FACULTY OF ENGINEERING

FACULTY LIST

OFFICERS OF THE FACULTY

Salem, Elie	President of the University
Nahas, George	Vice-President for Planning and Educational Relations
Karam, Nadim	Dean of Faculty of Health Sciences, Vice President for Health and Community Relations
Najjar, Michel	Dean for Faculty of Engineering, Vice President for Development, Administration and Public Affairs
Moubayed, Walid	Dean of Admissions and Registration
Bashir, Samira	Librarian

STAFF OF THE FACULTY

Antoun, Sally	Laboratory Assistant
Bachawati, Makram	Research Assistant
Daoud, Nassif	Instructor
Fallah, Hala	Laboratory Assistant
Ghorayeb, Fadi	Instructor
Hage Obeid, Marina	Research Assistant
Hanna, Badia	Faculty Secretary
Hilal, Nina	Instructor
Iaaly, Amal	Instructor
Jbeily, Christiane	Laboratory Assistant
Kheir, Michella	Laboratory Assistant
Khoury, Richard	Assistant Instructor
Khoury (El), Vanessa	Research Assistant
Malek, Abdallah	Laboratory Supervisor
Minkara, Rania	Instructor
Moujaes, Nabil	Laboratory Assistant
Murr, Nicolas	Laboratory Assistant Technician
Nakad, Mantoura	Executive Secretary
Rouphael, Fadi	Instructor
Saliba, Josette	Faculty Secretary
Yaacoub, Tony	Instructor
Zakhem, Claire	Research Assistant
Zein, Jean	Instructor

FACULTY MEMBERS

Abche, Antoine	Ph.D., Biomedical Engineering, Rutgers, The State University of New Jersey, USA.
Akkary, Ghassan	MS, Petroleum Processing, Institute of Petroleum and Gases, Romania.

Alamddine, Abdul-Menhem	M.S.E.S., Computer Engineering, University of Southeastern Louisiana, USA.
Ayoubi, Rafic	Ph.D., Computer Engineering, University of Southwestern Louisiana, USA.
BadaouiEl-Najjar, Maged	Ph.D., Electrical Engineering, Purdue University, USA.
Chaouk, Hamdi	Ph.D., Aeronautical Engineering, University of Sydney, Australia.
Daaboul, Michel	Ph.D., Fluid Mechanics, University of Poitiers, France.
Daba, Jihad	Ph.D., Electrical Engineering, Purdue University, USA.
Dagher, Issam	Ph.D., Electrical Engineering, University of Central Florida, USA.
Estephane, Jane	Ph.D., Chemistry and Material Science, Claude Bernard (Lyon, France) and Torino (Turin, Italy) Universities.
Fares, Nabil	Ph.D., Civil Engineering, Massachusetts Institute of Technology, Massachusetts, USA.
Gerges, Antoine	Ph.D., Civil Engineering, University of South Florida, USA.
Gerges, Najib	Ph.D., Civil Engineering, University of South Florida, USA.
Habib, Sami	Ph.D., Material Chemistry & Catalysis, University of Paris VI, Paris, France.
Haddad, Nicolas	Ph.D., Electrical Engineering, Ohio University, Athens, Ohio.
Haidar, Haissam	Ph.D., Mechanical Engineering, MIT, Cambridge, Massachusetts, USA.
Hamouche, Nakhle	Ph.D., Engineering Mechanics, Mississippi State University, USA.
Hassan(El), Moustapha	Ph.D., Electrical Engineering, University of Bordeaux, France.
Hassan, Nisrine	Ph.D., Chemical Process Engineering, Pierre & Marie Curie University, France.
Honein, Elie	Ph.D., Mechanical Engineering, Stanford University, Stanford, California, USA.
Hoz (El), Mervat	Ph.D., Civil Engineering, The University of Sydney, Australia.
Inaty, Elie	Ph.D., Optical Communications, Université Laval, Quebec City, Canada.
Issa, Georges	Diplôme D'Ingénieur, Saint Joseph University, Lebanon.
Issa, Ghassan	Diploma, Architecture, University of Athens, Greece.
Jadayel, Oussama	Ph.D., Mechanical Engineering, University of Birmingham, UK.

Karam, Elie	Ph.D., Biomedical Engineering, Rutgers, The State University of New Jersey, USA.
Khaldi, Mohamad	Ph.D., Electrical Engineering, Pennsylvania State University, USA.
Khalil, Nariman	Ph.D., Civil Engineering, Leeds University, England.
Makhoul, Nisrine	Ph.D., Civil Engineering, Ecole Nationale Supérieure des Arts et Métiers.
Manneh, Rima	Ph.D., Chemical Engineering (Environmental), Ecole Polytechnique de Montréal, Canada.
Mokbel, Chafic	Ph.D., Telecommunications, Ecole Nationale Supérieure des Télécommunications, France.
Moubayed, Walid	Ph.D., Civil Engineering, University of Houston, USA.
Najjar, Amal	Ph.D.,Microbiology and Biotechnologies for Sustainable Development, University of the Mediterranean Sea - Aix-Marseille II, France.
Najjar, Michel	Ph.D., Civil Engineering, Oklahoma State University, USA.
Nasr, Karim	Ph.D., Mechanical Engineering, Purdue University, West Lafayette, USA.
Nehme, Gabi	Ph.D., Mechanical Engineering, University of Texas, USA.
Nini, Robert	Ph.D., Civil Engineering, Ecole Centrale de Paris, France.
Raad, Robert	Ph.D., Electrical Engineering, Université Laval, Quebec City, Canada.
Rajeh, Roger	MS, Chemical Engineering, RWTH Aachen, Germany.
Rai, Habib	Ph.D., Mechanical Engineering, The University of Dayton, Ohio, USA.
Rishmany, Jihad	Ph.D., Mechanical Engineering, Ecole Nationale Supérieure d'Ingénieurs de Constructions, Aéronautiques, France.
Rizk, Joe	MS, Civil Engineering, Florida International University, USA.
Saba, Riad	MS, Electrical Engineering, Oklahoma State University, USA.
Semaan, Nabil	Ph.D., Engineering & Construction Management, Concordia University, Canada.
Salem, Salem	Public Housing Degree, Bowscentrum, Holland. BS, Architecture, University of Texas, USA.
Tawk, Issam	Ph.D., Mechanical Engineering, Université de Toulouse, France.
Youssef, Khaled	Ph.D., Technical Sciences, Moscow Power Institute, Russia.
Zakhem, Elias	MS, Chemical Engineering, Berlin University, Germany.
Zakhem, Henri	Ph.D., Chemical Engineering (Food Quality Control), University of Technology of Compiègne, France

PROGRAMS OF STUDY

The Faculty of Engineering offers three year programs leading to the Bachelor of Science Degree in Engineering in the following departments:

Engineering Faculty	Years	Degree	Status
Departement of Computer Engineering	3	BS	Offered
Departement of Electrical Engineering	3	BS	Offered
Departement of Civil Engineering	3	BS	Offered
Departement of Mechanical Engineering	3	BS	Offered
Departement of Chemical Engineering	3	BS	Offered

The sequence of study in all these programs proceeds from an education in science fundamentals toward training designed to give the student mastery of the principles and arts central to Engineering Science.

The award of the Bachelor's Degree in Engineering indicates that the graduate is ready to begin professional practice. The graduate may apply to advanced study leading to a Master's Degree, provided he/she has obtained high grades in the undergraduate studies.

UNDERGRADUATE PROGRAM

1. ADMISSION REQUIREMENTS

Admission to the undergraduate program in the Faculty of Engineering is normally restricted to the first year. However, in exceptional cases, and with the approval of the Admissions Committee, students transferring from other accredited institutions may be considered for admission on an individual basis provided the following requirements are satisfied:

a- Enrollment quotas are not filled.

b- The applicant attended a reputable university and obtained a minimum average of 70 in at least 20 transferable credits or, has successfully completed one year of study.

c- The applicant's Baccalaureate qualifies him/her for admission to the University.

d- The applicant satisfies the University admission requirements concerning English proficiency.

e- The Faculty Admissions Committee has evaluated the applicant's qualifications for academic success in scientific and engineering subjects and approved the transfer admission.

2. ACADEMIC RULES AND REGULATIONS

A. GRADUATION REQUIREMENTS

Refer to the Graduation Requirements in the General Section.

B. PERMISSION TO TAKE GRADUATE COURSES

A Student is permitted to take Graduate courses if he/she meets the following conditions:

1- Students who are finishing their last 20 credits of Bachelor degree and have an average in major courses of 75 or above are allowed to take a maximum of two master courses, provided that the total number of credits per semester does not exceed 15.

2- Students who are finishing their last 20 credits for the Bachelor degree and have an average in major courses of 75 or below may not take any Master courses.

C. PROMOTION TO 4TH YEAR

Students who achieve an average in major courses in their undergraduate plan of study above 75 but below 80 are accepted in a graduate program on probation.

Students who achieve an average in major courses in their undergraduate plan of study of 80 or above are accepted in a graduate program with clear standing.

D. EVALUATION CRITERIA

Refer to Scholastic Standing, General Section, I

E. DEAN'S HONOR LIST

To be placed on the Dean's honor list of the semester, a student must:

a- Be a regular full time student registered for at least 12 credits.

b- Have a semester major course average of 85 or above or have a semester general course average of 80 or above and rank in the top 10% of his/her class.

c- Have no failing, withdrawals, or incomplete grades.

d- Have no disciplinary action against him/her.

e- Be deemed worthy by the Dean to be placed on the Honor List.

F. CHANGE OF MAJOR

To transfer from any other Faculty of the University of Balamand to the Faculty of Engineering, the student must have a cumulative average of at least 70 to be eligible for consideration by the Admissions Committee of the Faculty. He/she must have obtained an average in major science courses (determined by the department) of at least 70 with no failures. The Faculty Admissions Committee grants the final approval.

