FACULTY OF ENGINEERING

FACULTY LIST

OFFICERS OF THE FACULTY

Salem, Elie A.	President of the University
Bashour, Tali'	Vice President for Medical Studies
Karam, Nadim	Vice President for Health Affairs and Community Development
Nahas, George	Vice President for Planning and Educational Relations
Najjar, Michel	Vice President for Development and Public Affairs, *Dean*
Moubayed, Walid	Dean of Admissions and Registration
Bashir, Sameera	Librarian

FACULTY STAFF

Kabbara, Souha	Faculty Secretary
Saliba, Josette	Faculty Secretary
Akkary, Nadine	Laboratory Instructor
Daoud, Nassif	Laboratory Instructor
Hilal, Nina	Laboratory Instructor
Rouphael, Fadi	Laboratory Instructor
Yaacoub, Tony	Laboratory Instructor
Abi-Chaar, Pierre	Laboratory Assistant
Hamati, Roula	Laboratory Assistant
Mujaes, Nabil	Laboratory Assistant
Nini, Eddy	Laboratory Assistant

FACULTY MEMBERS

Abbas, Abdel-Wahed	Ph.D., Computer Science, Queen Mary College, University of London, UK
Abche, Antoine	Ph.D., Biomedical Engineering, Rutgers, The State University of New Jersey, USA
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
Chaouk, Hamdi	Ph.D., Aeronautical Engineering, University of Sydney, Australia
Dagher, Issam	Ph.D., Electrical Engineering, University of Central Florida, USA
Fares, Nabil	Ph.D., Civil Engineering, Massachusetts Institute of Technology, Massachusetts, USA
Gerges, Antoine	Ph.D., Civil Engineering, University of South Florida, USA
Gerges, Nagib	Ph.D., Environmental Engineering, University of South Florida, USA

Greije, Jean	Doctorat, Mathématiques Appliquées, Université Pierre et Marie Curie, France
Haddad, Nicola	Ph.D., Electrical Engineering, Ohio University, Athens, Ohio
Hamouche, Nakhle	Ph.D., Engineering Mechanics, Mississippi State University, USA
Haidar, Haissam	Ph.D., Mechanical Engineering, MIT, Cambridge, Massachusetts, USA
Honein, Elie	Ph.D., Mechanical Engineering, Stanford University, Stanford, California, USA
Hoz (El), Mervatt	Ph.D., Civil Engineering, The University of Sydney, Australia
Inaty, Elie	Ph.D., Optical Communications, Lavalle University, Quebec City, Canada
Issa, Georges	Diplome D'Ingenieur, Saint Joseph University, Lebanon
Issa, Ghassan	Diploma, Architecture, University of Athens, Greece
Jadayel, Oussama	Ph.D., Mechanical Engineering, University of Birmingham, UK
Jammal, Ghassan	Ph.D., Automated Control Systems, Czech Technical University, Czechoslovakia
Karam, Elie	Ph.D., Biomedical Engineering, Rutgers, The State University of New Jersey, USA
Karam, Walid	MS, Electrical Engineering, South Dakota State University, USA
Khaldi, Mohamad	Ph.D., Electrical Engineering, Pennsylvania State University, USA
Khalil, Nariman	Ph.D., Civil Engineering, Leeds University, England
Melki, Antoine	MS, Computer Science, University of Athens, Greece
Moubayed, Walid	Ph.D., Civil Engineering, University of Houston, USA
Najjar, Maged	Ph.D., Electrical Engineering, Purdue University, USA
Najjar, Michel	Ph.D., Civil Engineering, Oklahoma State University, USA
Naja, Mohamad	Ph.D., Civil Engineering, Michigan State University, USA
Nakat (Al), Hanna	Ph.D., Physical Chemistry, University of New South Wales, Australia
Nasr, Karim	Ph.D., Mechanical Engineering Purdue University, West Lafayette, USA
Nini, Robert	D.E.A., Civil Engineering, Ecole Centrale de Paris, France
Rai, Habib	Ph.D., Mechanical Engineering, The University of Dayton, Ohio, USA

Rizk, Joe	MS, Civil Engineering, Florida International University, USA
Saba, Riad	MS, Electrical Engineering, Oklahoma State University, USA
Salem, Salem	Public Housing Degree, Bowscentrum, Holland BS, Architecture, University of Texas, USA
Tannous, Tony	Ph.D., Sciences, University of Sydney, NSW, Australia
Youssef, Khaled	Ph.D., Technical Sciences, Moscow Power Institute, Russia

PROGRAMS OF STUDY

The Faculty of Engineering includes:

The Department of Computer Engineering
The Department of Electrical Engineering
The Department of Civil Engineering
The Department of Mechanical Engineering

The Faculty offers two programs of study:

A three year program leading to the Bachelor Degree in Engineering
A five-year program designed for students willing to attain a broader and more intensive education

In both programs, the sequence of study 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; final decision on acceptance to the Master's Degree program resides with the Admissions Committee of the Faculty. In the Department of Computer and Electrical Engineering, the first two years are common. The Faculty of Engineering offers the following degrees:

Engineering Faculty	**Years**	**Degree**	**Status**
All Engineering Majors	3	BS	Offered
	3+2	MS	Offered

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 II 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. POLICY ON ACADEMIC PROGRESS

The following is a statement of the policy on academic progress in the Faculty of Engineering.

Undergraduate students are evaluated annually at the end of the corresponding summer semester.

Evaluation of academic progress is based on the average of the major courses taken during the evaluation period. All required courses are counted as major courses except Cultural Studies and English.

B. GRADUATION REQUIREMENTS

Refer to "Graduation Requirements" in the General Section.

C. 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 for the Bachelor degree and have a major average of 80 or above are allowed to take master courses (maximum six courses), provided that the total number of credits per semester does not exceed 16 credits.

2- Students who are finishing their last 20 credits of Bachelor degree and have an average in major courses of 75-80 are allowed to take a maximum of two Master's courses per semester, provided that the total number of credits per semester does not exceed 16.

3- 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.

D. PROMOTION TO 4TH YEAR

Students who achieve an average in major courses in their undergraduate plan of study of 76.5-79.4 are accepted in a graduate program on probation.

Students who achieve an average in major courses in their undergraduate plan of study of 79.5 or above are accepted in a graduate program with clear standing.

E. EVALUATION CRITERIA

1- Clear Standing:

i) Cumulative major average of the evaluation period of more than 70.
ii) Passing grade of more than 60 in all major courses.

2- Probation:

Case 1:

i) Cumulative average in major courses of the evaluation period greater than 70.
and
ii) Failure in two major courses with a grade below 60 during the evaluation period.

Case 2:

i) Cumulative average in major courses during the evaluation period is between 67 and 70.
and
ii) A maximum of one failed major course during the evaluation period.

3- Dean's Warning:

i) Cumulative average in major courses of the evaluation period above 70.
ii) Failure in one major course with a grade below 60.

4- Repeating the Year:

Case 1:

Cumulative average in major courses of the evaluation period below 67.

Case 2:

i) Cumulative average in major courses of the evaluation period between 67 and 70.
and
ii) Failure in two major courses during the evaluation period.

Case 3:

i) Cumulative average in major courses of the evaluation period above 70.
and
ii) Failure in three or more courses during the evaluation period.

5- Out of Department:

If the same year was repeated twice.

6- Out of Faculty:

Cumulative average in major courses of the evaluation period below 60.

General Remarks:

1. Repeating the year means repeating all major courses with a grade below 70.
2. The student is only allowed two new courses per semester while repeating the year.
3. If at the end of an evaluation period a student removes the reason/reasons behind a probation and is still subject to the conditions of article two, he/she is placed on probation for another evaluation period.

4. If at the end of an evaluation period, a student fails to remove the reasons behind probation, he/she will be placed on strict probation. He/She will not be allowed to enroll in new courses and must be evaluated on semestrial basis until he/she achieves clear standing.
5. If a student is out of department, he/she can spend one semester majorless and can reapply for another department within the Faculty or to any other department within the University.

F. 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 semestrial 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.

G. 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 courses 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.

GRADUATE PROGRAM

The Faculty of Engineering offers a two-year graduate program leading to the Master's of Engineering degree. To earn the degree, a student must successfully complete the required course work as approved by the Departments of the Faculty of Engineering.

1. ADMISSION REQUIREMENTS

Applicants must hold a BS degree in engineering, or any related field, from a recognized institution of higher learning with an undergraduate average of at least 80 or its equivalent in the major courses of the field of study. The candidate's folder should contain the following documents:

a- an official application to join the graduate program,

b- official transcripts from the universities attended during the last three years,

c- 3 letters of recommendation,

d- a personal statement.

Acceptance to the graduate program of Engineering is granted upon recommendation of the Faculty Graduate Committee after reviewing the application.

The Faculty Graduate Committee may also admit students on probationary status to the graduate program after evaluation of the student file. A student admitted on probation must achieve an average of 80 or above during the first regular semester of graduate study with a full-time load, and not have failed any courses. Failure to satisfy these requirements will result in automatic dismissal from the graduate program.

Students not admitted on probation because their undergraduate average is too low may repeat some courses to improve their average and reapply for admission to the graduate program.

2. ACADEMIC RULES AND REGULATIONS

The following is a statement of the policy on academic progress in the Faculty of Engineering.

Graduate students are evaluated annually at the end of the corresponding summer semester.

Evaluation of academic progress is based on the average of the graduate courses taken during the evaluation period. (See NOTE)

A. TIME LIMITATIONS

With careful planning, full-time students should be able to complete the MS program in two years. Part-time students can complete the MS degree in up to five years.

Course credits earned in the program of graduate study or accepted by transfer are valid for a maximum of six years unless the Graduate Committee of the Faculty grants an extension. Students should petition in writing to the Graduate Committee for such exceptions.

B. TRANSFER CREDITS

A maximum of 12 credits (four courses), obtained at an approved institution of higher learning, may be accepted towards the degree, provided the credits consist of work taken at the graduate level. A grade of 80 or better is required for transfer courses to be accepted. These courses must not have been credited toward any other degree at UOB. Transfer credits are granted for courses which are equivalent to a course offered at UOB.

C. PASSING-GRADE

The passing grade for all courses is 70.

D. FULL-TIME STATUS

The semester load for full-time students is no less than 9 hours. Full-time students may accept employment only with the approval of the Department. Students who are employed outside the University for more than 20 hours per week are not normally eligible for full-time status at the Faculty of Engineering.

E. GRADUATION REQUIREMENTS

In order to graduate, students must achieve a cumulative average of 80 or above.

F. CLEAR PROMOTION & PLACEMENT ON FACULTY PROBATION

a- A student is promoted with clear status if he/she attains an average in major courses of 80 or above has no failed courses.

b- A student is placed on faculty probation in each of the following cases:

1- If he/she attains an average in major courses of 80 or above with no more than two failed courses during the evaluation year (maximum 4 credits failed per semester). In this case, the faculty probation is removed by passing the failed courses by the end of the next evaluation period.

2- If he/she attains an average in major courses between 78-80 with no more than one failed course during the evaluation year (maximum 4 credits failed per semester). Raising the major course average to 80 and passing the failed course by the end of the next evaluation period removes faculty probation.

G. REPEATING THE ACADEMIC SEMESTER

A student will have to repeat all courses with grades less than 80 taken in one semester during the evaluation year for any of the following reasons:

i) Attains a major course average of less than 78.

ii) Fails in more than four credits in one semester with a grade less than 70.

iii) Fails to remove faculty probation.

H. DISMISSAL

A graduate student may be dismissed from the program for the following reasons:

a. Attains an average in major courses of less than 70 at the time of evaluation.

b. Fails to achieve a grade of 80 or more on repeated courses.

I. APPEAL

A graduate student may petition the Dean concerning the application of any academic regulation. Petitions should be made only when a dispute cannot be resolved at the Departmental level.

NOTE: Students, on faculty probation or repeating, are evaluated again after the subsequent semester.

