561	Digital Control	3	Pre: COMP 361
POWE 214	Electric and Electronic Measurements	3	Pre: POWE 212
MCHE 461	Applied Robotics	3	Pre: MCHE 213 and (MCHE 302 or COME 431 or COMP 328

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 410 e-GOVERNMENT (3Crs.: 2Lec, 2Lab): This course introduces the technology of e-government with an in-depth analysis of successful and influential implementations in the region and globally. Several topics are covered in the course: technical and business challenges for deploying e-government solutions, e-government Web architectures and their requirements, hosting e-government service models, developing effective e-government administrators, and managing the security and privacy risks of implementing e-government services in the cloud. ***Pre-req.: COMP* 211**.

COMP 438 PERFORMANCE EVALUATION (3Crs.: 3Lec, 0Lab): Work load performance indices. Single and multiple job processing models. Scheduling policies. Paging techniques. Network protocols. Routing policies. ***Pre-req.: MATH 283.***

COMP 444 SYSTEM PROGRAMMING (3Crs.: 2Lec, 2Lab): Programming in assembly language, macro assembler, loaders, linkers, languages for system programming. ***Pre-req.: COMP 238***

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 462 ARTIFICIAL INTELLIGENCE (3Crs.: 2Lec, 2Lab): Fundamental issues. Rule-based systems, logic programming, Search and constraint satisfaction. Knowledge representation and reasoning. Search: algorithms. Knowledge representation and reasoning: temporal and spatial reasoning, uncertainty, knowledge representation for diagnosis. Machine learning and neural networks. ***Pre-req.: COMP 231.***

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. Project management 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.: COMP226***.

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 511 CLOUD COMPUTING (3Crs.: 2Lec, 2Lab): The course presents a general overview of cloud computing, from applications and administration to programming and infrastructure. Its main emphasis is on programming techniques for cloud computing and large scale distributed systems which form the basis of the cloud infrastructure such as Hadoop and Map-Reduce. The topics include: overview of cloud computing, cloud systems, distributed processing in the cloud, storage systems, virtualization, and security. Students will study practical cloud solutions developed by Google, Amazon, Oracle, Microsoft, VMWare, etc. ***Pre-req.: COMP 454***.

COMP 512 WEB PROGRAMMING (3Crs.: 2Lec, 2Lab): Server-side programming : Web Servers, Web-Server Scripting language (PHP/ASP/JSP), Web-Site development using CMS. ***Pre-req.: COMP 211.***

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 333 and MATH 381***.

COMP 534 PATTERN RECOGNITION (3Crs.: 3Lec, 0Tut): Reconstruction from projections. Scene understanding. Matching and recognition. Methods for reconstructing three-dimensional scene information using techniques such as depth from stereo, structure from motion, and shape from shading. Motion and video analysis. Three-dimensional object recognition. ***Pre-req.: COMP 231.***

COMP 535 DIGITAL IMAGE PROCESSING (3Crs.: 3Lec, 0Lab): Image formation and perception. Image representation. Transformations on digital images. Enhancement and restoration. Segmentation. Encoding and data compression. ***Pre-req.: COMP 333.***

COMP 541 SOFTWARE DEVELOPMENT (3Crs.: 1Lec, 4Lab): Covers current technology in computer software. Topics will vary every year. ***Pre-req.: COMP311***.

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 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 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.***

POWE 214 ELECTRIC AND ELECTRONIC MEASURMENTS (3Crs.: 2Lec, 2Lab): Introduction to instrumentation and measurements (Errors, precision, accuracy, measurement statistics, etc.), Analog instrumentation (Permanent magnet moving coil PMMC, Moving Iron MI, Electrodynamometer), bridges (AC, DC), Oscilloscopes (functions and controls, voltage, time, and frequency measurements), Conversion (D/A, A/D, etc.), Electrical transducers, signal conditioning, data acquisition. ***Pre-req.: POWE 212.***

MCHE 461 APPLIED ROBOTICS (3Crs.: 2Lec, 2Lab): Robot architecture, subsystems, and applications; mechanisms and drives; forward and inverse kinematics; trajectory planning; dynamics and control; actuators and drive electronics; sensors and interface; mobile robots and navigation; intelligence; collaborative learning; team project. ***Pre-req.: MCHE 213 and either MCHE 302 or COME 431 or COMP 328.***

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 211	Introductory Web Programming	**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	**3**	Pre: COMP 231
COMP 311	Object Oriented Programming	**3**	Pre: COMP 210
COMP 328	CPU 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 333	Computer Algorithms	**3**	Pre: COMP 231
COMP 423	Computer Architecture	**3**	Pre: COMP 226 or COMP 326
COMP 361	Control Systems for Computer Engineers	**3**	Pre: MATH 283
COMP 431	Queuing and Modeling	**3**	Pre: MATH 381
COMP 453	Transmission and Processing of Digital Signals	**3**	Pre: COMP 231
	Technical Elective 1	**3**	

Sixth Semester (17 Credits)		**Crs.**	**Pre/Co-requisites**
COMP 344	Database Systems	**3**	Pre: COMP 232
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
	Technical Elective 2	**3**	
INME 423	Project Planning and Management	**3**	
	General Elective	**1**	

Seventh Semester (14 Credits)		**Crs.**	**Pre/Co-requisites**
COMP 443	Operating Systems	**3**	Pre: COMP 423
COMP 499	Internship (Approved Experience / Independent Study)	**1**	Pre: COMP 500
COMP 500	Research Methodology	**2**	Pre: ENGL300
COMP 501	Final Year Project I	**1**	Pre/Co: COMP 500
COMP 543	Cryptography and Information Security	**3**	Pre: COMP 333
COMP 543L	Cryptography and Information Security Lab	**1**	Co: COMP 543
	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 521	Microprocessor-based Systems	**3**	Pre: COMP 328
COMP 533	Computer Graphics	**3**	Pre: COMP 311
	Technical Elective 4	**3**	

Courses offered for other majors

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, 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 211 INTRODUCTORY WEB PROGRAMMING (3Crs.: 2Lec, 2Lab): Introduction to HTML, Java, Java Script, JSP, ASP and PHP. Packages for web-page design. ***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). Simple buffer registers. Counters.

COMP 226 DIGITAL SYSTEMS II (3Crs.: 2Lec, 2Lab): Latches and flip-flops. Synchronous and Asynchronous sequential systems. Registers and Counters. Control and Data path units. Serial data transfer for multiple register. Types of RAM and ROM. Cache concept. ALU functions and circuits (addition, subtraction, increment, decrement, transfer, AND, OR, XOR, NOT, etc.). Binary multiplier. BCD functions and circuits. Flags. Control unit. None binary logic. Several laboratory experiments and projects will be based on the simple logic gates to design micro-digital systems. ***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 particular 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 328.***

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 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.