3. LABORATORY CHARGES

A. SUPPLIES

Each student taking laboratory subjects must furnish, at his/her expense, the necessary notebooks, blank forms, lab coat, and similar supplies. For regular students taking prescribed laboratory work, no charge is made for normal amounts of expendable material used in connection with laboratory subject. Expendable materials are those that are necessarily consumed or rendered unfit for further use in the normal conduct of a laboratory test. If an excessive amount of expendable material is required because of carelessness on the part of the student, the cost of the additional material will be charged to the student or group responsible.

B. DAMAGES

Students will be charged for damage to instruments caused by lack of care. The amount of the charge will be the actual cost of repair, and if the damage results in total loss of the apparatus, adjustment will be made in light of the condition of the instruments. Where there is danger of costly damage, an instructor will be asked to check the set up. When a group does laboratory work, charges for breakage will be divided among the members of the group concerned. The amount of the charge will be stated at the time or as soon as it can be determined.

DEPARTMENT OF COMPUTER ENGINEERING
BACHELOR'S DEGREE

FIRST YEAR

Semester 1

Course Code	Course Title	Credit
CSIS 200	Introduction to Computers & Programming	3
ELEN 201	Instrumentation Lab	1
ENGL 203	English Comm. Skills III	3
MATH 200	Calculus I	3
MATH 211	Linear Algebra	3
MECH 211	Engineering Drawing I	1
MECH 221	Engineering Dynamics	3
Total		**17**

FIRST YEAR

Semester 2

Course Code	Course Title	Credit
CPEN 211	Introduction to Digital Logic Design	3
CSIS 201	Programming Methodology	3
ELEN 202	Electrical Simulation and Design	1
ELEN 221	Circuits Analysis I	3
ENGL 2xx	English Elective	3
MATH 202	Calculus II	3
MATH 270	Differential Equations	3
Total		**19**

SECOND YEAR

Semester 3

Course Code	Course Title	Credit
CPEN 202	Logic Lab	1
CPEN 212	Logic Circuits	3
CSIS 204	Object Oriented Programming	3
ELEN 222	Signals and Systems Theory	3
ELEN 231	Electronics I	3
MATH 230	Numerical Analysis I	3
MECH 232	Thermodynamics	3
Total		**19**

SECOND YEAR

Semester 4

Course Code	Course Title	Credit
CSIS 202	Data Structures	3
CSIS 222	Computer Networking	3
CPEN 213	Microprocessors	3
CVSQ 201	The Formation of Civilization	3
ELEN 303	Circuits Analysis Lab	1
ELEN 304	Electronics Lab	1
MATH 246	Probability for Engineers	3
Total		**17**

THIRD YEAR

Semester 5

Course Code	Course Title	Credit
	Option Elective 1 (**)	3
CPEN 305	Microcontrollers Lab	1
CPEN 307	PLC Lab	1
CPEN 314	Computer Architecture	3
CPEN 324	Programmable Logic Controllers	3
CVSQ 202	The Religious Experience: The Sacred	3
ELEN 341	Telecommunications	3
Total		**17**

THIRD YEAR

Semester 6

Course Code	Course Title	Credit
	Option Elective 2 (**)	3
CPEN 308	Electronics Design Automation Lab (EDA)	1
CPEN 346	Basics of Computer Security	3
CSIS 221	Operating Systems	3
CVSQ 203	Introduction to Modernity	3
ELEN 306	Telecommunications Lab	1
ELEN 326	Signal Processing	3
GENG 390	Undergraduate Project	1
Total		**18**

Total credits **107**

(*) Computer Hardware Option:

CPEN 317	Computer Hardware Design	3
CSIS 270	Database	3

(*) Information and Networking Option:

CPEN 347	Teletraffic	3
CSIS 270	Database	3

(*) Telecommunications Option:

ELEN 223	Electricity and Electromagnetism	3
ELEN340	Signal Transmission	3

(*) General/Management Option:

GENG 301	Engineering Management	3
CPEN 317	Computer Hardware Design	3

DEPARTMENT OF ELECTRICAL ENGINEERING

BACHELOR'S DEGREE

FIRST YEAR

Semester 1

Course Code	Course Title	Credit
CSIS 200	Introduction to Computers & Programming	3
ELEN 201	Instrumentation Lab	1
ENGL 203	English Communication. Skills III	3
MATH 200	Calculus I	3
MATH 211	Linear Algebra	3
MECH 211	Mechanical Drawing I	1
MECH 221	Engineering Dynamics	3
Total		**17**

FIRST YEAR

Semester 2

Course Code	Course Title	Credit
ENGL 204	English Communication Skills IV	3
CPEN 211	Introduction to Digital Logic Design	3
CSIS 201	Programming Methodology	3
ELEN 202	Electrical Simulation and Design	1
ELEN 221	Circuits Analysis I	3
MATH 202	Calculus II	3
MATH 270	Differential Equations	3
Total		**19**

SECOND YEAR

Semester 3

Course Code	Course Title	Credit
CPEN 202	Logic Lab	1
CPEN 212	Logic Circuits	3
ELEN 222	Signals and Systems Theory	3
ELEN 223	Electricity & Electromagnetism	3
ELEN 231	Electronics I	3
MATH 230	Numerical Analysis I	3
MECH 232	Thermodynamics	3
Total		**19**

SECOND YEAR

Semester 4

Course Code	Course Title	Credit
CPEN 213	Microprocessors	3
CVSQ 201	Early Formation of Civilization	3
ELEN 303	Circuits Analysis Lab	1
ELEN 304	Electronics Lab	1
ELEN 324	Circuits Analysis II	3
ELEN 332	Electronics II	3
MATH 246	Probability for Engineers	3
Total		**17**

THIRD YEAR

Semester 5

Course Code	Course Title	Credit
CPEN 305	Microcontrollers Lab	1
CVSQ 202	The Religious Experience	3
ELEN 307	Control Lab	1
ELEN 341	Telecommunications	3
ELEN 351	Control Systems	3
ELEN 361	Electric Machines	3
	Option Course (*)	3
Total		**17**

THIRD YEAR

Semester 6

Course Code	Course Title	Credit
CVSQ 203	Introduction to Modernity	3
ELEN 306	Telecommunications Lab	1
ELEN 308	Electric Machines Lab.	1
ELEN 325	Electrical Installation	3
ELEN 326	Signal Processing	3
ELEN 362	Power Electronics	3
GENG 390	Undergraduate Project	1
	Option Course (*)	3
Total		**18**
Total credits		**107**

(*) Biomedical Option:

BIOL 205	Principles of Biology	3
CPEN 314	Computer Architecture	3

(*) Telecommunications Option (EE Students):

CSIS 222	Introduction to Computer Networks	3
ELEN340	Signal Transmission	3

(*) Power & Control Option:

CPEN 324	Programming Logic Controllers	3
ELEN 352	Digital Control Systems	3

(*) Engineering Management/General Option:

GENG 301	Engineering Management	3
	Engineering/Management Elective	3

(*) Computer Hardware and Software Option:

CPEN 314	Computer Architecture	3
CSIS 270	Database	3

(*) Information & Networking Option:

CSIS 222	Introduction to Computer Networks	3
CPEN 347	Teletraffic	3

COURSE DESCRIPTIONS

BMEN 301 INTRODUCTION TO BIOMEDICAL ENGINEERING **3.0: 3 cr. E**

This course provide an overview of applications of engineering in medicine. Topics covered include basic biology and engineering problems associated with living systems and health care delivery; introduction to biomedical problems using fundamental concepts and tools from electrical, mechanical, and chemical engineering. Examples will be used to illustrate how basic concepts and tools of science & engineering can be brought to bear in understanding and simulation of biological processes.

CPEN 202 LOGIC LAB **0.3: 1 cr. E**

This laboratory provides an introduction to analysis and design of digital circuits and systems; combinational logic; sequential logic; MSI circuits; and selected topics in more advanced areas.

Co-requisite: CPEN 212.

CPEN 211 INTRODUCTION TO DIGITAL LOGIC DESIGN **3.0: 3 cr. E**

This course covers number Systems; Boolean algebra; Karnaugh maps; logic gates; combinational and sequential circuit design; adders; multiplexers; flip-flops; counters; shift registers.

Pre-requisite: CSIS 200, MATH 211.

CPEN 212 LOGIC CIRCUITS **3.0: 3 cr. E**

This course covers combinational logic design using MSI and LSI integrated circuits; sequential circuit analysis and design; state-machine design; registers; counters, and memory system analysis and design; register-transfer logic design techniques based on CPLD and FPGA technologies.

Prerequisites: ELEN 221 and CPEN 211.

CPEN 213 MICROPROCESSORS **3.0: 3 cr. E**

This course covers the microprocessor architecture and assembly language: building blocks of microprocessors, memories, input/output circuits; bus structures; software development for microprocessors; instruction sets, assembler; development tools; addressing structures; interfacing peripherals and input/output processing techniques; interface devices, interfacing input/output devices, microprocessor interrupt structures, direct memory access; 16 and 32 bit microprocessors; micro-controllers.

Prerequisite: ELEN 231 and CPEN 212.

CPEN 305 MICROCONTROLLERS LAB **0.3: 1 cr. E**

This laboratory applies the theory of both switching and dynamical control. Switching control includes Microprocessor hardware analysis, timing, and design, Microcontroller, and Programmable IC. Dynamical control includes system modeling, analysis, and control (PID, phase compensation, optimal control).

Prerequisites: CPEN 202 and CPEN 213.

CPEN 307 PLC LAB **0.3: 1 cr. E**

This lab covers the application on the uses of Programmable Logic Controller (PLC); Programming Logic, Memory organization, Relay Logic Ladder Diagram (RLLD), Instruction List Programming (ILP), State Based Design (SBD), Sequential Function Charts/Grafcet (SFC), Function Block Programming (FBP), Program Control Instructions, Timers, Counters, Data Manipulation, Sequencers; Project Design.

CPEN 308 ELECTRONIC DESIGN AUTOMATION LAB **0.3: 1 cr. E**

Electronic Design Automation (EDA) tools are used to design large-scale logic circuits with emphasis on hardware implementation using FPGA technology. Lab assignments are based on Verilog Hardware Description

language, where students design, simulate, synthesize, and download to FPGA-based boards using the same commercial EDA tools for all these steps.