DEPARTMENT OF COMPUTER ENGINEERING

BACHELOR'S DEGREE

FIRST YEAR

Semester 1

Course Code	Course Title	Credit
CSIS 200	Introduction to Computers & Programming	4
ELEN 201	Instrumentation Lab	1
ENGL 203	English Comm. Skills III	3
MATH 200	Calculus I	4
MATH 211	Linear Algebra	3
MECH 221	Engineering Dynamics	3
		18

Semester 2

Course Code	Course Title	Credit
	English Elective	3
CPEN 211	Introduction to Digital Logic Design	3
CSIS 201	Data Structures	3
ELEN 221	Circuits Analysis I	3
MATH 202	Calculus II	4
MECH 232	Thermodynamics	3
		19

SECOND YEAR

Semester 3

Course Code	Course Title	Credit
CPEN 212	Logic Circuits	3
CVSQ 201	The Formation of Civilization	3
ELEN 202	Electrical Technology Lab	1
ELEN 222	Signals and Systems Theory	3
ELEN 231	Electronics I	3
MATH 270	Differential Equations	3
MECH 211	Engineering Drawing I	1
		17

Semester 4

Course Code	Course Title	Credit
CPEN 202	Logic Lab	1
CPEN 213	Microprocessors	3
ELEN 303	Circuits Analysis Lab	1
ELEN 324	Circuits Analysis II	3
ELEN 332	Electronics II	3
MATH 230	Numerical Analysis I	3
MATH 246	Probability and Statistics	4
		18

THIRD YEAR

Semester 5

Course Code	Course Title	Credit
CPEN 305	Microcontrollers Lab	1
ELEN 341	Telecommunications	3
CSIS 204	Object Oriented Programming	3
CSIS 222	Computer Networking	3
CVSQ 202	The Religious Experience: The Sacred	3
ELEN 304	Electronics Lab	1
ELEN 351	Digital Control	3
		17

Semester 6

Course Code	Course Title	Credit
CPEN 314	Engineering Computer Architectures	3
CSIS 260	Introduction to Artificial Intelligence	3
CSIS 221	Operating Systems	3
ELEN 306	Telecommunications Lab	1
CVSQ 203	Introduction to Modernity	3
GENG 301	Engineering Management	3
GENG 390	Undergraduate Project	1
		17

MASTER'S DEGREE IN COMPUTER ENGINEERING

(General Option)

FOURTH YEAR

Semester 7

Course Code	Course Title	Credit
ELEN 400	Linear Systems	3
ELEN 401	Optimization Theory	3
ELEN 443	Communication Systems I	3
ELEN 451	Computer Hardware Design	3
ELEN 453	Digital Signal Processing	3
		15

Semester 8

Course Code	Course Title	Credit
CPEN 424	Programming Logic Controllers	3
ELEN 402	Stochastic Theory	3
ELEN 422	Automatic Control Systems	3
ELEN 459	Engineering Image Processing	3
ELEN 481	Database Programming	3
		15

Summer

Course Code	Course Title	Credit
ELEN 480	Field Training	

FIFTH YEAR

Semester 9

Course Code	Course Title	Credit
CSIS 312	Advanced Computer Architecture	3
GENG 402	Project Management	3
GENG 590	Master Project	3
	Directed Elective	3
	Directed Elective	3
		15

Semester 10

Course Code	Course Title	Credit
ELEN 455	Selected Engineering Applications	1
	Directed Elective	3
	irected Elective	3
		7

Students may choose the Thesis Option by taking GENG 599 – Engineering Thesis, 6 cr. that will replace GENG 590 and one Elective.

MASTER'S DEGREE IN COMPUTER ENGINEERING

(Computer Hardware Option)

FOURTH YEAR

Semester 7

Course Code	Course Title	Credit
ELEN 400	Linear Systems	3
ELEN 401	Optimization Theory	3
ELEN 443	Communication Systems I	3
ELEN 451	Computer Hardware Design	3
ELEN 453	Digital Signal Processing	3
		15

Semester 8

Course Code	Course Title	Credit
ELEN 402	Stochastic Theory	3
ELEN 459	Engineering Image Processing	3
CPEN 452	Advanced Microcontroller Applications	3
CPEN 551	Switching Theory	3
GENG 402	Project Management	3
		15

Summer

Course Code	Course Title	Credit
CPEN 480	Field Training	

FIFTH YEAR

Semester 9

Course Code	Course Title	Credit
CSIS 320	Advanced Operating Systems	3
CSIS 312	Advanced Computer Architecture	3
CPEN 552	VLSI	3
GENG 590	Master Project	3
	Elective	3
		15

Semester 10

Course Code	Course Title	Credit
ELEN 455	Selected Engineering Applications	1
CPEN 554	Parallel Processing	3
	Directed Elective	3
		7

Students may choose the Thesis Option by taking GENG 599 – Engineering Thesis, 6 cr. that will replace GENG 590 and one Elective.

MASTER'S DEGREE IN COMPUTER ENGINEERING

(Information and Networks Option)

FOURTH YEAR

Semester 7

Course Code	Course Title	Credit
CSIS 321	Computer Networks: Architecture and Protocols	3
ELEN 400	Linear Systems	3
ELEN 401	Optimization Theory	3
ELEN 443	Communication Systems I	3
ELEN 453	Digital Signal Processing	3
		15

Semester 8

Course Code	Course Title	Credit
ELEN 402	Stochastic Theory	3
ELEN 441	Information Theory and Error Correction	3
ELEN 444	Communication Systems II	3
ELEN 447	Teletraffic Engineering	3
ELEN 481	Database Programming	3
		15

Summer

Course Code	Course Title	Credit
CPEN 480	Field Training	

FIFTH YEAR

Semester 9

Course Code	Course Title	Credit
CSIS 329	Network Management & Security	3
ELEN 547	Advanced Teletraffic Engineering	3
GENG 402	Project Management	3
GENG 590	Master Project	3
	Elective	3
		15

Semester 10

Course Code	Course Title	Credit
CPEN 526	Advanced Networks	3
ELEN 455	Selected Engineering Applications	1
ELEN 542	Wireless Communication Systems	3
		7

Students may choose the Thesis Option by taking GENG 599 – Engineering Thesis, 6 cr. that will replace GENG 590 and one Elective.

DEPARTMENT OF ELECTRICAL ENGINEERING

BACHELOR'S DEGREE

FIRST YEAR

Semester 1

Course Code	Course Title	Credit
CSIS 200	Introduction to Computers & Programming	4
ELEN 201	Instrumentation Lab	1
ENGL 203	English Comm. Skills III	3
MATH 200	Calculus I	4
MATH 211	Linear Algebra	3
MECH 221	Engineering Dynamics	3
		18

Semester 2

Course Code	Course Title	Credit
	English Elective	3
CHEM 204	General Applied Chemistry	3
CPEN 211	Introduction to Digital Logic Design	3
ELEN 221	Circuits Analysis I	3
MATH 202	Calculus II	4
MECH 232	Thermodynamics	3
		19

SECOND YEAR

Semester 3

Course Code	Course Title	Credit
CVSQ 201	The Formation of Civilization	3
CPEN 212	Logic Circuits	3
ELEN 202	Electrical Technology Lab	1
ELEN 222	Signals and Systems Theory	3
ELEN 231	Electronics I	3
MATH 270	Differential Equations	3
MECH 211	Engineering Drawings I	1
		17

Semester 4

Course Code	Course Title	Credit
CPEN 202	Logic Lab	1
CPEN 213	Microprocessors	3
ELEN 223	Electricity & Electromagnetism	3
ELEN 303	Circuits Analysis Lab	1
ELEN 324	Circuits Analysis II	3
ELEN 332	Electronics II	3
MATH 246	Probability for Engineers	4
		18

THIRD YEAR

Semester 5

Course Code	Course Title	Credit
CVSQ 202	The Religious Experience: The Sacred	3
ELEN 341	Telecommunications	3
CPEN 305	Microcontrollers Lab	1
ELEN 361	Electric Machines	3
MATH 230	Numerical Analysis I	3
ELEN 304	Electronics Lab	1
ELEN 351	Digital Control	3
		17

Semester 6

Course Code	Course Title	Credit
GENG 301	Engineering Management	3
CVSQ 203	Introduction to Modernity	3
ELEN 308	Electric Machines Lab.	1
ELEN 306	Telecommunications Lab	1
ELEN 325	Electrical Installation	2
ELEN 362	Power Electronics	3
CPEN 314	Engineering Computer Architectures	3
GENG 390	Undergraduate Project	1
		17

MASTER'S DEGREE IN ELECTRICAL ENGINEERING

(General Option)

FOURTH YEAR

Semester 7

Course Code	Course Title	Credit
ELEN 400	Linear Systems	3
ELEN 401	Communication Systems I	3
ELEN 401	Optimization Theory	3
ELEN 417	Measurement Systems	3
ELEN 454	Digital Signal Processing	3
		15

Semester 8

Course Code	Course Title	Credit
ELEN 459	Engineering Image Processing	3
ELEN 402	Stochastic Theory	3
ELEN 422	Automatic Control Systems	3
ELEN 437	Power Systems I	3
CPEN 424	Programming Logic Controllers	3
		15

Summer

Course Code	Course Title	Credit
ELEN 480	Field Training	

FIFTH YEAR

Semester 9

Course Code	Course Title	Credit
GENG 402	Project Management	3
GENG 590	Master Project	3
	Directed Elective	3
	Directed Elective	3
	Directed Elective	3
		15

Semester 10

Course Code	Course Title	Credit
ELEN 455	Selected Engineering Applications	1
	Directed Elective	3
	Directed Elective	3
		7

Students may choose the Thesis Option by taking GENG 599 – Engineering Thesis, 6 cr. that will replace GENG 590 and one Elective.

MASTER'S DEGREE IN ELECTRICAL ENGINEERING

(Biomedical Option)

FOURTH YEAR

Semester 7

Course Code	Course Title	Credit
BMEN 400	General Physiology	3
BMEN 460	Introduction to Biomaterials	3
ELEN 400	Linear Systems	3
ELEN 417	Measurement Systems	3
ELEN 453	Digital Signal Processing	3
		15

Semester 8

Course Code	Course Title	Credit
BMEN 401	Human Physiology	3
BMEN 461	Physiological Control Systems	3
ELEN 459	Engineering Image Processing	3
ELEN 462	Biomedical Instrumentation I	3
GENG 402	Project Management	3
		15

Summer

Course Code	Course Title	Credit
ELEN 480	Field Training	

FIFTH YEAR

Semester 9

Course Code	Course Title	Credit
ELEN 463	Medical Imaging I	3
ELEN 562	Biomedical Instrumentation II	3
GENG 590	Master Project	3
	Elective	3
	Elective	3
		15

FIFTH YEAR

Semester 10

Course Code	Course Title	Credit
ELEN 455	Selected Engineering Applications	1
ELEN 564	Medical Imaging II	3
	Elective	3
		7

Students may choose the Thesis Option by taking GENG 599 – Engineering Thesis, 6 cr. that will replace GENG 590 and one Elective.

MASTER'S DEGREE IN ELECTRICAL ENGINEERING

(Control and Robotics Option)

FOURTH YEAR

Semester 7

Course Code	Course Title	Credit
ELEN 400	Linear Systems	3
ELEN 401	Optimization Theory	3
ELEN 417	Measurement Systems	3
ELEN 453	Digital Signal Processing	3
MECH 513	Robotics	3
		15

Semester 8

Course Code	Course Title	Credit
CPEN 424	Programming Logic Controllers	3
ELEN 402	Stochastic Theory	3
ELEN 422	Automatic Control Systems	3
ELEN 431	Specialty Machinery	3
ELEN 459	Engineering Image Processing	3
		15

Summer

Course Code	Course Title	Credit
ELEN 480	Field Training	

FIFTH YEAR

Semester 9

Course Code	Course Title	Credit
ELEN 527	Fuzzy Logic Control	3
ELEN 525	Mobile Robots	3
GENG 590	Master Project	3
GENG 402	Project Management	3
ELEN 526	Control System Design and Implementation	3
		15

Semester 10

Course Code	Course Title	Credit
ELEN 455	Selected Engineering Applications	1
	Directed Elective	3
	Directed Elective	3
		7

Students may choose the Thesis Option by taking GENG 599 – Engineering Thesis, 6 cr. that will replace GENG 590 and one Elective.

MASTER'S DEGREE IN ELECTRICAL ENGINEERING

(Power and Energy Option)

FOURTH YEAR

Semester 7

Course Code	Course Title	Credit
ELEN 400	Linear Systems	3
ELEN 401	Optimization Theory	3
ELEN 431	Specialty Machinery	3
ELEN 432	Advanced Power Electronics	3
ELEN 453	Digital Signal Processing	3
		15

Semester 8

Course Code	Course Title	Credit
ELEN 402	Stochastic Theory	3
ELEN 422	Automatic Control Systems	3
ELEN 435	Advanced Electric Machines	3
ELEN 437	Power Systems I	3
GENG 402	Project Management	3
		15

Summer

Course Code	Course Title	Credit
ELEN 480	Field Training	

FIFTH YEAR

Semester 9

Course Code	Course Title	Credit
ELEN 536	Power Systems Control	3
ELEN 533	Renewable Energy	3
GENG 590	Master Project	3
ELEN 539	Power Quality	3
	Directed Elective	3
		15

FIFTH YEAR

Semester 10

Course Code	Course Title	Credit
ELEN 455	Selected Engineering Applications	1
	Directed Elective	3
	Directed Elective	3
		7

Students may choose the Thesis Option by taking GENG 599 – Engineering Thesis, 6 cr. that will replace GENG 590 and one Elective.