CPEN 314 COMPUTER ARCHITECTURES **3.0: 3 cr. E**

This course deals with the specification and design of RISC-based microprocessors, taking into account such factors as cost versus performance, details of cache and virtual memory concepts, single- and multi-cycle data path, and control unit design.

Prerequisite: CPEN 213.

CPEN 317 COMPUTER HARDWARE DESIGN **3.0: 3 cr. E**

This course covers the specification and design of RISC-based microprocessor, taking into account such factors as cost versus performance. Details of ALU, floating points units, data path (unpipelined and pipelined), control units based on state diagrams and microprogramming, and techniques for peripheral interfacing.

CPEN 324 PROGRAMMABLE LOGIC CONTROLLERS **3.0: 3 cr. E&F**

This course covers the understanding and uses of Programmable Logic Controller (PLC); Programming devices, Memory organization, LADDER diagram, Relay type instructions, Program Control Instructions, Timers, Counters, Data Manipulation, Sequencers; Project design.

CPEN 346 BASICS OF COMPUTER SECURITY **3.0: 3 cr. E**

This introductory course builds on computer network and computer system concepts to create a feel for how information and respective information systems are best secured from threats. This general goal is addressed through creating an understanding of information security management best practices based on computer security known vulnerabilities and attack vectors in the framework of a typical organization.

CPEN 347 TELETRAFFIC **3.0: 3 cr. E**

This subject exposes students to theoretical and practical aspects of modern communication network design, including teletraffic engineering and network performance modeling. It covers an overview of relevant stochastic traffic modeling, traffic characterization, traffic measurement techniques, network dimensioning principles, queuing theory and its application to performance evaluation of networks. Students analyze practical examples of network dimensioning for capacity and network performance evaluation using simulation software packages.

Prerequisite: CSIS 222.

CVSQ 201, 202, 203

Refer to Faculty of Arts & Social Sciences, Cultural Studies Program.

ELEN 201 INSTRUMENTATION LAB. **0.3: 1 cr. E**

This laboratory provides an introduction on the use of multi-meters, oscilloscopes, function generators, power supplies and other instrumentation. Applications include solenoids, resistors, capacitors, periodic signals analysis, RC, RL, and RLC circuits; balanced bridge circuit.

ELEN 202 ELECTRICAL SIMULATION AND DESIGN **0.3: 1 cr. E**

The purpose of this workshop is to provide the students with working knowledge of the use and applications of PSPICE, MATLAB, LabView, and PCB design.

Prerequisites: ELEN 221.

ELEN 221 CIRCUITS ANALYSIS I **3.0: 3 cr. E**

The purpose of this course is to provide the students with basic understanding of electrical circuit theory. Topics covered include fundamental definitions and laws; resistive circuit analysis; mesh and nodal analysis; RL, RC, and RLC circuit analysis; DC/AC analysis; Thevenin and Norton theorems; phasor analysis.

Prerequisites: ELEN 201, MATH 200 and MATH 211.

ELEN 222 SIGNALS AND SYSTEMS THEORY **3.0: 3 cr. E**

This course covers simultaneously continuous-time and discrete-time signal transformations and system classifications; Linear Time Invariant system analysis (convolution and ordinary differential/difference equation); Fourier series; Fourier transform; Laplace transform; and z-transform.

Pre-requisite: ELEN 221 (or MECH231), MECH 221, and MATH 202.

ELEN 223 ELECTRICITY & ELECTROMAGNETISM **3.0: 3 cr. E**

This course covers the governing principles and laws of charge and matter; electric fields; Gauss's law; electric potential; capacitors; dielectrics; magnetic field; Biot-Savart law; Faraday's law; Ampere's law; inductors; paramagnetism; Maxwell's equation and electromagnetic waves.

Prerequisites: ELEN 221 and MATH 270.

ELEN 231 ELECTRONICS I **3.0: 3 cr. E**

This course covers the physics and operation of semiconductor diodes, bipolar junction transistors and field-effect transistors; analysis and design of simple analog wave shaping circuits; small-signal device models; introduction to difference and operational amplifiers; circuit analysis at intermediate and high frequencies.

Prerequisites: ELEN 221 and CPEN 211.

ELEN 303 CIRCUITS ANALYSIS LAB **0.3: 1 cr. E**

This laboratory provides an introduction to electrical circuit measurements; bridge circuits; steady-state and transient waveforms; frequency response; Bode plots; impedance measurement; high-pass, low-pass, band-pass and band-reject filters.

Prerequisite: ELEN 202/221.

ELEN 304 ELECTRONICS LAB **0.3: 1 cr. E**

This laboratory provides an introduction to electrical measurements, analysis and design of electronic circuits; diodes and transistor characteristics, diodes and transistor circuits, amplifier gain and impedance characteristics, frequency response, distortion, switching, operational amplifiers and their applications, mirror currents, voltage-regulator integrated circuits.

Prerequisite: ELEN 231.

ELEN 306 TELECOMMUNICATIONS LAB **0.3: 1 cr. E**

This laboratory work includes oscillators, AM, FM modulation and demodulation, detectors, phase locked loops, AM receivers, ASK, PSK modulators and receivers; effects of white noise on binary signals; signal degradation and filtering; fiber optics.

Prerequisite: ELEN 341.

ELEN 307 CONTROL LAB **0.3: 1 cr. E**

This laboratory covers feedback control implementations; PID; State Space; Frequency Analysis design; Using Analogue and MATLAB Control Toolbox.

Co requisite: ELEN 351.

ELEN 308 ELECTRIC MACHINES LAB **0.3: 1 cr. E**

This laboratory covers magnetic circuits; transformers; induction motors; reluctance motors; synchronous and DC machines.

Prerequisite: ELEN 361.

ELEN 324 CIRCUITS ANALYSIS II **3.0: 3 cr. E**

This course covers general two-port networks; transfer function; Fourier techniques in network analysis; power calculations; three-phase circuits; mutual inductance and magnetically coupled circuits; series and parallel resonance; Op-Amp circuits.

Prerequisite: ELEN 221.

ELEN 325 ELECTRICAL INSTALLATIONS **0.3: 2 cr. E**

This course exposes students to electric wires and cables; wiring systems and techniques; residential and industrial wiring in conformance with the current National Electrical Code and local codes; circuit protection devices; circuits for electric lamps; metering of current, voltage, power and energy; transformer construction and winding; windings for electric machines is covered as time permit.

Prerequisite: ELEN 303.

ELEN 326 SIGNAL PROCESSING **3.0: 3 cr. E**

This course covers the principles of digital signal processing; sampling, and quantization; reconstruction of signals; mathematical tools used in the modeling, analysis and synthesis of discrete-time communication and control systems; applications to sampled-data control and quantified-data communications systems; Multirate signal processing; optimal and adaptive techniques; introduction to digital filtering, Kalman filters.

Prerequisite: ELEN 222.

ELEN 332 ELECTRONICS II **3.0: 3 cr. E**

This course covers the behavior and operating limitations of large-signal and small-signal amplifiers, differential and multistage amplifiers, feedback amplifiers, transistor and audio power amplifiers, high-frequency amplifications, stability and compensation; operational amplifiers; comparators; low frequency oscillators; active filters; tuned amplifiers and oscillators; linear power supplies; wave shaping; other integrated-circuits.

Prerequisite: ELEN 231.

ELEN 340 SIGNAL TRANSMISSION **3.0: 3 cr. E**

This course covers the principles of field theory. Topics include solution of boundary value problems in electromagnetic using both analytic and numerical techniques; transmission line concepts; Smith charts and design tools for distributed circuits; conducting and dielectric guiding structures for waves; radiation from antennas; low frequency applications.

Prerequisite: ELEN 223.

ELEN 341 TELECOMMUNICATIONS **3.0: 3 cr. E**

This course covers the principles of analog communication; linear modulation, AM, DSB, SSB, VSB; linear demodulation, envelope detection, coherent demodulation mixer and super-heterodyne receiver; angular (nonlinear) modulation, phase modulation, frequency modulation, stereo FM; angular demodulation, different types of discriminators pre-emphasis and de-emphasis; pulse modulation, PAM, PWM, PPM, and PFM; time

division and frequency division multiplexing.

Prerequisites: ELEN 304 and MATH 246.

ELEN 351 CONTROL SYSTEMS **3.0: 3 cr. E**

This course covers continuous-time and design; block diagram algebra and the signal flow graph; stability analysis techniques (Routh-Hurwitz and Jury stability criterions), root locus, Nyquist, Bode, and Nicholas; Impulse transfer function; state space analysis; State Feedback Control, PID, and phase compensation design.

Prerequisite: ELEN 202 and ELEN 222.

ELEN 352 DIGITAL CONTROL SYSTEMS **3.0: 3 cr. E**

This course covers discrete-time systems analysis and design; analysis and design of digital control systems; signal conversion and processing; sampling; A/D and D/A conversion; Z-transform applications; state variables; Z-Domain analysis; frequency domain analysis; digital simulation and digital redesign; controller design using the root-locus; discrete equivalent and deadbeat design methods.

Prerequisite: ELEN 307 and ELEN 351.

ELEN 361 ELECTRIC MACHINES **3.0: 3 cr. E**

This course covers Faraday's law applied to magnetic circuits and transformers; per unit system; energy balance and electromechanical conversion processes; analysis of reluctance machines; three-phase and single-phase induction motors; synchronous motors and generators; DC motors and generators; fractional horsepower motors.

Prerequisites: ELEN 223/324/332.

ELEN 362 POWER ELECTRONICS **3.0: 3 cr. E**

This course covers the applications of power semiconductor devices; circuit analysis, signal analysis, and energy concepts are integrated to develop steady state and dynamic models of generic power converters; specific topics include AC/DC, DC/DC, DC/AC, and AC/AC conversions. These generic converters are applied as controlled rectifiers, switching power supplies, motor drives, HVDC transmission, induction heating, and others; ancillary circuits needed for the proper operation and control of power semiconductor devices are also discussed; computer simulation and application to power supplies and motor drives.

Prerequisite: ELEN 202/361.

ENGL 203 AND ELECTIVE

Refer to Faculty of Arts & Social Sciences, Department of English Language and Literature.

GENG 301, 390, 402, 590, 599

Refer to the Faculty of Engineering Requirements.

MATH 200, 202, 211, 230, 246, 270

Refer to Faculty of Sciences, Department of Mathematics.

MECH 513

Refer to Department of Mechanical Engineering.

DEPARTMENT OF CIVIL ENGINEERING
BACHELOR'S DEGREE

SEMESTER 1

Course Code	Course Title	Credit
CSIS 206	Principles of Programming	3
CIVE 201	Statics	3
ENGL 203	English Comm. Skills III	3
MATH 200	Calculus I	3
MATH 211	Linear Algebra	3
MECH 221	Engineering Dynamics	3
Total		**18**

SEMESTER 2

Course Code	Course Title	Credit
CHEM 202	Basic Chemistry	3
CIVE 202	Mechanics of Materials	3
CIVE 203	Engineering Drawing 1	1
ENGL 2xx	English Elective	3
MATH 202	Calculus II	3
MECH 222	Science of Materials	3
MECH 233	Workshop Technology	1
Total		**17**

SEMESTER 3

Course Code	Course Title	Credit
CVSQ 201	Early Formation of Civilization	3
CIVE 204	Construction Materials & Methods	3
CIVE 205	Theory of Structures I	3
CIVE 206	Engineering Drawing II	1
MATH 246	Probability For Engineers	3
MATH 270	Differential Equations	3
MECH 232	Thermodynamics	3
Total		**19**

SEMESTER 4

Course Code	Course Title	Credit
CVSQ 202	The Religious Experience	3
CIVE 208	Surveying	2
CIVE 209	Reinforced Concrete I	3

CIVE 210	Strength of Materials Laboratory	1
CIVE 243	Fluid Mechanics Laboratory	1
MATH 230	Numerical Analysis	3
MECH 243	Fluid Mechanics	3
Total		**16**

SEMESTER 5

Course Code	Course Title	Credit
CVSQ 203	Introduction to Modernity	3
CIVE 301	Soil Mechanics & Foundation	3
CIVE 303	Computer Aided Design	1
CIVE 304	Reinforced Concrete II	3
CIVE 305	HVAC	3
CIVE 306	Soil Lab.	1
CIVE 310	Building Laws	2
CIVE 312	Construction Management Fundamentals	2
CIVE 316	Construction Management Modeling	1
Total		**19**

SEMESTER 6

Course Code	Course Title	Credit
CIVE 307	Foundation Design	3
CIVE 308	Transportation Engineering	3
CIVE 309	Engineering Economy	3
CIVE 311	Sanitary Engineering	3
CIVE 313	Transportation Engineering Modeling	1
CIVE 315	Geotechnical Engineering Modeling	1
GENG 390	Undergraduate Project	1
	Elective	3
		18
Total credits		**107**

Electives: CIVE 212, 213, 241, 314, GENG 310.

COURSE DESCRIPTIONS

CIVE 201 STATICS **3.0: 3 cr. E**

Fundamental concepts of the statics of rigid bodies using a vector analysis approach: force systems, analysis of simple structures, centroids and centers of gravity, free body diagrams, equilibrium, friction, moments of inertia, and shear and bending moment diagrams.

CIVE 202 MECHANICS OF MATERIALS **3.0: 3 cr. E**

Fundamental stress and strain relationships, axial stress, safety factors, statically indeterminate axially loaded members, torsion, bending and shear stresses in beams, transformation of stress and strain, combined stresses, deflections in beams, and analysis of columns.

Pre-requisites: CIVE 201, MATH 200, MECH 221

CIVE 203 DRAWING I **0.3: 1 cr. E**

Concepts and practices in lettering, geometric construction, multi-view and auxiliary projections, sections and connections, dimensioning, and isometric and oblique pictorials. Emphasis on freehand sketching skills.

CIVE 204 CONSTRUCTION MATERIALS & METHODS **3.0: 3 cr. E**

Materials and methods used in the construction industry. Physical and mechanical properties of construction materials; Portland cement concrete, asphalt, wood, ferrous metals, non-ferrous metals; proportioning of concrete mixtures including admixtures.

Pre-requisite: CHEM 202

CIVE 205 THEORY OF STRUCTURES I **3.0: 3 cr. E**

Stability and determinacy of structures. Analysis of statically determinate structures: Stress resultants (reactions, axial forces, shear forces, and bending moments) for beams and framed structures. Deflection of beams and frames by geometric methods (moment-area theorems, conjugate-beam analogy), by energy methods (virtual-work method, Castigliano's theorems). Influence lines functions and their applications. Criteria for moving loads. Analysis of statically indeterminate structures by force methods: (consistent deformations method), by displacement methods (slope-deflection method and moment-distribution method).

Pre-requisites: CIVE 202

CIVE 206 DRAWING II (AutoCad) **0.3: 1 cr. E**

Concepts and practices in lettering, geometric construction, multi-view and auxiliary projections, sections and connections, dimensioning, and isometric and oblique pictorials. Emphasis on freehand sketching skills.

Pre-requisite: CIVE 203

CIVE 208 SURVEYING **2.2: 2 cr. E**

Principles of surveying, instruments, basic measuring procedures, error analysis, traverse, leveling and mapping. Principles and practice in measuring distances, elevation differences and angles; construction surveys, traverses, topographic surveys and subdivision of land, mass diagram, cut and fill calculations. Boundary surveys, area computations and profile surveys. Introduction to horizontal and vertical curves design.

Pre-requisite: MATH 200

CIVE 209 REINFORCED CONCRETE I **3.0: 3 cr. E**

Strength and deformation of reinforced concrete according to the provisions of ACI building code, beams in flexure and shear, one way ribbed and solid slabs, deflection and cracking control, allowable stress design of rectangular sections, bond stress and reinforcement anchorage, and short reinforced concrete columns. Prerequisites: CIVE 205.

CIVE 210 STRENGTH OF MATERIALS LABORATORY **0.3: 1 cr. E**

Concrete constituents and mix design; time of setting of cement; mixing and testing fresh concrete; determination of density of hardened concrete; compressive strength of concrete cubes and cylinders; flexural tensile strength of concrete; splitting tensile Strength of cylindrical concrete specimens; determination of static modulus of elasticity in compression; tensile strength of steel bars; Marshall stability and flow of bituminous mixtures.

Pre-requisite: CIVE 202, CIVE 204 Co-requisite: CIVE 209.

CIVE 212 INTRODUCTION TO ENVIROMENTAL ENGINEERING **3.0: 3cr. E**

Knowledge of environmental elements; mass and energy transfer and balances; environmental chemistry; mathematics of growth and decay; risk assessment and management; surface water pollutants, biological and chemical oxygen demands, eutrophication; water supply systems and drinking water standards; wastewater treatment systems and effluent standards; groundwater flow, contaminant transport, and remediation technologies; hazardous waste and pollution prevention; air pollution sources, control and atmospheric stability; ambient air quality standards, indoor air quality; global temperature, greenhouse effect and warming potential; global energy balance, carbon emission, and stratospheric ozone depletion; solid waste management, landfill disposal; medical waste; green building; and environmental law, ethics, and justice. Field trips are integrated into the classes.

CIVE 213 INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEMS (GIS) FOR ENVIRONMENTAL ENGINEERING **3.0: 3cr. E**

Basic theoretical and practical understanding of GIS concepts and technical issues and its application to the design and analysis of environmental engineering systems. The focus is a fundamental understanding of spatial data acquisition, geo-processing, geo-statistical methods; visualization, and querying of spatial data; network modeling, terrain mapping, and spatial analysis. Students are trained through extensive computer lab sessions, including applications in urban stormwater management, nonpoint source pollution control, ecological assessment, water distribution and sewer network analysis. The course will be based on the recently released ESRI ArcGIS 11.

CIVE 214 SURVEYING LABORATORY **0.3:1 cr. E**

Field application of concepts learned in class (CIVE 208) including basic measuring procedures for distances, elevations, angles, bearings, azimuth; theory of measurements and errors, mapping, construction and topographic surveys, traverses, adjustment and closure, area and volume computations.

Pre-requisite: CIVE 206

Co-requisite: CIVE 208

CIVE 241 TECHNICAL PLATFORM COMPUTING FOR CIVIL ENGINEERING **3.0: 3cr. E**

This course develops computing skills using the technical computing platform Mathematica. Topics include: introduction to Mathematica, symbolics, numerics, graphics, animations, programming, document organization and typesetting. Applications to statics, dynamics, engineering mechanics, fluid mechanics and other engineering related courses. Emphasis on ability to plan solutions to technical problems then execute and prepare organized technical reports including tables, figures and illustrations.

Pre-requisites: CIVE 201, CSIS 206, MATH 200, 211, MECH 221, 243.

CIVE 243 FLUID MECHANICS LABORATORY **0.3: 1 cr. E**

Laboratory applications in fluid mechanics including fluid measurements and properties; flow in pipes; Reynolds number; forces on gates; orifices; weirs; open channel flow; and pumps.

Co-requisite: MECH 243

CIVE 301 SOIL MECHANICS & FOUNDATIONS 3.0: 3 cr. E

Origin of soil and grain size, weight volume relationships and soil plasticity, engineering classification of soil, permeability and seepage, effective pressure concept, shear strength of soil, stress in a soil mass, soil consolidation settlement, lateral earth pressure (Retaining wall).

Pre-requisites: CIVE 202, 209.

CIVE 303 COMPUTER-AIDED DESIGN 2.1: 3 cr. E

Application of computers to analyzing common structures. Use of standard industry software packages (ETABS and SAFE) for analyzing two dimensional and three dimensional structures including trusses, moment resisting frames, and shear walls against gravity loads as well as lateral loads (seismic and wind). Introduction of Local and Global Coordinates Systems, the importance of the proper connectivity among elements as well as the definition of the Cardinal points and the insertion points. Modeling of one-way and two-way slabs using different slabs types. Export of Structure Reactions from ETABS to SAFE and modeling of foundations.