MASTER'S DEGREE IN ELECTRICAL ENGINEERING

(Telecommunication Systems Option)

FOURTH YEAR

Semester 7

Course Code	Course Title	Credit
CSIS 327	Network Programming	3
ELEN 400	Linear Systems	3
ELEN 401	Optimization Theory	3
ELEN 443	Communication Systems I	3
ELEN 453	Digital Signal Processing	3
		15

Semester 8

Course Code	Course Title	Credit
ELEN 402	Stochastic Theory	3
ELEN 441	Information Theory and Error Correction	3
ELEN 444	Communication Systems II	3
ELEN 447	Teletraffic Engineering	3
ELEN 481	Database Programming	3
		15

Summer

Course Code	Course Title	Credit
ELEN 480	Field Training	4

FIFTH YEAR

Semester 9

Course Code	Course Title	Credit
	Directed Elective	3
ELEN 440	Signal Transmission	3
ELEN 546	Estimation and Detection	3
GENG 402	Project Management	3
GENG 590	Master Project	3
		15

FIFTH YEAR

Semester 10

Course Code	Course Title	Credit
ELEN 455	Selected Engineering Applications	1
ELEN 472	Fiber Optics	3
ELEN 542	Wireless Communication Systems	3
		7

Students may choose the Thesis Option by taking GENG 599 – Engineering Thesis, 6 cr. that will replace GENG 590 and one Elective.

LIST OF DIRECTED ELECTIVES

(Biomedical Option)

Course Code	Course Title	Credit
BMEN 466	Circulatory Dynamics	3
BMEN 467	Biomechanics	3
BMEN 468	Physiological Transport Phenomena	3
BMEN 563	Biosignal Analysis	3
BMEN 565	Physiological Modeling	3
BMEN 568	Artificial Implants	3

(Computer Hardware Option)

Course Code	Course Title	Credit
CSIS 352	Computer Vision	3
CSIS 361	Neural Networks	3
ELEN 520	Non-Linear Systems Dynamics	3
ELEN 524	Industrial Control System Design	3

(Control and Robotic Option)

Course Code	Course Title	Credit
CSC 415	Neural Networks	3
CSC 418	Computer Vision	3
EE 520	Non-Linear Systems Dynamics	3
EE 524	Industrial Control System Design	3

(Information and Networks Option)

Course Code	Course Title	Credit
CSIS 327	Network Programming	3
CSIS 330	Internet Programming and Java	3
ELEN 451	Computer Hardware Design	3
ELEN 545	Cryptography	3
ELEN 547	Speech Technologies	3
ELEN 548	Intelligent Networks	3

(Telecommunication Systems Option)

Course Code	Course Title	Credit
CSIS 361	Neural Networks	3
ELEN 451	Computer Hardware Design	3
ELEN 459	Engineering Image Processing	3
ELEN 571	Cellular Communication	3
ELEN 572	Satellite and Radar Communication	3
ELEN 578	Antenna Design	3

(Power and Energy Option)

Course Code	Course Title	Credit
ELEN 531	Power Systems Protection and Reliability	3
ELEN 537	Power Systems II	3
ELEN 538	Power Systems Generation and Distribution	3

COURSE DESCRIPTIONS

BMEN 401 (BME 401) HUMAN PHYSIOLOGY **3.0: 3 cr. E**

This course covers the human physiological systems: nervous system; cardiovascular system; respiratory system; gastrointestinal system; renal system; skeletal system; muscular system; and some special medical topics, such as exercise physiology.

BMEN 460 (BME 460) BIOMATERIALS **3.0: 3 cr. E**

This course provides understanding of the following topics: Mechanical and electromechanical properties of tissue; properties of biomaterials (chemical, mechanical, immunological…); biomaterial applications (artificial organs, bone/joints replacement, drug delivery…); and other specialized issues.

BMEN 461 (BME 461) PHYSIOLOGICAL CONTROL SYSTEMS **3.0: 3 cr. E**

This course covers the physical, mathematical and chemical bases of control organ system function and the applications of systems and control theory to biological systems; topics include cardiovascular, renal, pulmonary, pharmaco-kinetics, membrane potentials, visual and other systems. These physiological systems are covered with emphasis on the feedback control aspects.

BMEN 466 (BME 466) CIRCULATORY DYNAMICS **3.0: 3 cr. E**

This course covers the mechanics and fluid mechanics of circulatory system; mathematical modeling and experimental methods in circulatory dynamics; invasive and noninvasive measuring techniques. Topics include measurement of blood pressure and flow in arteries and veins, muscle mechanics, models of the heart, microcirculation, the closed cardiovascular system, and cardiac assist devices.
Prerequisite: BMEN 461.

BMEN 467 (BME 467) BIOMECHANICS **3.0: 3 cr. E**

This course presents an integrated approach to the study of human movement. Fundamental mechanical principles will be reviewed, with subsequent application to the major joints and structures of various regions of the human body, resulting in an understanding of and appreciation for total body movement and the integration of biomechanics with other exercise and sport science disciplines.
Prerequisite: BMEN 460.

BMEN 468 (BME 468) PHYSIOLOGICAL TRANSPORT PHENOMENA **3.0: 3 cr. E**

The course provides an introduction to transport phenomena, including the fundamentals of mass, momentum, heat transfer, and mechanical energy balances with their analogies and applications to the analysis of physiological and metabolic systems and the design of artificial tissues and drug delivery systems.

BMEN 563 (BME 563) BIOSIGNAL ANALYSIS **3.0: 3 cr. E**

This course covers topics of wavelet and time-frequency analysis. Applications include pulmonary and respiratory signals, ELENG, ECG, evoked potentials, MRI, X-Rays, mammograms, and other issues.

BMEN 565 (BME 565) PHYSIOLOGICAL MODELING **3.0: 3 cr. E**

This course covers various approaches to the design and use of mathematical models and computer simulations in the quantitative description of physiological systems. A selection will cover some of the following topics: membrane biophysics, neural modeling, cardiovascular system dynamics, respiratory mechanics, and muscle contraction, pharmacokinetics, risk extrapolation techniques, and quantitative cancer modeling.
Prerequisite: BMEN 461.

CHEM 204

Refer to Faculty of Sciences, Department of Chemistry.

CPEN 202 (EE 204) 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 (EE 151) 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.
Prerequisite: CSIS 200, MATH 211.

CPEN 212 (EE 203) 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 (EE 351) 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: CPEN 212.

CPEN 305 (EE 355) 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 314 (EE352) ENGINELENRING 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: ELEN 231.

CPEN 315 (EE 451) 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 316 (EE 424) 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 452 (EE 452) ADVANCED MICROCONTROLLER APPLICATIONS 3.0: 3 cr. E

The course is intended to enhance your knowledge in the area of microcontrollers through an in-depth coverage of the dsPIC30F Digital Signal Controller. The emphasis will be on: efficient software design techniques, on-chip I/O subsections and advanced peripheral devices. By the end of the course, students are expected to design, build and prototype a full-blown system. Typical applications include the following areas: control, telecommunications, data acquisition, telemetry, power electronics, instrumentation, etc.
Prerequisites: ELEN 400.

CPEN 481 (EE 481) DATABASE PROGRAMMING 3.0: 3 cr. E

This course introduces to engineering students the database concepts. It describes the different steps involved in the process of database development. It covers data modeling with emphasis on rational model, normalization, entity-relationship modeling, application design, SQL, and the implementation for personal and multi-user databases. Client-server systems are also discussed with the associated security issues, as part of the described architecture. A detailed study of database technologies is part of the course in order to provide the student with the maximum ability to accomplish a database project.

CPEN 545 (EE 545) CRYPTOGRAPHY 3.0: 3 cr. E

This course aims to introduce the students to cyptography in its algorithmic sides. The course starts with a definition of cryptosystems using simple examples (shift cipher, affine cipher, hill ciper, Vigenère cipher…). A small review of Shanon theory is then performed. Bulk encryption is detailed with a focus on Data Encryption Standard (DES) and its variants. Afterwards, public-key cryptosystems are studied (Diffie-Hellman, RSA,.). Attacks on both classes of cryptosystems are presented. The final part of the course is relative to hashing algorithms (MD4, MD5,.). At the end of the course, students will become aware of cryptography and of the strength and weakness of every cryptosystem.
Prerequisites: ELEN 402/541.

CPEN 549 (EE 549) INTELLIGENT NETWORKS **3.0: 3 cr. E**

In public telecommunication networks, telephone network and wireless network, the control and services offering is one of the most important issues for successful service providing. The concept of intelligent networks has been introduced in the last 1980s to permit an easy and efficient development and deployment of services for such networks. Intelligent networks will be presented in details in this course. The underlying communication protocols (INAP) will be described. Those presentations will cover intelligent networks for both fixed and wireless telephone networks. Students must have a good knowledge of networking principles and general telecommunication concepts in order to attend this course.
Prerequisites: ELEN 444, and CSIS 321.

CPEN 551 (EE 551) SWITCHING THEORY **3.0: 3 cr. E**

This course covers finite-state sequential machine theory and design, state identification, state minimization in incompletely specified tables, partition theory, decomposition of machines, asynchronous machine design and test methodologies for improving testability and combinational and sequential digital systems.

CPEN 552 (EE 552) VLSI **3.0: 3 cr. E & F**

The purpose of this course is to introduce students to the topic of CMOS technology in VLSI. Implementations in CMOS will be discussed starting from CMOS inverters and basic gates all the way to multiplexers, decoders, ALUs, registers, memories, sequential circuits, etc. Other topics include propagation delay, noise margins, and power dissipation. Speed, area, and power optimization are discussed. CAD Tools for layout, extraction, and simulation are used.
Prerequisites: ELEN 541, CPEN 551.

CPEN 554 (EE 554) PARALLEL PROCESSING **3.0: 3 cr. E**

The design of large-scale parallel processing systems: Synchronous (SIMD) and asynchronous (MIMD) machine organizations, single stage, and multistage interconnection networks are covered. Various parallel algorithms are presented to demonstrate different techniques for mapping tasks onto parallel machines.
Prerequisite: CSIS 312.

CVSQ 201, 202, 203

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

CSIS 200, 201, 204, 221, 222, 312, 320, 321, 327, 329, 362, 375

Refer to Faculty of Sciences, Department of Computer Science.

ELEN 201 (EE 100) 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 (EE 103) ELECTRICAL TECHNOLOGY LAB. **0.3: 1 cr. E**

The purpose of this workshop is to provide the students with working knowledge of the use of PSPICE, AUTOCAD, MATLAB, PCB layouts (design and soldering); electrical instrument handling and maintenance.
Prerequisites: EE 101.

ELEN 221 (EE 101) 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 200/211.

ELEN 222 (EE 200) 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.
Prerequisites: ELEN 221, MECH 211, and MATH 202.

ELEN 223 (EE 235) 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 (EE 215) 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 (EE 202) 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.
Co-requisite: ELEN 324.

ELEN 304 (EE 217) 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.
Co-requisite: ELEN 332.

ELEN 306 (EE 347) 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 308 (EE 336) ELECTRIC MACHINES LAB **0.3: 1 cr. E**

This laboratory covers magnetic circuits; transformers; induction motors; reluctance motors; synchronous and DC machines.
Prerequisite: ELEN 362.

ELEN 324 (EE 201) 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 (EE 331) ELECTRICAL INSTALLATIONS **0.3: 2 cr. E**

This course exposes students to electric wires and cables; wiring systems and techniques; 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.
Prerequisites: ELEN 303.

ELEN 326 (EE 453) 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.

ELEN 332 (EE 216) 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; waveshaping; other integrated-circuits.
Prerequisite: ELEN 231.

ELEN 341 (EE 346) 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 324 and MATH 246.

ELEN 351 (EE 323) DIGITAL CONTROL **3.0: 3 cr. E**

This course covers continuous-time and discrete-time systems analysis 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; pulse transfer function, discrete equivalent, Zero Order Hold, and bilinear transformation; state space analysis; State Feedback Control, PID, and phase compensation design.
Prerequisites: ELEN 324 and MATH 270.