Pre-requisites: CSIS 206, 205, CIVE 209.

CIVE 304 REINFORCED CONCRETE II 3.0: 3 cr. E

Analysis and design of advanced reinforced concrete structures and components: short columns subjected to flexure in one or in two directions, slender columns, beams subjected to shear and torsion, and floor systems including two-way slabs (flat slabs and slabs with beams).

Prerequisite: CIVE 209, 210.

CIVE 305 HEATING, VENTILATING and AIR CONDITIONING (HVAC) 3.0: 3 cr. E

Environmental comfort parameters. Heat transfer in building sections. Estimating heating, cooling and ventilation loads and the choice of appropriate systems. Selection of equipment, design and layout of distribution ducts, pipes, and outlets.

Pre-requisite: MATH 200.

CIVE 306 SOIL MECHANICS LABORATORY 0.3: 1 cr. E

Soil properties and behavior, soil classifications, sieve analysis of soil, specific gravity of soil, relative density of soil, Atterberg limits, Proctor test, CBR test, in situ density of base material, hydrometer of fine grained soil, permeameter test (Constant head and falling head method), consolidation and settlement, strength characteristics.

Co-requisite: CIVE 301

CIVE 307 FOUNDATION DESIGN 3.0: 3 cr. E

Design and analysis for shallow reinforced concrete footings: centrally loaded isolated footing, eccentrically loaded isolated footings, combined rectangular footing, combined trapezoidal footing, strap footing, mat foundation, retaining wall design.

Pre-requisites: CIVE 301, CIVE 304

CIVE 308 TRANSPORTATION ENGINEERING **3.0: 3 cr. E**

The role of transportation in society and the engineer's role in planning, design and operation of transportation systems; consideration of system constraints, costs and basic design criteria. Theory and practice in highway design according to AASHTO criteria; design of vertical and horizontal curves and cross-sections. Introduction to traffic elements including intersection design and analysis of roads and intersections service levels.

Prerequisite: CIVE 208.

CIVE 309 ENGINEERING ECONOMY **3.0: 3 cr. E**

The course introduces the student to the fundamental concepts of engineering economy covering: time value of money; economic analysis and evaluation of private construction projects, namely: net present value, future and annual worth, and internal rate of return; evaluation of public projects, mainly benefit to cost ratio; replacement analysis; depreciation methods; break even analysis; economic risk analysis; and after tax cash flow.

Pre-requisite: MATH 200.

CIVE 310 BUILDING LAWS **2.2: 2 cr. E**

The purpose of this course is to instruct the students to organize the building industry, and to enhance their knowledge of the Lebanese Building Laws in order to safeguard the environment and private and public rights.

Pre-requisite: CIVE 206.

CIVE 311 SANITARY ENGINEERING **2.2: 2 cr. E**

Sources and quantities of water supply and methods of collection, treatment and distribution. Quantities, treatment and disposal of wastewater. Quality parameters, criteria and international standards for drinking water and wastewater pollution control.

Pre-requisite: MECH 243.

CIVE 312 CONSTRUCTION MANAGEMENT FUNDAMENTALS **3.0: 3 cr. E**

Civil engineers working on sites as construction managers need to know the fundamentals of construction management. This course introduces the basic principles and procedures of construction management, mainly contracts management, planning, scheduling and cost estimation. It also expands on project deterministic scheduling, mainly, bar charts, network schedules AON and AOA, and CPM. The course expands on the basic cost terminology, quantity take-off, bar bending schedule estimation and bill of quantities.

Prerequisites: CIVE 206,209.

CIVE 313 TRANSPORTATION ENGINEERING MODELING **0.3: 1 cr. E**

Highway design using professional commercial softwares integrating planning, geometric design including horizontal and vertical curves design, cross-sections with cut and fill calculations, and traffic modeling including traffic lights design and level of service. Results visualizations and assessment.

C0-requisite: CIVE 308.

CIVE 314 ADVANCED COMPUTER AIDED DESIGN **3.0: 3 cr. E**

The introduction of advanced modeling techniques using ETABS Software package. It consists of modeling in multiple-grid systems using Cartesian and/or Polar coordinates, as well as non-concentric modeling with a variation in the Cardinal Points and Insertion Points; the use of Section Designer members and Non-Prismatic elements; all loading types and shapes in the global and local coordinates; the ETABS concept for the Pattern Live Load Factor; modeling of inclined slabs for stairs and ramps, and modeling of shells for all types of

domes. Introduction to the ETABS overwrites for the design of Reinforced Concrete members (Seismic or Non-Seismic Design) using ACI318 Provisions.

Pre-requisites: CIVE 303, 304

CIVE 315 GEOTECHNICAL ENGINEERING MODELING **0.3: 1 cr. E**

Geotechnical analysis and design using commercial software PLAXIS including design of foundations and lateral earth retaining systems. Results vizualizations and assessment.

Co-requisite: CIVE 307

CIVE 316 CONSTRUCTION MANAGEMENT MODELING **0.3:1 cr. E**

Use of commercial software for the operations, planning, budgeting, scheduling, resource allocation, resource leveling, and controlling construction projects.

Co-requisite: CIVE 312

CHEM 202
Refer to the Department of Chemistry.

CSIS 206
Refer to the Department of Computer Science.

CVSQ 201, 202, 203
Refer to the Civilization Sequence Program.

ENGL 203, Elective
Refer to the Division of English Language and Literature.

GENG 310, 390
Refer to the Faculty of Engineering requirements.

MATH 200, 202, 211, 230, 246, 270
Refer to the Department of Mathematics.

MECH 221, 222, 232, 233, 243
Refer to the Department of Mechanical Engineering.

DEPARTMENT OF MECHANICAL ENGINEERING

BACHELOR'S DEGREE

SEMESTER 1

Course Code	Course Title	Credit
CIVE 201	Statics	3
CSIS 206	Programming for Engineers	3
ENGL 203	English Communication Skills III	3
MATH 200	Calculus I	3
MATH 211	Linear Algebra	3
MECH 212	Instrumentation & Experimentation I	1
MECH 211	Mechanical Drawing I	1
Total		**17**

SEMESTER 2

Course Code	Course Title	Credit
CHEM 204	General Applied Chemistry	3
CIVE 202	Mechanics of Materials	3
ENGL 2xx	English Elective	3
MATH 202	Calculus II	3
MECH 221	Engineering Dynamics	3
MECH 222	Science of Materials	3
Total		**18**

SEMESTER 3

Course Code	Course Title	Credit
CVSQ 201	The Formation of Civilization	3
ELEN 201	Electrical Instrumentation Lab	1
MATH 230	Numerical Analysis	3
MATH 246	Probability for Engineers	3
MECH 231	Circuit Fundamentals	3
MECH 232	Thermodynamics	3
MECH 233	Workshop Technology	1
MECH 234	Mechanical Drawing II	1
Total		**18**

SEMESTER 4

Course Code	Course Title	Credit
CVSQ 202	The Religious Experience	3
ELEN 222	Signals & Systems Theory	3

MATH 270	Differential Equations	3
MECH 241	Comp. Tech. in Mech. Eng.	3
MECH 242	Engineering Vibrations	3
MECH 243	Fluids Mechanics	3
MECH 244	Instrumentation & Experimentation II	1
Total		**19**

SEMESTER 5

Course Code	**Course Title**	**Credit**
CVSQ 203	Introduction to Modernity	3
GENG 301	Engineering Management	3
MECH 311	Mechanical Design I	3
MECH 313	Electromechanical Systems	3
MECH 314	Gas Dynamics	3
MECH 315	Mechanics of Machines	3
Total		**18**

SEMESTER 6

Course Code	**Course Title**	**Credit**
ELEN 350	Control System	3
GENG 390	Undergraduate Project	1
MECH 321	Heat Transfer	3
MECH 323	CAD/CAM	3
MECH 324	Steam & Gas Turbines	3
MECH 325	Instrumentation & Experimentation III	1
	Elective	3
Total		**17**
Total credits		**107**

DEPARTMENT OF MECHANICAL ENGINEERING
BACHELOR'S DEGREE (AEROSPACE SPECIALTY)

FIRST YEAR

SEMESTER 1

Course Code	Course Title	Credit
AERO 211	Aircraft Basic Science	3
CIVE 201	Statics	3
ENGL 203	English Communication Skills III	3
MATH 200	Calculus I	3
MATH 211	Linear Algebra	3
MECH 211	Mechanical Drawing I	1
MECH 212	Instrumentation and Experimentation I	1
Total		**17**

FIRST YEAR

SEMESTER 2

Course Code	Course Title	Credit
AERO 221	Airframe Workshop	1
CIVE 202	Mechanics of Materials	3
CSIS 206	Programming for Engineers	3
MATH 202	Calculus II	3
MECH 221	Engineering Dynamics	3
MECH 222	Science of Materials	3
Total		**19**

SECOND YEAR

SEMESTER 3

Course Code	Course Title	Credit
AERO 234	Fundamentals of Aircraft Structures	3
MATH 270	Differential Equations	3
CVSQ 201	The Formation of Civilization	3
MECH 231	Circuit Fundamentals	3
MECH 232	Thermodynamics	3
MECH 234	Mechanical Drawing II	1
MECH 243	Fluid Mechanics	3
Total		**19**

SECOND YEAR

SEMESTER 4

Course Code	Course Title	Credit
AERO 231	Aircraft Dynamics and Control	3
AERO 232	Aerodynamics of Flight	3
AERO 244	Aero-Engines Workshop	1
CVSQ 202	The Religious Experience	3
ELEN 231	Electronics I	3
MATH 230	Numerical Analysis	3
MECH 244	Instrumentation & Experimentation II	1
Total		**17**

THIRD YEAR

SEMESTER 5

Course Code	Course Title	Credit
AERO 245	Aircraft Instruments & Systems	3
AERO 313	Introductory Aviation Management	3
MECH 241	Computational Techniques in Mech. Eng.	3
MECH 242	Engineering Vibrations	3
MECH 314	Gas Dynamics	3
MECH 315	Mechanics of Machines	3
	Elective	3
Total		**18**

THIRD YEAR

SEMESTER 6

Course Code	Course Title	Credit
AERO 313	Introductory Aviation Management	3
AERO 316	Fundamentals of Aircraft Design	3
AERO 343	Helicopter Fundamentals	3
AERO 344	Aircraft Propulsion Systems	3
CVSQ 203	Introduction to Modernity	3
GENG 390	Design Project	1
MECH 325	Instrumentation & Experimentation III	1
Total		**17**

Total credits **107**

COURSE DESCRIPTIONS

CIVE 201, 202
Refer to the Department of Civil Engineering.