ELEN 361 (EE 335) 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 (EE 333) 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.
Prerequisites: ELEN 332/361.

ELEN 400 (EE 400) LINEAR SYSTEMS **3.0: 3 cr. E**

This course covers the concepts and theories of linear system analysis; state-space modeling and analysis; controllability, observability, and stability of linear systems; properties of transfer function matrices; minimal realization.

ELEN 401 (EE 401) OPTIMIZATION THEORY **3.0: 3 cr. E**

This course is an introduction to various methods of obtaining the extreme of a non-dynamic or a dynamic system and its use in system design. Linear programming, various search methods, nonlinear programming and dynamic programming are also covered. Various real-life applications are discussed and appropriate case studies are investigated.

ELEN 402 (EE 402) STOCHASTIC THEORY **3.0: 3 cr. E**

This course covers general concepts of stochastic processes; stationarity and ergodicity; stochastic continuity and differentiation; Gaussian process; linear systems with stochastic inputs; correlation functions and power spectra; matched filtering; mean square estimation; spectral estimation; modulation; Entropy; Markov processes; queuing theory.

ELEN 415 (EE 415) ADVANCED ELECTRONICS **3.0: 3 cr. E**

This course covers advanced applications of integrated circuits: IC regulators, Op-Amp applications, active filters, oscillators, waveform generators, frequency multiplier and divider circuits, optoelectronic circuits, and other integrated circuits and applications.

ELEN 417 (EE 417) MEASUREMENT SYSTEMS **3.0: 3 cr. E & F**

This course covers the principles of measurement systems from the sensor/transducer unit to the display unit; static and dynamic characteristics; accuracy; loading effects; signals and noise; reliability, choice and economics; sensing elements: resistive, capacitive, inductive, electromagnetic, thermoelectric, elastic, piezoelectric, and electromechanical; signal conditioning; signal processing, and software; data presentation. Applications selection from force and pressure measurement systems; flow measurement systems; intrinsically safe measurement systems; heat transfer effects in measurement systems; optical measurement systems; ultrasonic measurement systems; gas/chemical measurement systems.

ELEN 422 (EE 422) ADVANCED CONTROL SYSTEMS **3.0: 3 cr. E & F**

This course covers the analysis and design of modern feedback control systems. Advanced state space analysis; State Feedback control design; Cayley-Hamilton theorem; Ackerman's formula; full order and Luenberger observer design; optimal control design (LQR); system identification; robust control.
Prerequisite: ELEN 400.

ELEN 423 (EE 323) DIGITAL CONTROL SYSTEMS **3.0: 3 cr. E & F**

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 400.

ELEN 431 (EE 431) SPECIALTY MACHINERY **3.0: 3 cr. E**

Special purpose motors; stepper motors; servo motors; PM motors. Other motors that are used in manufacturing, robotics, and electrical systems are also covered.

ELEN 432 (EE 432) ADVANCED POWER ELECTRONICS **3.0: 3 cr. E**

Advanced static VAR compensation; system stability enhancement; harmonic minimization; mathematical modeling of switching power converters; advanced power converter topologies; design constraints and control methods; design-oriented analysis techniques for applications in electro-mechanical systems, power systems, transportation systems, etc.

ELEN 435 (EE 435) ADVANCED ELECTRIC MACHINES **3.0: 3 CR. E**

This course covers the generalized theory of machines based on coupled circuit approach using matrix methods; transformations from three-phase to two-phase dq variables; applications to dc induction, and synchronous machines and there parameters; performance in the transient and the steady state.

ELEN 437 (EE 437) POWER SYSTEMS I **3.0: 3 cr. E**

This course covers the three-phase power systems; matrix methods; symmetrical components; sequence; impedance diagrams; power system transformers; per unit system; transmission line parameter; steady state operation of transmission lines and power flow; computer projects included.

ELEN 440 (EE 440) 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.

ELEN 443 (EE 443) COMMUNICATION SYSTEMS I **3.0: 3 cr. E**

This course treats the principles of digital transmission of information in the presence of noise. The course starts with an overview of information theory and coding, analog to digital conversion, and focuses on the design and analysis principles of baseband PAM transmission systems, M-ary signaling, and various carrier systems including ASK, FSK and PSK. An introductory treatment of channel coding is also presented.

ELEN 444 (EE 444) COMMUNICATION SYSTEMS II **3.0: 3 cr. E**

This course covers source coding and compression techniques. Students are exposed to entropy coding (DCT and arithmetic coding), predictive coding (DPCM), transform coding (DCT, Walsh-Hadamard, Karhunen-Loeve), vector quantization, statistical coding (BTC), and an overview of MPEG compression. Design issues in communication systems are also covered with special emphasis to system trade-offs, Shannon-Hartley capacity theorem, and Shannon's limit. Students are exposed to M-ary signaling, the design of binary waveforms (orthogonal, biorthogonal, and transorthogonal-simplex) for channel coding. Modulation of vector codes is also analyzed with concentration on non-coherent MFSK, QAM, MSK, DPSK, and OQPSK schemes. Prerequisite: ELEN 443.

ELEN 446 (EE 446) TELECOM ELECTRONICS **3.0: 3 cr. E**

This course covers applications of operational amplifiers and other integrated circuits in current technology; wide bandwidth amplifiers; low-noise amplifiers; current mode circuits; analogue multipliers; radio frequency input circuits and impedance matching; R.F. amplifiers; micro-strip circuits; I.F. circuits; oscillators; P.L.L's.

ELEN 454 (EE 454) DIGITAL FILTERS **3.0: 3 cr. E**

This course covers advanced methods and techniques in digital filter design; linear optimum filtering: Wiener filters, linear prediction; linear adaptive filtering, steepest descent, LMS algorithm, frequency-domain adaptive filters, square-root and order-recursive adaptive filters; introduction to nonlinear adaptive filtering.

ELEN 455 (EE 455) SELECTED ENGINEERING APPLICATIONS **0.3: 1 cr. E**

This advanced design laboratory includes selected applications in the topics of DSP, control, communications, measurement, and digital hardware (FPGA and CPLD chips).

ELEN 459 (EE 459) ENGINEERING IMAGE PROCESSING **3.0: 3 cr. E & F**

In this course, an observer is helped to interpret the content of an image by improving the pictorial image information interpretation and processing of seen data for autonomous machine perception. Topics covered include: Image acquisition and storage, image transformation, image enhancement in frequency and special domains, representation and description of a seen, recognition and interpretation.

ELEN 462 (EE 462) BIOMEDICAL INSTRUMENTATION I **3.0: 3 cr. E**

This course covers the concepts and applications of biomedical instrumentation; basic transducers and principles; amplifiers and biomedical signal processing; origin of bio-potentials; electrodes and amplifiers; blood pressure and sound; measurement of blood flow and volume; measurements of the respiratory system parameters; clinical laboratory instrumentation; electrical Safety.

ELEN 463 (EE 563) MEDICAL IMAGING I **3.0: 3 cr. E**

This course covers the physical principles, design and functions of ultrasonic- and X-ray- based diagnostic imaging systems (including radiographic, fluoroscopic and computer topography); and other related issues.

ELEN 470 (EE 470) ELECTROMAGNETICS **3.0: 3 cr. E**

This course covers the theory and applications of plane waves and transmission lines.

ELEN 472 (EE 472) FIBER OPTICS **3.0: 3 cr. E**

This course covers the principles of fiber optics communication systems; optics review; Light fundamentals; integrated optic wave-guides; light sources, detectors, and couplers; distribution networks and fiber components; modulation; noise; system design; measurement.
Prerequisite: ELEN 440.

ELEN 490 (EE 490) SELECTED ENGINELENRING TOPICS **2.0: 1 cr. E**

This course consists of lectures and seminars covering recent research and advances in various fields and applications of electrical and computer engineering.

ELEN 520 (EE 520) NONLINEAR SYSTEM DYNAMICS **3.0: 3 cr. E**

This course covers topics related to nonlinear systems; definition of linear and nonlinear systems; introduction to approximate analysis of nonlinear systems-describing functions, Krylov and Bogliubov asymptotical method, and Tyskin locus; Forced oscillations-jump resonance; stability analysis-Liapunov criterion; Lure problem and Popov method.
Prerequisite: ELEN 400.

ELEN 522 (EE 522) STOCHASTIC CONTROL SYSTEMS **3.0: 3 cr. E & F**

This course covers control systems using random process; properties of Markov process; systems of covariance equivalence and of deterministic and stochastic control equivalence; dynamic programming for Markov process-principle of optimality; linear systems with quadratic cost; Kalman filtering; smoothing; predicting.
Prerequisite: ELEN 402.

ELEN 524 (EE 524) INDUSTRIAL CONTROL SYSTEM DESIGN **3.0: 3 cr. E**

Teams will design and implement a real-time automatic decision-making system for a process control application. Challenges include hardware design, how to interface computer algorithms to physical variables and how to design and implement real-time software.

ELEN 525 (EE 525) MOBILE ROBOTS **3.0: 3 cr. E & F**

This course covers inspiration to implementation of mobile robots: Computational hardware, designing and prototyping, sensors, mechanics, motors, power, and robot programming.

ELEN 526 (EE 526) CONTROL SYSTEM DESIGN AND IMPLEMENTATION 3.0: 3 cr. E

This course presents major design experience in control systems; modern control theory; specification, design, and construction of signal transducers, and design and testing of the overall system.
Prerequisite: ELEN 400.

ELEN 527 (EE 527) FUZZY LOGIC CONTROL **3.0: 3 cr. E & F**

A course covering the analysis and design of adaptive Fuzzy Systems; Training of Fuzzy Logic Systems Using Back-Propagation, Orthogonal Least Squares, Table Lookup Scheme, Nearest Neighborhood Clustering; Comparison of adaptive fuzzy systems with artificial neural networks; Design using Input-Output Linearization Concept; Fuzzy Adaptive Filters.
Prerequisite: ELEN 400.

ELEN 531 (EE 531) POWER SYSTEMS PROTECTION AND RELIABILITY 3.0: 3 cr. E

This course covers the concepts of high voltage engineering, circuits breaks and switch gear, H.V. power equipment; protection schemes; digital protection and fault diagnosis; reliability analysis.
Prerequisite: ELEN 437.

ELEN 533 (EE 533) RENEWABLE ENERGY 3.0: 3 cr. E

An introduction to alternative clean energy: Wind, Solar, Hydro, Biomass, and others. However emphasis will be on Solar and Wind energies that include: Power generation, conversion, distribution and utilization.
Prerequisite: ELEN 437.

ELEN 534 (EE534) INDUSTRIAL/COMMERCIAL POWER SYSTEMS 3.0: 3 cr. E

An introduction to power system design for commercial buildings and industrial plants; legal and economic considerations; equipment specifications and ratings; design practice; fault calculations, protection, and coordination; grounding; and illumination design.
Prerequisite: ELEN437.

ELEN 536 (EE 536) POWER SYSTEMS CONTROL 3.0: 3 cr. E

This course presents the theory and applications of power flow control; economic dispatch; unit commitment; voltage-reactive power control; automatic generation of interconnected power systems; the energy control center and the role of the digital computer.
Prerequisites: ELEN 400 and ELEN 531.

ELEN 537 (EE 537) POWER SYSTEMS II 3.0: 3 cr. E

This course presents symmetrical and unsymmetrical fault studies; bus impedance and admittance methods; power system controls; transient operation of transmission lines; transient stability; computer projects included.
Prerequisite: ELEN 437.

ELEN 538 (EE 538) POWER SYSTEMS GENERATION AND DISTRIBUTION 3.0: 3 cr. E

This course presents the concepts of power generation and synchronization; functional and equivalent circuits for transmission lines and transformers; per unit system; balanced three-phase systems and power transfer limits; unbalanced system harmonics; symmetrical components and sequence network characteristics of transmission lines and transformers; symmetrical component fault analysis; Clarke components; switching surges; lighting surges; traveling waves; impact of surges on terminal equipment; insulation coordination; system protection; synchronization laboratory.

ELEN 539 (EE 539) POWER QUALITY 3.0: 3 cr. E

In this course electric power quality; measures and standard of power quality measurements; modeling of networks and components under non-sinusoidal conditions; loads which may cause power quality problems; analysis methods, harmonics in power systems; and power quality improvement are covered.
Prerequisite: ELEN 538.

ELEN 541 (EE 541) INFORMATION THEORY AND ERROR CORRECTION 3.0: 3 cr. E

This course deals with orthonormal expansions, effect of additive noise in electrical communications, vector channels, waveform channels, matched filters, bandwidth, and dimensionality. Optimum receiver structures, probability of error, bit and block signaling, introduction to coding techniques. Protocols for error control, signaling, addressing, fault management, and security control. Block, cyclic, and convolutional codes; circuits and algorithms for decoding; application to reliable communication and fault-tolerant computing.
Prerequisite: ELEN 443.

ELEN 542 (EE 542) WIRELESS COMMUNICATION SYSTEMS 3.0: 3 cr. E

This course aims to present wireless communication systems in general. It is a graduate course that covers several aspects of wireless communication starting from the general concepts and going towards specific wireless networking protocols. Different propagation models, modulation techniques, multiple access approaches will be deepened. Speech coding and data transmission approaches will be introduced. Examples on the GSM, DECT and satellite communication will be given. As a result, the students will have a good knowledge of the most common wireless communication systems which permits them to easily start any study in this area.
Prerequisites: ELEN 402/443.

ELEN 543 (EE 543) 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.

ELEN 544 (EE 544) SPEECH TECHNOLOGIES 3.0: 3 cr. E

Speech is the most natural way of communication. Classical telecommunication systems have been built to carry this signal. Nowadays, speech is a major media in human-machine communication. Besides, the classical and basic studies on speech coding, new speech technologies have been developed, i.e. speech synthesis, speech recognition and speaker verification. This course presents the state of the art techniques. It starts with a brief presentation of the signal and of the most widely used coding techniques. Concatenative speech synthesis is then described in details. State of the art Speech recognition systems are also presented covering Hidden Markov Models (HMM). N-grams language models are explained.
Prerequisite: ELEN 402.

ELEN 546 (EE 546) ESTIMATION AND DETECTION 3.0: 3 cr. E

As a major subject in statistical communication, this course is intended to provide solid foundation for advanced studies and research in telecommunication systems. Topics include: Bayes' decision, maximum likelihood estimator and detector, MAP estimator, linear mean-square estimation, the Karhunen-Loeve expansion, Wiener filter, Kalman filter, sampling of random signals, detection of signals in Gaussian noise, and fading in Rayleigh and Rician channels.
Prerequisite: ELEN 402.

ELEN 547 (EE 547) ADVANCED TELETRAFFIC **3.0: 3 cr. E**

This course exposes students to source characterization of bursty sources (video, audio) through stochastic modeling of bursty traffic. The theory is illustrated through simulated results from the research literature. Students are also given computer projects to simulate bursty traffic sources. A major portion of the course is devoted to performance evaluation of networks using advanced queuing theory. The course will also treat traffic management and control in ATM networks, statistical multiplexing, dimensioning of cellular networks, and frame relay dimensioning.
Prerequisite: ELEN 543.

ELEN 548 (EE 548) REAL-TIME TELECOM APPLICATIONS **3.0: 3 cr. E**

The course is intended to expose you in depth to the dsPIC30F DSP and show you all the features that make it a powerful processor for digital filtering applications, FFT computation, adaptive filtering, etc. A meticulous study of the processor will be covered along with many real-time telecom applications.
Prerequisite: ELEN 443.

ELEN 562 (EE 562) BIOMEDICAL INSTRUMENTATION II **3.0: 3 cr. E**

This course covers selected topics on the design and maintenance of major medical equipment: electrocardiography, pressure and other cardiovascular measurement and life support instruments, respiratory measurement instruments, brain-parameters measurement instruments, medical lab instruments, ultrasound equipment, electro-optics, fiber optics and lasers, computers and biomedical equipment, electromagnetic interference to medical electronic equipment, battery-operated medical equipment. In-hospital visits and observation are included in the course.
Prerequisite: ELEN 462.

ELEN 564 (EE 564) MEDICAL IMAGING II **3.0: 3 cr. E**

This course covers the physical principles, design and functions of magnetic resonance imaging (MRI) and nuclear medicine diagnostic imaging systems; and other related issues.
Prerequisite: ELEN 463.

ELEN 571 (EE 571) CELLULAR COMMUNICATION **3.0: 3 cr. E**

This course focuses on cellular communication in general. Cellular communication principles will be explained to the students. The constraints and solutions for different particular cases are given. Different cellular systems will be presented: the GSM, Wireless LAN, and Bluetooth. Students must have a good knowledge of networking principles and general telecommunication concepts in order to attend this course.
Prerequisite: ELEN 443.

ELEN 572 (EE 572) SATELLITE AND RADAR COMMUNICATION **3.0: 3 cr. E**

This course is designed to provide students with an understanding of the working principles of satellite communications and the technologies involved. Topics covered include: introduction to satellite and radar communication, orbital aspects of satellite communication, satellite link design, multiple access methods (FDMA, TDMA, CDMA, FCMA), and systems examples (satellite TV, VSAT applications, mobile to satellite communication).
Prerequisite: ELEN 443.

ELEN 578 (EE 578) ANTENNA DESIGN **3.0: 3 cr. E**

This course presents electrically small antennas; wire antennas, antenna arrays; aperture antennas (slots, horns, and parabolic reflectors); broadband antennas; high frequency methods; antenna synthesis; ground wave and ionospheric propagation; receiving antennas and antenna measurements. Students design and construct antennas in associated laboratory.
Prerequisite: ELEN 440.

ENGL 203 and an elective course

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

GENG 301/390/402/590/599

Refer to Faculty of Engineering Requirements.

MATH 200/202/211/230/246/270

Refer to Faculty of Sciences, Department of Mathematics.

MECH 211/221/232/ 513

Refer to Department of Mechanical Engineering.

MGMT 310, 323, MRKT 310, ISYS 320

Refer to Faculty of Business & Management, Department of Business Administration.

DEPARTMENT OF CIVIL ENGINEERING

BACHELOR'S DEGREE

FIRST YEAR:

Semester 1:

Name of Course		Credit
CSIS 200	Intro. to Computers & Programming	4
CIVE 201	Statics	3
MECH 221	Engineering Dynamics	3
ENGL 203	English Comm. Skills III	3
MATH 200	Calculus I	4
		17

Semester 2:

Name of Course		Credit
ENGL xxx	English Elective	3
MATH 211	Linear Algebra	3
CIVE 202	Mechanics of Materials	3
MECH 222	Science of Materials	3
MATH 202	Calculus II	4
CIVE 203	Engineering Drawing 1	1
		17

SECOND YEAR:

Semester 3:

Name of Course		Credit
CVSQ 201	The Formation of Civilization	3
CIVE 204	Construction Materials & Methods	3
MECH 243	Fluid Mechanics	3
MATH 240	Probability & Statistics	4
CIVE 205	Theory of Structures I	3
MATH 270	Differential Equations	3
		19

Semester 4:

Name of Course		Credit
CVSQ 202	The Religious Exp: The Sacred	3
CIVE 207	Construction Planning & Scheduling	3
CIVE 208	Surveying	4
CIVE 209	Reinforced Concrete I	3
MECH 232	Thermodynamics	3
CIVE 206	Engineering Drawing II	1
MECH 233	Workshop Technology	1
CIVE 210	Strength of Materials Laboratory	1
		19

THIRD YEAR

Semester 5

Name of Course		Credit
CVSQ 203	Introduction to Modernity	3
CIVE 301	Soil Mechanics & Foundation	3
CIVE 302	Construction Estimating	3
CIVE 303	Computer Aided Design	3
CIVE 304	Reinforced Concrete II	3
CIVE 305	HVAC	3
CIVE 306	Soil Lab.	1
		19

Semester 6

Name of Course		Credit
CIVE 308	Transportation Engineering	3
CIVE 309	Engineering Economy	3
CIVE 310	Plans & Specifications	3
CIVE 311	Sanitary Engineering	3
MATH 230	Numerical Analysis	3
GENG 390	Undergraduate Project	1
		16

MASTER'S DEGREE IN CIVIL ENGINEERING

(5 Electives will define an Option)

FOURTH YEAR

Semester 7

Name of Course		Credit
CIVE 401	Theory of Structures II	3
CIVE 402	Dynamics of Structures I	3
CIVE 403	Foundation Design	3
CIVE 405	Prestressed Concrete	3
	Elective	3
		15

Semester 8

Name of Course		Credit
MECH 411	Advance Mechanics of Materials	3
CIVE 407	Soil-Structure Interaction	3
GENG 402	Project Management	3
CIVE 408	Dynamics of Structures II	3
	Elective	3
		15

Summer

Name of Course		Credit
CIVE 480	Field Training	

FIFTH YEAR

Semester 9

Name of Course		Credit
CIVE 501	Theory of Steel Design	3
CIVE 503	Highway Design	3
CIVE 504	Finite Element Analysis	3
GENG 590	Master Project	3
	Elective	3
		15

Semester 10

Name of Course		Credit
GENG 590	Master Project (Reactivation)	0
	Electives	6
		6

LIST OF ELECTIVES: STRUCTUCAL ENGINEERING OPTION

Name of Course		Credit
CIVE 406	Theory of Plates & Shells	3
CIVE 502	Theory of Elasticity	3
CIVE 505	Dynamics of Structures III (Earthquake Design)	3
CIVE 506	Stability of Structures	3
CIVE 507	Boundary Surveys	3
CIVE 512	Pavement Design	3
CIVE 556	Bridge Design	3

LIST OF ELECTIVES: TRANSPORTATION ENGINEERING OPTION

Name of Course		Credit
CIVE 408	Dynamics of Structures II	3
CIVE 504	Finite Element Analysis	3
CIVE 505	Dynamics of Structures III (Earthquake Design)	3
CIVE 512	Pavement Design	3
CIVE 556	Bridge Design	3

LIST OF ELECTIVES: ENVIRONMENTAL ENGINEERING OPTION

Name of Course		Credit
CIVE 520	Principles of Environmental Engineering	3
CIVE 521	Wastewater Engineering Design	3
CIVE 522	Water Resources & Water Quality	3
CIVE 523	Air Pollution Control	3
CIVE 524	Solid Waste Disposal	3
CIVE 525	Sanitary Landfill	3
CIVE 526	Water Supply Engineering Design	3
CIVE 527	Environmental Impact Assessment	3
CIVE 528	Environmental Economics and Management	3
CIVE 529	Environmental Water Chemistry	3

LIST OF ELECTIVES: CONSTRUCTION MANAGEMENT OPTION

Name of Course	Credit	
CIVE 412	Quality Assurance & Control	3
CIVE 413	Modern Techniques in Human Resource Management	3
CIVE 415	Process Reengineering/Administrative Reform	3
CIVE 416	Management Support Systems	3
CIVE 417	Strategic Management	3

N.B. Student may choose Thesis Option GENG 599, 6 cr. This option will replace GENG 590 and one Elective.

COURSE DESCRIPTIONS

CIVE 201 (CIV 101) STATICS **3.0: 3 cr. E**

Composition and resolution of forces, free-body diagrams, analysis of forces acting on structures and machines, shear and bending moment diagrams, friction, centroid, and moment of inertia.

CIVE 202 (ENG 103) MECHANICS OF MATERIALS **3.0: 3 cr. E**

Introduction - Concept of stress; stress and strain. Axial loading; torsion; Pure bending; Transverse loading-Shear stress; Transformation of stress and strain; Deflection of beams; Columns.
Prerequisites: CIVE 201 and MATH 200.

CIVE 203 (ENG 102) 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 (CIV 200) 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.

CIVE 205 (CIV 202) THEORY OF STRUCTURES I **3.0: 3 cr. E**

Analysis of statically determinate structures: Elastic deformations; deflection of beams by Moment-Area Theorems, Conjugate-Beam Method. Deflections by Energy Methods, Virtual-Work Method, Castigliano's Second Theorem. Influence Lines and Criteria for Moving Loads; Statically Indeterminate Structures: Method of Consistent deformations; Slope-Deflection Method; Moment-Distribution Method.
Prerequisites: CIVE 201/202.

CIVE 206 (ENG 202) 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: CIVE 203.

CIVE 207 (CIV 204) CONSTRUCTION PLANNING & SCHEDULING **3.0: 3 cr. E**

Basic elements of management of civil engineering projects; roles of all participants in the process: owners, designers, contractors and suppliers; emphasis on contractual aspect of the process, project estimate, planning and controls. Planning, scheduling and control of construction projects; management functions, network techniques (CPM), resource scheduling, construction financing and cost/schedule relations.
Prerequisite: English Proficiency Level: ENGL 102.

CIVE 208 (CIV 205) SURVEYING **2.2: 4 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.
Prerequisite: MATH 200.