CSIS 206
Refer to the Department of Computer Science.

CVSQ 201, 202, 203
Refer to the Civilization Sequence Program.

ENGL 203, Elective
Refer to the Division of English Language and Literature.

GENG 390, 402, 590, 599
Refer to the Faculty of Engineering Requirements.

MECH 211 MECHANICAL DRAWING I **0.3: 1 cr. E**
Concepts and practices in lettering, geometric construction, multi-view and auxiliary projections, sections and connections, dimensioning, and isometric and oblique pictorials. Emphasis on freehand sketching skills.

MECH 212 INSTRUMENTATION AND EXPERIMENTATION I **0.3: 1 cr. E**
General considerations for safe operation within a mechanical engineering laboratory environment. Presentation of general measurement theory, and concepts of accuracy and precision. Criteria behind "confidence" in measurements, significant notation, data processing professional data presentation methodologies and various available tools. Various measurement reporting methods. Applying learnt methodologies and techniques to various experimental cases, and the exposure of students to different experimental equipment.

MECH 221 ENGINEERING DYNAMICS **3.0: 3 cr. E**
Kinematics and kinetics of particles: Force, acceleration, work, energy and momentum. Two dimensional kinematics and kinetics of rigid bodies, translational and rotational motions. Vibrations.

MECH 222 SCIENCE OF MATERIALS **3.0: 3 cr. E**
Material classification. Atomic structures. Crystal structure solidification. Crystalline imperfections. Phase diagrams. Engineering alloys. Electrical and Mechanical properties of metals. Polymeric ceramic and magnetic materials. Corrosion. Composite materials.

Prerequisite: English Proficiency Level: ENGL 101.

MECH 231 CIRCUITS FUNDAMENTALS **3.0: 3 cr. E**
The purpose of this course is to provide the students with basic understanding of electrical and electronics circuit theory. Topics covered include: fundamental definitions and laws; essential circuit analysis techniques applied to resistive circuits, RL, RC and RLC circuits; diodes circuits; transistor circuits; introduction to difference and operational amplifiers.

Prerequisites: MATH 200/211.

MECH 232 THERMODYNAMICS **3.0: 3 cr. E**

Basic concepts and definitions. Properties of pure substance. Heat. Work. First Law of Thermodynamics. Second Law of Thermodynamics. Entropy. Reversibility and Irreversibility. Power and refrigeration cycles.

MECH 233 WORKSHOP TECHNOLOGY **0.3: 1 cr. E**

Drilling, milling, grinding, lath work, welding, molding, heat treatments, forging, electric workshop technologies.

MECH 234 MECHANICAL DRAWING II **0.3: 1 cr. E**

Architectural drawings of residential/commercial/ industrial buildings meeting local specifications. electrical and mechanical views, sectioning, hatching and assembling of mechanical machines and equipment.

Prerequisite: MECH 211.

MECH 241 COMPUTATIONAL TECHNIQUES IN MECH. ENG. **3.0: 3 cr. E**

The purpose of this course is to enhance students computational capacities by exposing them to problems in mechanical engineering problems that are best solved or analyzed numerically. Applications from mechanics, thermo-fluids, heat transfer, and design are all considered. Special emphasis is put on pre- and post processing and the importance of appropriate presentation and animation.

Prerequisite: CIVE 202, MATH 202, CSIS 206, MATH 230.

MECH 242 ENGINEERING VIBRATIONS **3.0: 3 cr. E**

Linear single degree of freedom systems, transient and steady vibrations, linear undamped multi-forced degree of freedom systems. Lagrange Equation.

Prerequisite: MECH 221.

MECH 243 FLUID MECHANICS **3.0: 3 cr. E**

Fluid properties, fluid statics and manometry, kinematics, basic conservation equations of continuity, momentum and energy. Incompressible flows. Viscous effects in pipes and restrictions, Laminar and Turbulent Flows. Dimensional Analysis and Similitude.

MECH 244 INSTRUMENTATION AND EXPERIMENTATION II **0.3: 1 cr. E**

This lab course, the second in a series, is designed to consolidate theories gained in other courses taken up to the second year and build lab competencies through practical experiments. Typical experiments are in the areas of thermodynamics, Fluid Mechanics, Mechanics, Dynamics, Vibrations, etc. Special emphasis is exercised on modern data acquisition techniques as well as data presentation and reporting.

MECH 311 MECHANICAL DESIGN I **3.0: 3 cr. E**

The course clarifies the role of design, and design activities and tools in the production of goods. It reviews such concepts as factor of safety, stress and strain, and deflection. The course explains static and fatigue failure theories and their applications. It also covers the design for strength of pressure vessels, columns, shafts, and other structural and machine elements. Design of weldments and bolted joints is also included.

Prerequisite: CIVE 202.

MECH 313 ELECTROMECHANICAL SYSTEMS **3.0: 3 cr. E**

This course deals with induced force, induced voltage in a conductor, DC machinery fundamentals. Equivalent circuit, DC generators, DC motors, single phase and three phase transformers, autotransformers, induced

motors, speed control of induced motors, synchronous generators and motors.

Prerequisite: MECH 231.

MECH 314 GAS DYNAMICS **3.0: 3 cr. E**

This course is divided in two parts: the Boundary Layer Theory and Compressible Flows. Boundary Layer Theory introduces the Navier Stokes Equations, Prandtl's approximations and practical methods of solution of viscous flows. Part 2 is directed at one dimensional compressible flow in nozzles and pipes including shock wave analysis and real effects such heat transfer and friction.

Prerequisite: MECH 232, 243.

MECH 315 MECHANICS OF MACHINES **3.0: 3 cr. E**

Degrees of Freedom. Linkages and their kinematic analysis. Cam synthesis, kinematic requirements, and graphical and analytical design. gears and gear trains. Introduction to synthesis. Force analysis of machinery and balancing.

Prerequisite: MECH 221.

MECH 321 HEAT TRANSFER **3.0: 3 cr. E**

The course introduces the principles of thermal conduction, convection and radiation. It is also concerned with the design and analysis of Heat Exchangers and outlines the basic principles of computational modeling in Heat Transfer. Prerequisites: MECH 232, 243.

Co-Requisite MECH 314.

MECH 322 AUTOMATIC CONTROLS **3.0:3 cr. E**

This course deals with introduction to design and analysis of feedback control systems, properties and advantages of feedback systems, time-domain and frequency-domain performance measures, stability and degree of stability. It also covers root locus method, nyquist criterion, frequency-domain design, and state space methods.

MECH 323 CAD/CAM **1.2: 3 cr. E**

The course explains terminology used in CAD/CAM. It also explains the concepts, the mathematics and the building blocks that are the basis of CAD and CAM packages. Mathematical details relating to curve and surface generation, display and manipulation are also covered. Basic CAD and CAM data file structures, and exchange formats are included in the course. The interface between CAD and CAM is demonstrated through the design and manufacture of sample parts on laboratory CNC tool.

Prerequisite: MECH 234.

MECH 324 STEAM AND GAS TURBINES **3.0: 3 cr. E**

This is an advanced thermodynamics course in which students are introduced to the thermal design and analysis of Gas and Steam Turbine cycles and their variations as implemented by the power generation and aviation industries.

Prerequisite: MECH 314.

MECH 325 INSTRUMENTATION AND EXPERIMENTATION III **0.3: 1 cr. E**

This lab course, the third in a series, is designed to consolidate theories gained in other courses taken up to the third year and build lab competencies through practical experiments. Typical experiments are in the areas of

Gas Dynamics, Heat Transfer, Power and Refrigeration Systems, Automatic Controls, Manufacturing Systems, etc. Special emphasis is exercised on modern data acquisition techniques as well as data presentation and reporting.

COURSE DESCRIPTIONS (AEROSPACE SPECIALTY)

AERO 211 AIRCRAFT BASIC SCIENCE **3.0: 3 cr. E**

This course provides students with an introductory treatment of the aerodynamic theory of aircraft, including flight dynamics, basic design issues, instrumentation in addition to important maintenance requirements and regulations.

AERO 221 AIRFRAME WORKSHOP **1.2: 1 cr. E**

This is a practical course which introduces students to the basic workshop practices involved in handling airframes. Working with hand tools, machine tools and special tools appropriate to aircraft is emphasized in addition to introducing them some elementary manufacturing techniques.

AERO 231 AIRCRAFT DYNAMICS AND CONTROL **3.0: 3 cr. E**

Concepts of classical mechanics with the aerodynamic conclusions and derivations applied flying objects, range and endurance derivations for different types of aircraft, rates of climb, landing, best speeds for climb and speeds for best angle of climb, special performance problems, mechanics of some maneuvering operations, introduction to concepts of stability and control.

AERO 232 AERODYNAMICS OF FLIGHT **3.0: 3 cr. E**

This course deals with the dynamics of inviscid incompressible air flows, mathematical development of wing theory, analytical and experimental techniques in predicting performance of finite wings and thin airfoil sections, importance of boundary layer theory is emphasized.