CIVE 209 (CIV 206) REINFORCED CONCRETE I **3.0: 3 cr. E**

Strength and deformation of reinforced concrete according to the provisions of the ACI Building Code; Beams in flexure and shear; Bond and development of bars; Deflection; One way ribbed and solid slabs; Short columns.
Prerequisites: CIVE 205.

CIVE 210 (CIV 207) STRENGTH OF MATERIALS LABORATORY **0.3: 1 cr. E**

Concrete Constituents and Mix Design; Slump Test; 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; Standard Method for Resistance to Plastic Flow of Bituminous Mixtures using Marshall Apparatus.
Prerequisite: CIVE 202, Co-requisite: CIVE 209.

CIVE 301 (CIV 301) SOIL MECHANICS & FOUNDATIONS **3.0: 3 cr. E**

Soil explorations and testing, foundations for buildings, piles and footings, bracing of open trenches, sheet piling, and laboratory testing of soils. Stability of slopes, earth pressure, steady seepage.
Prerequisites: CIVE 202/209.

CIVE 302 (CIV 302) CONSTRUCTION ESTIMATING **3.0: 3 cr. E**

An overview of the construction estimating process is presented. Topics covered include preparation of quantity take off, bill of quantities, detailed estimates for all different construction trades, i.e., materials and labor, along with pricing of bids. The student learns how to transfer estimates into the construction process and project management control tools. To emphasize the importance of computer application in estimating, the student designs several estimating spreadsheets. Familiarity with spreadsheet programs is an asset.
Prerequisite: CIVE 207.

CIVE 303 (CIV 303) COMPUTER-AIDED DESIGN **2.1: 3 cr. E**

Applications of interactive computer graphics to design of common Civil Engineering problems; Introduction to the stiffness method; Frame analysis, beam and arbitrary shaped slabs.
Prerequisites: CSIS 200, CIVE 203/209.

CIVE 304 (CIV 304) REINFORCED CONCRETE II **3.0: 3 cr. E**

Design of reinforced concrete building and floor slab systems. Moment curvature relationship for beams and columns, bi-axially loaded columns, slenderness effects, interaction diagrams, shear and torsion in members. Extensive use of microcomputers.
Prerequisite: CIVE 209.

CIVE 305 (CIV 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.

CIVE 306 (CIV 307) SOIL MECHANICS LABORATORY 0.3: 1 cr. E

Soil properties and behavior, soil classifications, hydraulics of soil moisture, consolidation and settlement, strength characteristics, soil stabilization.
Co-requisite: CIVE 301.

CIVE 308 (CIV 306) 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 cross-section. Introduction to traffic elements including intersection design and analysis of roads and intersections service levels.
Prerequisite: CIVE 208.

CIVE 309 (CIV 308) ENGINEERING ECONOMY 3.0: 3 cr. E

The course introduces the student to the fundamental concepts of engineering economy covering: economic analysis of projects, operations analysis, as well as the evaluation of alternatives, namely , benefit/cost ratio, present and annual worth, internal rate of return, and utility study. The course discusses retirement and replacement analysis, depreciation methods, and risk analysis.

CIVE 310 (CIV 309) PLANS & SPECIFICATIONS 3.0: 3 cr. E

Plans, specification and writing and interpretation, and contract documents related to the construction industry.
Prerequisite: CIVE 206.

CIVE 311 (CIV 310) SANITARY ENGINEERING 3.0: 3 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.
Prerequisite: MECH 243.

CIVE 401 (CIV 401) THEORY OF STRUCTURES II 3.0: 3 cr. E

Approximate analysis of continuous beams and frames. Parametric studies of some basic structures including towers, buildings and bridges. Analysis of beam, truss and frame structures using the direct stiffness method. Two topics selected from nonlinear truss analysis, energy methods, Timoshenko beam-columns, structural optimization, influence lines, arches, cable structures and others (content varies by year).

CIVE 402 (CIV 402) DYNAMICS OF STRUCTURES I 3.0: 3 cr. E

Dynamic modelization. Equations of motions of structures modeled as single degree of freedom and as multi-degree of freedom systems. Response analysis of structures subjected to harmonic, periodic, impulsive and general types of excitations.

CIVE 403 (CIV 403) FOUNDATION DESIGN **3.0: 3 cr. E**

Geotechnical engineering applications to the analysis, design, construction of shallow foundations and earth retaining structures.

CIVE 404 (CIV 404) HYDRAULICS **3.0: 3 cr. E**

Design and analysis of hydraulic projects using modern computational procedures; student team projects involving steady and unsteady flow in pipelines, pipe networks, bridge and culvert hydraulics, flood-plain delineation, water supply canals, structures and channel modification, design of drainage elements such as storm water networks, sewerage networks, water supply networks, grates and inlets, and introduction to scour analysis.

CIVE 405 (CIV 405) PRESTRESSED CONCRETE **3.0: 3 cr. E**

Introduction to Materials and Systems of Prestressing; Basic Concepts of Prestressing: Basic-Concept Method, Load-Balancing Method, Pressure-Line Method; Prestress Losses; Composite Construction; Ultimate Flexural Strength Analysis and Design; Shear Design; Continuous Prestressed Concrete Beams.

CIVE 406 (CIV 406) THEORY OF PLATES & SHELLS **3.0: 3 cr. E**

Basic theory of plates, bending of rectangular and circular plates, geometry of shells, stresses and deformations of various shell structures, numerical applications, finite element modeling.
Prerequisite: CIVE 401 or MECH 411.

CIVE 407 (CIV 407) SOIL-STRUCTURE INTERACTION **3.0: 3 cr. E**

Fundamentals of geotechnics applied to design and analysis of deep soil-structure systems; ,single pile, pile groups under axial load; sheet piles, tiebacks, caissons and piers; effect of lateral loads; computer software implementation.

CIVE 408 (CIV 408) DYNAMICS OF STRUCTURES II **3.0: 3 cr. E**

Basic seismology, earthquake characteristics and effect of earthquakes on structures, building configurations, seismic design and analysis of structures using the Uniform Building Code (UBC). Details of seismic resistant concrete structures. N.B.: Design Project is Obligatory for Passing.
Prerequisite: CIVE 402.

CIVE 409 (CIV 409) HYDROLOGY **3.0: 3 cr. E**

Descriptive hydrology: hydrologic cycle, precipitation, stream flow, evaporation, and transpiration. Quantitative hydrology: hydrograph analysis, hydrographs of basis outflow, storage routing. Probability concepts in hydrology. Flood frequency, rainfall frequency, stochastic hydrology, and introduction to groundwater hydrology.

CIVE 410 (CIV 410) APPLIED HYDRAULICS **3.0: 3 cr. E**

Complete and detailed design of drainage, sewerage, water supply, and irrigation networks using StormCad, SewerCad, WaterCad and Epanet softwares. Design also includes open channel flow and river analysis with scour analysis for bridges over waterways using HEC-RAS software. Pond design with PondPack SOFTWARE AND Pump design with surge analysis using Hammer software are also included. Detailed derivation of the continuity equation, Navier-Stokes equations, and energy equation are included. Prerequisites: CIVE 404/409.

CIVE 412 (CIV 412) QUALITY ASSURANCE AND CONTROL 3.0: 3 cr. E

The course introduces the student to the concept of engineering quality assurance and control. It also expands the knowledge of the students in areas related to quality standards and their applications in engineering. The latest technology of total quality management is introduced and several techniques and tools used to ensure quality on construction sites as well as in engineering design firms are discussed. The course discusses quality management concept, statistical quality control techniques, quality control specifications and standards, ISO 9000/14000, benchmarking, JIT program, and quality function deployment-house of quality.

CIVE 413 (CIV 413) MODERN TECHNIQUES IN HUMAN RESOURCE MANAGEMENT 3.0: 3 cr. E

Human resource management is considered one of the main topics of micro-management. Managers in engineering firms need to know some leadership skills and managerial techniques that can help them develop their abilities in communicating, directing, and achieving the objectives of their companies. The course emphasizes the modern approach of total quality management in performance appraisal, leadership skills, the motivation and rewards systems, team formation, and inter-group communication. Comparison is made with the conventional approach. Techniques for resource allocation, resource leveling, and decision-making are discussed and the Need Theories are stressed.

CIVE 415 (CIV 415) PROCESS REENGINEERING/ADMINISTRATIVE REFORM 3.0: 3 cr. E

Reengineering is a radical new way of remaking a company's business process with the objective of heading to competitive dominance. The student learns how to redesign the business process of firms by focusing on organization architecture, current management systems, corporate values and culture, process workflow, and planning and control systems. He will be able to design the hard processes as well as the soft processes in the firm.

CIVE 416 (CIV 416) MANAGEMENT SUPPORT SYSTEMS 3.0: 3 cr. E

Management theory and practice have undergone radical changes in the past two decades. Information technology has added a new dimension to modern management. The purpose of this course is to introduce the student to the information systems and technologies available to managers. By looking at these management systems from the managerial perspective, the DSS, EIS, ES, TPS, and OAS fundamentals are introduced. The manner in which they can be constructed and used to help managers make rational decisions is elaborated. This course blends the topics of management and engineering information systems in pursuit of providing competent and innovative managers.

CIVE 417 (CIV 417) STRATEGIC MANAGEMENT 3.0: 3 cr. E

Strategic planning plays an important role in shaping present activities and envisioning future trends of successful companies. The course introduces the student to basic concepts of strategy, with emphasis in engineering firms. Topics such as organizational mission, environmental assessment, setting of goals and objectives, strategy implementation, and strategy formulation are covered. The student learns how to select corporate-level grand strategy types and those of the business units types, evaluate the SWOT of his firm as well as the competitor firms, map the organizational dimensions for strategy implementation, match between the strategy and structure of the firm, and transform the strategy into action plans.

CIVE 480 TRAINING 0 cr. E

CIVE 501 (CIV 501) THEORY OF STEEL STRUCTURES 3.0: 3 cr. E

AISC Load and resistance factor design (LRFD) of tension members, columns, beams, beam-columns, built-up and composite members, connections (welded and bolted). Materials specifications (ASTM) for conventional and high performance steel grades.
Prerequisite: CIVE 401.

CIVE 502 (CIV 502) THEORY OF ELASTICITY 3.0: 3 cr. E

This course deals with solving problems within the framework of linear theory of elasticity. First, problems in Cartesian coordinates are considered and solutions by polynomial and Fourier methods are presented. Second, the elasticity problem is formulated in polar coordinates and several problems are solved. Finally, some problems in three-dimensional elasticity are presented solved.
Prerequisite: MECH 411.

CIVE 503 (CIV 503) HIGHWAY DESIGN 3.0: 3 cr. E

Theory and practice in highway design according to AASHTO criteria; highway classification and design criteria, location studies, complete design of vertical and horizontal alignment, cross section, pavement, intersections and highway drainage elements, and design of noise barriers.
Prerequisite: CIVE 308.

CIVE 504 (CIV 504) FINITE ELEMENT ANALYSIS 2.2: 3 cr. E

Introduction to basic theory and techniques; one- and two-dimensional formulations for solid mechanics applications; direct and general approaches; computer implementation, programming and projects.
Prerequisite: CIVE 401 or MECH 411.

CIVE 505 (CIV 505) DYNAMICS OF STRUCTURES III (EARTHQUAKE DESIGN) 3.0: 3 cr. E

Special topics in structural dynamics, including problems in wave propagation, response of structures to waves, dynamics of foundations, soil-structure, and fluid-structure interaction.
Prerequisite: CIVE 408.

CIVE 506 (CIV 506) STABILITY OF STRUCTURES 3.0: 3 cr. E

Buckling of discrete and continuous elastic structural systems using equilibrium analysis and energy methods. Flexural buckling of beam-columns and frames. Lateral buckling of beams. Role of shear deformation in the buckling of built-up beams and beam-columns. Basic post buckling analysis and the study of imperfection sensitivity. Stability criteria. Elastoplastic buckling of perfect and imperfect columns. Evaluation of design code provisions.
Prerequisite: CIVE 401.

CIVE 507 (CIV 507) BOUNDARY SURVEYS 3.0: 3 cr. E

Land surveying, registration laws, history, survey systems, legal principles, boundary calculations, boundary descriptions, and evidence interpretation.

CIVE 508 (CIV 508) OCEAN ENGINEERING 3.0: 3 cr. E

Incompressible fluid mechanics and applications to analysis of wave motions, circulations, and other free surface flows in coastal and offshore regions; wave spectra, water-level fluctuations, tides, tsunamis, oscillations, and storm surges; wind-generated waves, beaches, wave forces on coastal and offshore structures.

CIVE 509 (CIV 509) MECHANICS OF WATER WAVES 3.0: 3 cr. E

Irrotational theory for deep- and shallow-water waves, reflection, refraction, diffraction, attenuation. Water waves of finite amplitude. Shallow-water theory, tides, long-waves theory, conoïdal and solitary waves. Wave generation by wind. Wave breaking and reflection.
Prerequisite: CIVE 508.

CIVE 510 (CIV 510) MODELING OF COASTAL ENGINEERING PROBLEMS 3.0: 3 cr. E

Mathematical modeling, differential equations of wave motion, dimensionless presentations and scaling, initial and boundary conditions, analytical solutions, numerical solutions, computer applications on selected problems.
Prerequisite: CIVE 509.

CIVE 511 (CIV 511) COASTAL & PLATFORMS DESIGN 3.0: 3 cr. E

Applications of principles of ocean and coastal engineering to coastal protection structures, breakwaters, seawalls. Wave forces on offshore platforms: fixed and floating.
Prerequisite: CIVE 510.

CIVE 512 PAVEMENT DESIGN 3.0: 3 cr. E

To provide a good understanding of pavement design and the stresses that are produced in pavement layers under wheel loads, temperature changes, and climatic effects. In addition, special design topics such as airport design will be presented.
Prerequisite: CIVE 503.

CIVE 520 (CIV 520) PRINCIPLES OF ENVIRONMENTAL ENGINEERING 3.0: 3 cr. E

Man and environment. Sources of environmental pollution. Water pollution and its control. Principles of water and wastewater treatment. Air pollution and its control. Solid wastes and noise problems. Environmental Impact Assessment studies. Case studies.

CIVE 521 (CIV 521) WASTEWATER ENGINEERING DESIGN 3.0: 3 cr. E

Sources and characteristics of wastewater. Collection works design. Theory and application of commonly used processes. Design of sludge treatment and disposal facilities. Process combinations to produce treatment systems. Case studies.
Prerequisite: CIVE 520.

CIVE 522 (CIV 522) WATER RESOURCES AND WATER QUALITY 3.0: 3 cr. E

Sources and use of water. Characteristics of water and wastewater. Water quality criteria and standards. Methods of evaluating water quality. Problems arising in the resources, the distribution and home plumbing systems and from water treatment. Water quality management planning. Regulatory concepts and practices. Water supply in Lebanon.
Prerequisite: CIVE 520.

CIVE 523 (CIV 523) AIR POLLUTION CONTROL 3.0: 3 cr. E

Sources and nature of air pollutants and their effects. Air quality standards. Legislation and regulatory trends. Statistical analysis of data. Design principles of air pollution control structures and equipment. Acid deposition. Global warming, climate change, greenhouse gases. Case studies from selected Industries.
Prerequisite: CIVE 520.

CIVE 524 (CIV 524) SOLID WASTE DISPOSAL 3.0: 3 cr. E

Generation of solid wastes. Onsite handling, storage and processing. Collection, transfer and transport of solid Wastes. Processing Techniques and Equipment. Recovery of resources, conversion Products and Energy. Disposal methods for solid wastes and Residual Matter: Sanitary Landfill, incineration, composting, and other techniques.
Prerequisite: CIVE 520.

CIVE 525 (CIV 525) SANITARY LANDFILL 3.0: 3 cr. E

Disposal of solid wastes on land. Effect of leachate on groundwater pollution. Theory and current practice regarding design, construction, and monitoring of sanitary landfill. Landfill operation and economic analysis. Control Laws and Regulations.
Prerequisites: CIVE 520/524.

CIVE 526 (CIV 526) WATER SUPPLY ENGINEERING DESIGN 3.0: 3 cr. E

Concepts in engineering, concepts in engineering design, concepts in branch design, phases of engineering designs, case studies. Water characteristics, quality criteria and standards need for treatment, water treatment plant hydraulics and sludge disposal, storage and distribution system design, intake and transmission system design, computer applications for design, economical considerations in water supply engineering design.
Prerequisites: CIVE 520/522.

CIVE 527 (CIV 527) ENVIRONMENTAL IMPACT ASSESSMENT 3.0: 3 cr. E

Concepts of environmental impact assessment. Planning and management of impact studies. Methods of impact identifications-matrices, network and checklists. Description of environmental setting. Environmental indices and indicators for describing the affected environment. Prediction and assessment of impacts on the air, soil, water, noise, visual, socioeconomic, biological and cultural environment. Decision methods for evaluation of alternatives. Public participation in environmental decision making. Case studies.
Prerequisite: CIVE 520.

CIVE 528 ENVIRONMENTAL ECONOMICS AND MANAGEMENT 3.0: 3 cr. E

Introduction to environmental economic problems; Modeling the Market Process and Failure. Conventional and Economic Solutions to environmental problems. Environmental decision making. Environmental risk analysis. Benefits and costs assessment and analysis for environmental decision making. Case studies of major environmental problems and policy solutions.
Prerequisite: CIVE 520.

CIVE 529 ENVIRONMENTAL WATER CHEMISTRY 3.0: 3 cr. E

Theory and practice of water chemistry; Chemistry concepts and properties for natural and treated waters; Principles of chemical kinetics; Composition of natural waters; Solubility; water softening; Metal-ion complexation; Principles of redox equilibria; nutrient cycles; iron and manganese chemistry; chlorine chemistry; sorption processes; Trace metal cycling; Organic structures and nomenclature; properties of organic compounds; fate of organic pollutants; natural organic matter; Pollution (drinking water contamination, marine pollution, and wastewater treatment).

CIVE 530 ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY 3.0: 3 cr. E

Chemistry of organic and inorganic contaminants in the environment. Natural chemical cycles in the biosphere, geosphere, hydrosphere and atmosphere, and consequences of anthropogenic disturbances. Chemical equilibrium and kinetics. Fundamentals of aquatic, atmospheric and soil chemistry. The fate of hazardous, refractory and heavy metal pollutants in the environment. Introduction to microbial taxonomy, ecology and growth kinetics of microorganisms. The microbes of public health importance in water, soil and air, including their detection, occurrence, transport, and survival in the environment. Introduction to the application of different processes to remove contaminants in natural and engineered systems.

CIVE 531 ENVIRONMENTAL SAMPLING AND ANALYSIS 3.0: 3 cr. E

This course is designed to introduce the student to the principles of environmental chemistry and methods for the analysis of environmental samples. The principles of a given analysis should be understood before any analysis should be undertaken, so the course will include a review of chemical principles relevant to the analyses performed in the lab. These chemical principles will be taught using examples from treatment processes and the behavior of materials in the environment, as well as from laboratory analyses. The analyses performed in the lab are all commonly used in environmental work, for monitoring ambient air and water conditions, effluent discharges, or the performance of treatment processes. Topics will be oriented to describe treatment processes in industrial water and in municipal wastewater. Mass balances and kinetics are emphasized. Six hours of lecture and laboratory a week for one semester.

CIVE 555 (CIV 555) SPECIAL TOPICS IN ENGINEERING 3.0: 3 cr. E

Stairways; Flat slabs; Design of concrete water tanks: Rectangular and circular; Concrete domes; Corbels and deep beams; Wind Load provisions; Design of shear walls.

CIVE 556 (CIV 556) BRIDGE DESIGN 3.0: 3 cr. E

AASHTO LRFD Bridge Design Specifications and AASHTO Standard Specifications for Highway Bridges for short span cast-in-place reinforced concrete slabs and precast prestressed planks, medium span prestressed concrete I-girders and box girders, and cast-in-place post tensioned box-girders and voided slabs. Design of substructure elements (abutment and piers). Computer Application using software program. Overview of long span segmental and cable stayed bridges.
Prerequisites: CIVE 401/405.

CVSQ 201, 202, 203

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

CSIS 200

Refer to Faculty of Sciences, Department of Computer Science.

ENGL 203, Elective
Refer to Faculty of Arts & Social Sciences, Department of English Language and Literature.

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

MATH 200, 202, 211, 230, 240, 270
Refer to Faculty of Sciences, Department of Mathematics.

MECH 221, 222, 232, 233, 243, 411
Refer to Department of Mechanical Engineering.

DEPARTMENT OF MECHANICAL ENGINEERING

BACHELOR'S DEGREE

FIRST YEAR:

Semester 1:

Name of Course		Credit
CIVE 201	Statics	3
CSIS 206	Programming for Engineers	4
ENGL 203	English Communication Skills III	3
MATH 200	Calculus I	4
MATH 211	Linear Algebra	3
MECH 212	Instrumentation & Experimentation I	1
		18

Semester 2:

Name of Course		Credit
	English Elective	3
MECH 222	Science of Materials	3
CIVE 202	Mechanics of Materials	3
MATH 202	Calculus II	4
MECH 221	Engineering Dynamics	3
MECH 211	Drawing I	1
		17

SECOND YEAR:

Semester 3:

Name of Course		Credit
MECH 231	Circuit Fundamentals	3
MATH 230	Numerical Analysis	3
MECH 232	Thermodynamics	3
CVSQ 201	The Formation of Civilization	3
MATH 246	Probability for Engineers	4
MECH 233	Workshop Technology	1
MECH 234	Drawing II	1
		18

Semester 4:

Name of Course		Credit
MATH 270	Differential Equations	3
MECH 241	Comp. Tech. in Mech. Eng.	3
ELEN 222	Signals & Systems Theory	3
CVSQ 202	The Religious Experience	3
MECH 242	Engineering Vibrations	3
MECH 243	Fluids Mechanics	3
MECH 244	Instrumentation & Experimentation II	1
		19

THIRD YEAR:

Semester 5:

Name of Course		Credit
MECH 311	Mechanical Design I	3
CVSQ 203	Introduction to Modernity	3
GENG 301	Engineering Management	3
MECH 313	Electromechanical System	3
MECH 314	Gas Dynamics	3
MECH 315	Mechanics of Machines	3
		18

Semester 6:

Name of Course		Credit
MECH 321	Heat Transfer	3
MECH 322	Automatic Controls	3
MECH 323	CAD/CAM	3
MECH 324	Steam & Gas Turbines	3
MECH 325	Instrumentation & Experimentation III	1
	Elective	3
GENG 390	Undergraduate Project	1
		17

3-4 Weeks Industrial Training is a Graduation Requirement

LIST OF ELECTIVES

Semester 5:

Name of Course		Credit
CIVE 205	Theory of Structures	3
MATH 261	Operations Research	3
BUSN 201	Introduction to Business	3
MGMT 220	Principles of Management	3
ECON 201	Introduction to Economics	3
ECON 211	Microeconomics Theory	3
		18

Other Approved Elective from within or outside the Faculty *3*

MASTER'S DEGREE IN MECHANICAL ENGINEERING

(General Major)

FOURTH YEAR:

Semester 7:

Name of Course		Credit
MECH 411	Advanced Mechanics of Materials	3
MECH 412	Mechanics of Composite Materials	3
MECH 413	Internal Combustion Engines	3
MECH 414	Process Control Systems	3
	Elective	3
		15

Semester 8:

Name of Course		Credit
CIVE 406	Theory of Plates and Shells	3
GENG 402	Project Management	3
MECH 421	Refrigeration and Air Conditioning	3
GENG 590	Master Project	3
	Elective	3
		15

FIFTH YEAR:

Semester 9:

Name of Course		Credit
CIVE 504	Finite Element Analysis	3
MECH 423	Advanced Manufacturing Processes	3
MECH 513	Robotics	3
	Elective	3
	Elective	3
		15

Semester 10:

Name of Course		Credit
GENG 599	Engineering Thesis.	6
Or		
GENG 590	Graduate Project,	3
	Elective	3
		6

MASTER'S DEGREE IN MECHANICAL ENGINEERING

AEROSPACE MAJOR

FOURTH YEAR

Semester 7

Name of Course		Credits
AERO 401	Aerodynamics I	3
AERO 402	Aircraft Structures I	3
AERO 403	Mechanics of Flight	3
MECH 414	Process Control Systems	3
	Elective	3
		15

Semester 8

Name of Course		Credits
AERO 404	Aircraft Structures II	3
AERO 405	Aircraft Design I	3
AERO 406	Aircraft Systems Engineering	3
	Elective	3
	Elective	3
		15

FIFTH YEAR

Semester 9

Name of Course		Credits
CIVE 504	Finite Element Analysis	3
MECH 423	Advanced Manufacturing Processes	3
AERO 501	Aerodynamics II	3
AERO 502	Aircraft Design II	3
AERO 503	Helicopter Dynamics	3
		15

Semester 10

Name of Course		Credits
GENG 599	Engineering Thesis.	6
Or		
GENG 590	Graduate Project,	3
	Elective	3
		6

LIST OF ELECTIVES: THERMO-FLUIDS

Name of Course		Credit
MECH 415	Turbomachinery	3
MECH 426	Plumbing Engineering	3
MECH 428	Special Topics in Thermal Sciences	3
MECH 511	Computational Fluid Dynamics	3
MECH 512	Solar Energy	3
MECH 514	Fracture Mechanics	3
MECH 515	Turbulence and Transport Phenomena	3
MECH 518	Advanced Gas Dynamics	3

LIST OF ELECTIVES: MANUFACTURING

Name of Course		Credit
MECH 425	Mechatronics	3
MECH 427	Facility Planning and Quality Control	3
MECH 514	Fracture Mechanics	3

LIST OF ELECTIVES: AEROSPACE

Name of Course		Credit
AERO 421	Gas Turbine Propulsion Systems	3
AERO 401	Aerodynamics I	3
AERO 406	Aircraft Systems Engineering	3
AERO 424	Aircraft Maintenance Technology	3
AERO 503	Helicopter Dynamics	3

N.B. Student may choose Thesis Option GENG 599, 6 cr. This option will replace GENG 590 and one Elective.