AERO 233 HUMAN FACTORS AND AVIATION REGULATION **3.0: 3 cr. E**

This course instills in students an appreciation of the importance of human related issues in the aeronautical industry. Aspects of physiology, psychology, fatigue and sleep patterns are all discussed in addition to interpersonal professional relationships, work environments, attitudes and habits. These are analyzed in relation to flight decks, maintenance stations, dispatch units, administrations. The course also seeks to introduce students to the concepts of aviation laws and regulations, their sources, applicability and administrative control.

AERO 234 FUNDAMENTALS OF AIRCRAFT STRUCTURES **3.0: 3 cr. E**

Analysis of statically indeterminate structures. Thermal stresses and plasticity, applications in plane stress systems. Analysis of complex frameworks; structural airworthiness. Analysis of thin walled tube with all loading conditions. Multi cell tubes.

AERO 244 AERO-ENGINES WORKSHOP **1.2:1 cr. E**

Aircraft electrical, mechanical and hydraulic systems; propulsion control systems; radar radio aids, cockpit displays; guidance and communication systems; electronic surveillance and counter measures. Flight testing, video displays, crash recorders.

AERO 245 AIRCRAFT INSTRUMENTS AND SYSTEMS **3.0: 3 cr. E**

Aircraft electrical, mechanical and hydraulic systems; propulsion control systems; radar radio aids, cockpit displays; guidance and communication systems; electronic surveillance and counter measures. Flight testing,

video displays, crash recorders.

AERO 311 PRODUCTION PLANNING AND CONTROL **3.0: 3 cr. E**

General outline of Production Planning and control, standard terminology, Maintenance philosophies and concepts, Planning method and standards, Production forecasting, Materials Routing, Production method and standards, Manpower planning, Production scheduling and control, Production performance analysis, Computer applications in aircraft maintenance engineering.

AERO 312 BASIC AVIONICS AND NAVIGATION SYSTEMS **3.0: 3 cr. E**

General theories of dead reckoning and radio navigation. Gyroscopic flight and navigation systems, Radio navigation systems, VORs, DMEs, NDBs and ADFs, Global Positioning and Satellite Navigation Systems.

AERO 313 INTRODUCTORY AVIATION MANAGEMENT **3.0: 3 cr. E**

Introduction of the historical development of modern airports; business and operational factors, airport regulations and government agencies, labor and personnel relations, security, safety, facility maintenance. Study of airline operations; fleet composition, scheduling, demand forecasting, pricing structure, facilities planning, marketing, financing, analyzing labor requirements, operational costs, and profit/loss reporting.

AERO 316 FUNDAMENTALS OF AIRCRAFT DESIGN **3.0: 3 cr. E**

Design of minor and major components of aircraft structures, demonstration sessions on A/C models, importance of aerodynamics and solid mechanics in the design of various A/C components, a number of projects are assigned in the course.

AERO 341 QUALITY ASSURANCE IN AVIATION **3.0: 3 cr. E**

This course provides students with an appreciation of quality assurance programs, quality management and quality control philosophies, in order to prevent unnecessary loss or damage to aircraft or property, or injury to human life in parallel with improving the efficiency of an aviation business. The course includes topics relating to tasks and features of QAP, evaluation concept and quality verification inspections, personnel evaluation, special functions of QAP, QA documentation, management and implementation of QAP, statistical methods in QC, ISO9001, and the 5S concept.

AERO 342 COMPUTATIONAL TECHNIQUES IN AVIATION **3.0: 3 cr. E**

The purpose of this course is to enhance students computational capacities by exposing them to problems in aeronautical engineering problems that are best solved or analyzed numerically. Applications from flight mechanics, aerodynamics, thermo-fluids, heat transfer, and design are all considered. Special emphasis is put on pre- and post processing and the importance of appropriate presentation and animation.

AERO 343 HELICOPTER FUNDAMENTALS **3.0: 3 cr. E**

The objectives of this course are to provide an introductory treatment of the aerodynamic theory of rotary wing aircraft, including basic performance, control, and basic rotor dynamics, history of helicopter flight, fundamentals of rotor aerodynamics, blade element analysis, rotating blade motion, basic helicopter performance, conceptual design of helicopter.

AERO 344 AIRCRAFT PROPULSION SYSTEMS **3.0: 3 cr. E**

This course deals with the basic principles of aircraft propulsion. It starts with the basic theory of thrust generation, and distinguishes between propeller and jet driven aircraft. It introduces students to piston engines and propeller power-plants as used on light aircraft and then progresses towards gas turbine engines of the various types. Of particular importance is the thermodynamics performance analyses as well as thrust calculations for the different engines.

AERO 345 MODERN DEVELOPMENTS IN AVIATION **3.0: 3 cr. E**

The course deals with the most modern developments in aeronautical engineering. It covers the fundamentals of human factors concepts, an introduction to aircraft maintenance engineering human factors, automation, composite materials for the modern aircraft and the fly-by-wire technology.

DEPARTMENT OF CHEMICAL ENGINEERING

BACHELOR'S DEGREE

FIRST YEAR

SEMESTER 1

Course Code	Course Title	Credit
CHEM 202	Basic Chemistry	3
CHEM 203	Basic Chemistry Lab	1
CHEN 215	Materials Science and Engineering	3
ENGL 203	English Comm. Skills III	3
MATH 200	Calculus I	3
MATH 211	Linear Algebra	3
	Instrumental Lab*	1
Total		**17**

FIRST YEAR

SEMESTER 2

Course Code	Course Title	Credit
CHEM 242	Organic Chemistry I	3
CHEM 262	Physical and Chemical Kinetics	3
CHEN 212	Chemical Engineering I	3
ENGL 2XX	English Elective	3
MATH 202	Calculus II	3
MECH 232	Thermodynamics	3
Total		**18**

SECOND YEAR

SEMESTER 3

Course Code	Course Title	Credit
CHEM 244	Organic Chemistry II	3
CHEM 245	Organic Chemistry Lab I	1
CHEN 222	Process simulation and modeling	1
CHEN 312	Mass Transfer	3
CHEN 377	Chemical Engineering Thermodynamics II	3
CVSQ 201	Early Formation of Civilization	3
MATH 270	Differential Equations	3
Total		**17**

SECOND YEAR

SEMESTER 4

Course Code	Course Title	Credit
CHEM 247	Organic Chemistry Lab II	1
CHEN 325	Chemical Reactions and Reactor Design	3
CSIS 206	Principles of Programming	3
CVSQ 202	The Religious Experience	3
MATH 246	Probability for Engineers	3
MECH 221	Engineering Dynamics	3
MECH 243	Fluids Mechanics	3
Total		**19**

THIRD YEAR

SEMESTER 5

Course Code	Course Title	Credit
CHEN XXX	Option Elective	3
CHEN 303	Unit Operations	3
CHEN 357	Gas Engineering	3
CHEN 369	Continuous-time Process Control Systems	3
CVSQ 203	Introduction to Modernity	3
MATH 230	Numerical Analysis	3
Total		**18**

THIRD YEAR

SEMESTER 6

Course Code	Course Title	Credit
CHEN XXX	Option Elective	3
CHEN 307	Chemical Process Control Lab	1
CHEN 323	Plant and Environmental Safety	3
CHEN 326	Chemical Engineering Lab	1
CHEN 336	Separation Processes	3
GENG 390	Undergraduate Project	1

MECH 321	Heat Transfer	3
Total		**18**
Total Credits		**107**

ELECTIVES FOR MS OPTIONS

General Option

Course Code	Course Title	Credit
CHEN 246	Chemical Engineering Instrumentation	3
CHEN 329	Plant Economics	3
CHEN 378	Living Cells Engineering	3
CHEN 388	Biofuel Engineering	3
GENG 311	Engineering Economy & Management	3
MECH 231	Circuit Fundamentals	3

Petroleum Option

Course Code	Course Title	Credit
CHEN 211	Fundamentals of Geology	3
CHEN 311	Petroleum Fluids	3
CHEN 321	Fundamentals of Petroleum Engineering	3
CHEN 322	Petroleum Refinery Engineering	3

Food Processing Option

Course Code	Course Title	Credit
CHEN 333	Food Chemistry and Technology Principles	3
CHEN 340	Food Engineering Fundamentals	3
CHEN 350	Methods of Food Preservation	3

COURSE DESCRIPTIONS

CHEN 206 INSTRUMENTATION LAB AND RESEARCH METHODS 3.0: 3 cr. E

This laboratory initializes students to the experimental work and to the use of measuring instruments. Methodology in writing technical reports will be covered. Student will learn also how to identify important and relevant information from different sources (books, journal papers, patents, etc.) and how to use practically essential softwares (Excel, Power point, Word, etc.) for experimental data processing.

CHEN 211 FUNDAMENTALS OF GEOLOGY 3.0: 3 cr. E

This course provides an introduction to Earth geology. Topics include plate tectonics, the makeup of continents and mountain building. Heat flow, magnetism, gravity, rock deformation, earthquakes and the earth's interior. Surface processes including weathering, erosion, transport and deposition. Landforms, rivers, groundwater, glaciers, ocean processes, and volcanoes. Minerals and rocks.

CHEN 212 CHEMICAL ENGINEERING I 3.0: 3 cr. E

This course provides an introduction to the discipline of chemical engineering. An introduction is provided to the first principles of chemical engineering, as well as environmental, health, safety and ethical issues in chemical engineering practice. An overview is provided of the chemical engineering profession, career choices, the course of study, and a survey of the chemical industry, e.g., polymer, pharmaceutical, food processing, electrochemical, biotechnology, process control, energy, and petroleum refining.

Prerequisite: MATH 200

CHEN 213 CHEMICAL ENGINEERING DRAWING 0.3: 1 cr. E

In this course, students will be exposed to the basic concepts of standard Chemical Engineering Drawing. Students will be able to draw/sketch objects orthographically and isometrically. The conventional symbols used in drawing/sketching of chemical engineering processes will be addressed as well. Different crystal structures drawing will also be covered.

CHEN 215 MATERIALS SCIENCE AND ENGINEERING 3.0: 3 cr. E

This course introduces fundamental concepts in materials science. The main purpose of this course is to provide a good undrestanding of the materials science and engineering. Topics covered include: atomic structure and interatomic bonding, crystalline structure, crystal defects, diffusion, phase diagrams, mechanical properties of metals, ceramic, polymers and composite materials, corrosion and degradation of materials.