COURSE DESCRIPTIONS

CVSQ 201, 202, 203
Refer to Faculty of Arts & Social Sciences, Cultural Studies Program.

CSIS 200
Refer to Faculty of Sciences, Department of Computer Science.

ENGL 203, Elective
Refer to Faculty of Arts & Social Sciences, Department of English Language and Literature.

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

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

MECH 211 (ENG 102) 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 (ME 101) 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 (ENG 101) 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 (ENG 104) 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 (ME 202) 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 (ENG 201) 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 (ENG 206) WORKSHOP TECHNOLOGY **0.3: 1 cr. E**

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

MECH 234 (ENG 202) 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 261, CSIS 206.

MECH 242 (ME 306) 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 (CIV 203) 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 (ME 307) 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 (ME 303) 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 (ME 304) 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 (ME 305) 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 (ME 302) 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.

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 (ME 301) 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 (ME 308) 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.

MECH 411 (ME 400) ADVANCED MECHANICS OF MATERIALS **3.0: 3 cr. E**

Theories of stresses and strains. Material behavior for general anisotropic, orthotropic and isotropic materials. Formulation of elasticity and boundary conditions. Plane stress and plane strain. Navier equations. Calculus of variations and its application to elasticity. Energy formulation. Unsymmetrical bending and shear center. Torsion of beams of noncircular cross-sections. Beams on elastic foundations. Curved beams.

MECH 412 (ME 401) MECHANICS OF COMPOSITE MATERIALS **3.0: 3 cr. E**

Anisotropic elasticity and laminate theory, analysis of various members of composite materials, energy methods, Failure Analysis. Applications using software packages.

MECH 413 (ME 403) INTERNAL COMBUSTION ENGINE **3.0: 3 cr. E**

This course covers the fundamentals of how the design and operation of internal combustion engines affect their performance, fuel requirements, and environmental impact. Fluid flow, thermodynamics, combustion, heat transfer, friction, and fuel properties, relevant to engine power, efficiency, and emissions are also studied. Examination of design features and operating characteristics of different types of internal combustion engines: spark-ignition and diesel running two or four-stroke cycles.

MECH 414 (ME 406) PROCESS CONTROL SYSTEMS **3.0: 3 cr. E**

The course builds upon the foundation developed in previous course in Control System Theory. It covers advanced topics in analysis of process control systems such as Feedback control; Modeling and computer simulation of control systems; Discrete time models; Process control techniques; State Space methods applied to process control systems; Logic programming and devices.

MECH 415 (ME 410) TURBOMACHINARY **3.0: 3 cr. E**

The course provides a brief overview and historical background about the development turbomachinery and related applications. It details the fundamental principles of thermodynamics and fluid mechanics applied to turbomachines, introduces the concept of turbomachiney characteristic curves and terminology, covers dimensional analysis related to turbomachinery, as well as theoretical analysis of hydraulic pumps, hydraulic turbines, air compressors, and gas and steam turbines.

MECH 421 (ME 404) REFRIGERATION & AIR CONDITIONING 3.0: 3 cr. E

The course guides the student towards the understanding of the basic thermodynamic cycles, psychrometrics, ventilating, heating load, cooling load, duct design, and hydraulic pipe design.

MECH 422 (ME 405) MECHANICAL DESIGN II 3.0: 3 cr. E

The course teaches the design, analysis, and selection of mechanical machine elements such as gears, bearings, brakes, springs, and power transmission sub-systems. It also covers the selection (spec-ing) of hydraulic and pneumatic parts, and electric motors. It teaches the analysis and synthesis of hydraulic and pneumatic circuits.

MECH 423 (ME 501) ADVANCED MANUFACTURING PROCESSES 2.2: 3 cr. E

The course covers manufacturing engineering subjects such as concurrent engineering, design for manufacturing and assembly (DFM, DFA), BOM, MRP, ERP, Just-In-Time manufacturing systems, Automation, Flexible manufacturing, Group Technology, total quality control (TQC), statistical process control (SPC), Gantt charts, BOM, and CAM. The course also offers an introduction to manufacturing processes including CNC. The course also seeks – through the participation of students- to identify potential research themes in manufacturing.

MECH 425 MECHATRONICS 3.0: 3 cr. E

Sensors and transducers, signal conditioning, measurement systems, pneumatic and hydraulic actuation systems, mechanical and electrical actuation systems, dynamic responses of systems, system transfer, frequency response, adaptive control, microprocessors, PLC, communication systems, fault finding.

MECH 426 (ME 413) PLUMBING ENGINEERING 3.0: 3 cr. E

The Course guides the student towards the understanding of the different domestic water and drainage systems in buildings. It covers water treatments, domestic cold and hot water systems, pumps, drainage and venting systems, storm water, septic tanks, sump pits, and an overview on fire fighting.

MECH 427 (ME 422) FACILITY PLANNING & CONTROL 3.0: 3 cr. E

Strategy, Process and schedule design, activity relationship and space requirements, personnel requirements, statistical process control, Deming's and Crosby's approach, Probability models for quality control, sampling and interface, normal distribution, control charts for variables and attributes.

MECH 428 (ME 407) SPECIAL TOPICS IN THERMAL SCIENCES 3.0: 3 cr. E

This course covers some of the topics of particular interest to the thermal engineer but not covered in other courses such as mass transfer, boiling and condensation, as well as two phase flows and heat transfer. Applications include numerical modeling, computer exercises and lab experiments.

MECH 511 (ME 512) COMPUTATIONAL FLUID DYNAMICS 2.2: 3 cr. E

Basic theory of CFD, flow modeling, mesh generation and convergence criteria. Finite-volume discretization of 2-dimensional flow equations. Pre-processing, boundary conditions and solutions. Post processing criteria. Hands-on experience using CFD computer packages. Compressible flow applications and comparisons with theories.

MECH 512 (ME 511) SOLAR ENERGY **3.0: 3 cr. E**

The course provides a brief overview and historical background about the development solar energy and related applications. It outlines the fundamental principles of solar energy, as well as thermodynamic analyses applied in solar energy field. It reviews the optics of solar radiations, and covers the radiation characteristics of materials. As an application to the theory, the course covers flat and curved solar collectors, water heating using solar energy, and solar ponds.

MECH 513 (ME 502) ROBOTICS **3.0: 3 cr. E**

The course deals with the basic components of robotics systems, kinematics for manipulators, selection of coordinate frames, homogeneous transformations, solutions to kinematics equations, lagrangian equations and manipulator dynamics, motion planning, position, velocity and force control, controller design, digital simulations.

MECH 514 FRACTURE MECHANICS **3.0: 3 cr. E**

Energy in elastic solids. Fracture mechanics versus mechanics of materials. Atomic model of fracture. Linear elastic fracture. Modes of fracture. Stress concentration. Griffith approach and energy release rate. Instability and the R curve. Stress analysis and stress intensity factor and its relation to the energy release rate. Crack tip plasticity. Plane stress/plane strain. Mixed mode fracture. Introduction to elastic/plastic fracture. Introduction to fatigue. Fracture in design.

MECH 515 TURBULENCE AND TRANSPORT PHENOMEMA **3.0: 3 cr. E**

This course will study turbulent flows, with emphasis on engineering methods. The governing equations for momentum, energy, and species transfer will be derived. Turbulence, its production, dissipation, and scaling laws will be introduced. Reynolds averaged equations for momentum, energy, and species transfer will be introduced and derived. Simple closure approaches for free and bounded turbulent shear flows with applications to jets, pipe and channel flows, boundary layers, buoyant plumes and thermals, and Taylor dispersion, etc., including heat and species transport as well as flow fields will be analyzed. Introduction to more complex closure schemes, including the k-epsilon, and statistical methods in turbulence will also be treated.

MECH 517 FINITE ELEMENT METHODS IN MECH & AERO ENG. **3.0: 3 cr. E**

Introduction to Finite Element theories and techniques. FE formulations in 1 and 2 dimensions in solid mechanics, fluid mechanics, gas dynamics and heat transfer. Computer implementation, programming and projects.
Prerequisite: MECH 411.

MECH 518 (ME 510) ADVANCED GAS DYNAMICS **3.0: 3 cr. E**

Turbulence concepts, numerical approaches and applications, iterative and direct matrix methods, numerical implementation of turbulence model.

COURSE DESCRIPTIONS

(AERONAUTICAL ENGINEERING)

AERO 401 AERODYNAMICS I **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 402 AIRCRAFT STURCTURES I **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 403 MECHANICS OF FLIGHT **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 404 AIRCRAFT STRUCTURES II **3.0: 3 cr. E**

Analysis of plates & shells; optimum structures, Structural dynamics; Structural fatigue, principles & practices. Introduction to aeroelasticity; static & dynamic.

AERO 405 AIRCRAFT DESIGN I **3.0: 3 cr. E**

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

AERO 406 AIRCRAFT SYSTEMS ENGINEERING **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 421 (ME 411) GAS TURBINE PROPULSION SYSTEMS **3.0:3 cr. E**

This advanced course on gas turbine engines is concerned with the identification of the suitability different engines to different flight missions. Details of engine performance during different phases of flight are discussed. In addition, the course seeks to give students insight into the workings of engines at off-design conditions.

AERO 424 (MEA 523) AIRCRAFT MAINTENANCE TECHNOLOGY 1.2: 3 cr. E

A practical course dealing with the general Maintenance Concept, production planning and control of aircraft checks, ground handling, fuselage and airframes, main landing gear, tires and wheels, nose landing gear, braking system, flying controls, aircraft fuel system, engine construction and maintenance, engine fuel system, propeller maintenance utility system, aircraft instruments maintenance and repairs electrical system maintenance and repairs metallic aircraft structural repairs, painting.

AERO 501 AERODYNAMICS II 3.0: 3 cr. E

Dynamics of inviscid, compressible airflows, treatment of normal and oblique shock waves, transonic drag, critical mach number, Prandtl-Meyer expansion flow around convex corners, supersonic airfoil sections, supersonic intakes, friction and heat transfer on compressible flows-shock waves and boundary layer interactions.

AERO 502 AIRCRAFT DESIGN II 3.0: 3 cr. E

Significance of various engineering courses and their interactions in the design process are cleared out, design of an aircraft satisfying certain requirements as the best compromise of several trials and modifications, weight estimation, methods of improvement, minor and major projects in the design of light and large airplanes are assigned to students teams. A graduate from this course plays the role of an architect and a designing aircraft structural engineer.

AERO 503 HELICOPTER DYNAMICS 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, fundamental of rotor aerodynamics, blade element analysis, rotating blade motion, basic helicopter performance, conceptual design of helicopter.

FACULTY OF ENGINEERING REQUIREMENTS

GENG 390 UNDERGRADUATE PROJECT **0.3: 1 cr. E**

Research work in the related engineering field. Applied using computer packages.

GENG 402 PROJECT MANAGEMENT **3.0: 3 cr. E**

An overview of project: management, definition, planning, implementation, completion, management information systems, rules, responsibility and authority, organizational behavioral skills, case study (leadership effectiveness, management of conflicts, time management, project control), contract managers. Project management software package and application. Financial management. Quality control.

GENG 590 GRADUATE PROJECT **0.4: 3 cr. E**

GENG 599 ENGINEERING THESIS **0.8: 6 cr. E**