CHEN 222 PROCESS SIMULATION AND MODELING 0.3: 1 cr. E

This course makes use of computers and software as problem solving aids in chemical engineering. The course focuses on the learning and application of the following process simulation, modeling and control software: Hysis, Aspen and Labview. An introduction to the drawing software Autocad is also covered.

CHEN 246 CHEMICAL ENGINEERING INSTRUMENTATION 3.0: 3 cr. E

This course presents the theory of optical, electro-analytical, and chromatographic methods of analysis, including electronic aspects of modern instrumentation; fundamentals principles and methods used in measurement and control of process variables such as pressure, temperature and flow rate; as well as chemical transducers and statistical methods of data handling.

CHEN 303 UINT OPERATION LAB 0.3: 1 cr. E

This laboratory covers experiments in the area of unit operations which include fluid-flow phenomena through various media such as: friction in conduits, filtration, pressure drop in packed towers, fluidization of solids,

and spray drying; heat and mass transfer such as: heat transfer in two heaters and a cooler, climbing film evaporation, multiple effect evaporation, absorption, extraction, distillation and rotary drying of solids.

Prerequisite: MECH 232, 243, CHEN 312.

CHEN 307 CHEMICAL PROCESS CONTROL LAB **0.3: 1 cr. E**

This course is intended to provide laboratory application of fundamental principles of chemical process dynamics and feedback control. This includes open-loop dynamics of typical chemical engineering processes such as distillation, fluid flow, chemical reactors and heated stirred tanks. Closed-loop experiments will involve control loop design, controller tuning, multivariable, and computer control.

Prerequisite: CHEN 369.

CHEN 311 PETROLEUM FLUIDS **3.0: 3 cr. E**

This course covers properties of natural gases; properties of crude oils; fluid phase behavior; vapor-liquid equilibria; equations of state theory and applications; petroleum fluid characterization; petroleum product specifications; surface separations; H2O/hydrocarbon phase behavior; introduction to PVT phase behavior simulation software

CHEN 312 MASS TRANSFER **3.0: 3 cr. E**

This course covers topics on diffusion, convective and interfacial mass transfer, and its application to continuous contact operations; design of equilibrium-stage separation processes including distillation, gas-liquid absorption and stripping, liquid-liquid extraction, and humidification.

Prerequisite: MECH232, CHEM 262, CHEN 212.

CHEN 321 FUNDAMENTALS OF PETROLEUM ENGINEERING **3.0: 3 cr. E**

This course provides an overview of petroleum engineering systems including: uses of petroleum products, exploration, exploitation subjects such as drilling, production, reservoir and formation evaluation, transportation and refining; design of the reservoir management plan; performance prediction; marketing; government regulation.

CHEN 322 PETROLEUM REFINERY ENGINEERING **3.0: 3 cr. E**

This course covers the following topics: petroleum composition, crude oil preparation, evaluation of oil stocks, refinery products and test methods, physical properties of petroleum oil, refinery equipments, and the main refinery operations in petroleum processing.

Prerequisite: CHEN 357.

CHEN 323 PLANT AND ENVIRONMENTAL SAFETY **3.0: 3 cr. E**

The course is designed to acquaint students to topics of the safety , health and environment (SHE) in the chemical plants like : temperature and pressure hazards, fire and explosion hazards, radioactive wastes hazards, equipment, energy and electrical hazards, construction and tool hazards, personal protective equipment hazards, engineering controls, administrative controls, vehicle and transportation hazards, working area and height hazards, hearing and noise hazards, fire, rescue, and emergency response equipments.

Prerequisite: CHEN 303.

CHEN 325 CHEMICAL REACTIONS AND REACTOR DESIGN **3.0: 3 cr. E**

This course covers the principles of chemical reactions and reactor design. It emphasizes on the construction of Chemical Reaction Engineering Algorithm starting from mole balances and considering the effects of heat and mass transfer.

Prerequisite: CHEN 312.

CHEN 326 CHEMICAL ENGINEERING LAB **0.3: 1 cr. E**

Experiments covering fundamental mass, energy and momentum transport. Students use new and sophisticated equipment such as multi-purpose manual reactor, centrifugal pumps, fluid dynamics apparatus, pasteurization unit, press filter, ebulliometer, fluidization-drying unit and heat exchangers. Prerequisite: CHEN 303.

CHEN 329 PLANT ECONOMICS **3.0: 3 cr. E**

Design of equipment, systems and plants; discussion of factors important in chemical plant design such as: economics, cost estimation, profitability, process selection, materials of construction, process control, plant location and safety. Introduction to optimization and computer-aided design. Principles are illustrated with short industrial-type problems. Recommended background: thermodynamics; heat, mass and momentum transfer; inorganic and organic chemistry; chemical kinetics and reactor design.

CHEN 333 FOOD CHEMISTRY AND TECHNOLOGY PRINCIPLES **3.0: 3 cr. E**

The aim of this course is to provide an introduction to the chemistry of the major food constituents amino acids, proteins, enzymes, fats, carbohydrates and vitamins; analyze the major food groups; describe the main reactions of the major food constituents. This course emphasizes on the relationship of processing technology to keep quality, nutritional value, and acceptability of foods.

CHEN 336 SEPARATION PROCESSES **3.0: 3 cr. E**

This course covers concepts on the thermodynamics, mechanisms, processes and design of equilibrium separation processes such as membrane separations, adsorption, ion exchange, chromatography and crystallization. Prerequisite: CHEN 303, 312, MECH 243.

CHEN 340 FOOD ENGINEERING FUNDAMENTALS **3.0: 3 cr. E**

This course covers the multidisciplinary field of applied physical sciences which combines science, microbiology, and engineering education for food and related industries; the application of agricultural engineering and chemical engineering principles to food materials; many challenges to employ modern tools, knowledge and technology to develop new products and processes.

CHEN 350 METHODS OF FOOD PRESERVATION **3.0: 3 cr. E**

This course covers the common methods of preservation & techniques used in commercial food processing methods. These methods are used to treat and handle food to stop or greatly slow down microbial growth in order to preserve the foods quality and nutritive value.

CHEN 357 GAS ENGINEERING **3.0: 3 cr. E**

This course deals with the inflow performance. Material balance between the well, fracture and reservoir will be stated to deduce the pseudo-steady and steady state equations of the flow. Near well bore alterations and the different flow regimes heading to the well bore will be studied. The two types of well drilling are explained: Vertical and Horizontal well. The influencing aspects on the wells performance as: Water conning, frack & gravel pack completions will be covered.

Prerequisite: MATH 270.

CHEN 369 CONTINUOUS-TIME PROCESS CONTROL SYSTEMS **3.0: 3 cr. E**

Continuous-time signal transformations and system classifications; Fourier series and transform; Laplace

transform; block diagram algebra and signal flow graph; stability analysis techniques (Routh-Hurwitz Criterion); root locus; state space analysis; modern control design (State Feedback Control) and classical control design (PID and phase compensation). Prerequisite: MATH 211, 270, CSIS 206

CHEN 377 CHEMICAL ENGINEERING THERMODYNAMICS II **3.0: 3 cr. E**

This course covers the second law of thermodynamics, entropy, thermodynamic properties of fluids and thermodynamic diagrams, Application of thermodynamics to flow processes, power production from heat, refrigeration, vapor-liquid equilibrium, solution thermodynamics, and chemical reaction equilibria and equilibrium constants.

Prerequisite: MECH232

CHEN 378 LIVING CELLS ENGINEERING **3.0: 3 cr. E**

Engineering of the living systems; Biomolecules, biological catalysers and living cells; Basic concepts and applications related to chemical engineering; Structure and role of the cellular components in bioprocesses; Cell and enzyme types; Examples of bioprocesses using different types of cells; Kinetics of enzymatic reactions; Nutrition and cell growth; Operating conditions and selection of bioreactors; Operations and conditions of asepsis; Biocaptors; Metabolic pathways and metabolic regulation; Applications in biotechnology, environmental engineering, pulp and paper, food technology and petroleum engineering.

Prerequisite: CHEN 312.

CHEN 388 BIOFUEL ENGINEERING **3.0: 3 cr. E**

This course will emphasize the importance of biofuel engineering process technology. It will cover the following topics: the harvesting of energy from biochemical reactions, the modeling of biofuel production, the biofuel feedstocks, the ethanol production, the different kinds of biodiesel, the microbial fuel cell, and the methane production.

Prerequisite: CHEN 377.

CHEM 202, 203, 240, 242, 244, 245, 247, 262

Refer to the Department of Chemistry.

CSIS 206

Refer to the Department of Computer Science.

CVSQ 201, 202, 203 / 204

Refer to the Civilization Sequence Program.

ELEN 201

Refer to Department of Electrical Engineering.

ENGL 203, ELECTIVE

Refer to the Division of English Language and Literature.

GENG 311, 390
Refer to the Faculty of Engineering Requirements.

MATH 200, 202, 211, 230, 246, 270
Refer to the Department of Mathematics.

MECH 212, 221, 231, 232, 234, 321, 511
Refer to the Department of Mechanical Engineering.

FACULTY OF ENGINEERING REQUIREMENTS

GENG 310 INTRODUCTION TO GIS **3.0: 3 cr. E**

GENG 311 ENGINEERING ECONOMY AND MANAGEMENT **3.0: 3 cr. E**
Engineers with excellent managerial skills and superior economic acumen are needed as leader of the new century engineering world. This course prepares engineers to fulfill their managerial responsibilities, and acquire useful economic perspectives. This course is organized to contain two major parts: (I) Functions of engineering management, and (II) Economic fundamentals for engineering managers. Part (I) introduces the basic functions on engineering management such as planning, organizing, leading and controlling, while part (II) covers the fundamentals of engineering economics.

GENG 390 UNDERGRADUATE PROJECT **0.3: 1 cr. E**
Applied work and design skills in the related engineering field. Applications involve hardware as well as software and simulations.