FACULTY OF SCIENCES

FACULTY LIST

OFFICERS OF THE FACULTY

Salem, Elie A.	President of the University
Bashour, Tali'	Honorary Vice President for Medical Affairs in the US
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
Attieh, Jihad	Acting Dean
Moubayed, Walid	Dean of Admissions and Registration
Bashir, Sameera	Librarian

FACULTY STAFF

Elias, Sally	Executive Secretary
Nasr, Adele	Faculty Secretary
Aoun, Amal	Laboratory Assistant
Bazzi, Samer	Research Assistant
Esber, Michella	Laboratory Assistant
Khoury (El), Takla	Laboratory Assistant
Ouaygen, Lama	Laboratory Assistant
Zakhem, Michel	Laboratory Assistant

FACULTY MEMBERS

Abbas, Abdel-Wahed	Ph.D., Computer Science, Queen Mary College, University of London, UK
Abdel-Massih, Roula	Ph.D., Biochemistry, University of Glasgow, UK
Abdul-Aziz, Abdul-Rahman	Ph.D., Mathematics, University of Sydney, Australia
Achkar (El), Eliane	Ph.D., Molecular Genetics, Université Paris VI, Pierre & Marie Curie, France
Aouad, Samer	Ph.D., Physical Chemistry, ULCO, France
Attieh, Jihad	Ph.D., Plant Physiology & Biochemistry, Université de Montréal, Canada
Bitar, Amine	Ph.D., Computer Science, University of Bedford, U.K.
Chami, Riad	M.S., Computer Science, University of Technology, Australia
Debs, Esperance	Ph.D., Food Microbiology, Université de Technologie de Compiègne, France

Debs (El), Hamid	Ph.D., Biomedical Engineering, Université de Technologie de Compiègne, France
Dib Nehme, Micheline	M.S., Mathematics, University of Texas-Arlington, USA
Echtay, Karim	Ph.D., Biochemistry, Ludwig Maximillians University, Germany
Ghanem, Noha	Ph.D., Medicinal Chemistry, Université of Montpellier II, France
Ghorayeb, Sleiman	D.E.S.S., Computer Science, Université Nancy I & II, France
Greije, Hanna	Ph.D., Statistical Mathematics, Université Pierre et Marie Curie, France
Hanna, Robert	Emeritus Professor, Chemistry
Houalla, Rym	Ph.D., Microbiology, Edinburgh University, England
Itani, Omar	Ph.D., Physiology, University of Minnisotta, USA
Jadayel, Roula	M.S., Mathematics, American University of Beirut, Lebanon
Jreige, Jocelyne	M.Sc., Computer Science, University of Balamand, Lebanon
Karam, Marc	Ph.D., Biology, Surrey University, UK
Karam, Walid	M.S., Electrical Engineering, South Dakota State University, USA
Kassab, Rima	Ph.D., Organic Chemistry, Université Claude-Bernard, France.
Masri, Rania	Ph.D., Forestry, North Carolina State University, USA
Melki, Antoine	Ph.D., Computer Science, University of Patras, Greece
Nader, Manal	Ph.D., Biology and Aquaculture, Hokkaido University, Japan
Nakat (El), Hanna	Ph.D., Physical Chemistry, University of New South Wales, Australia
Nehme, Gaby	Ph.D., Material Sciences and Mechanical Engineering, University of Texas, USA
Obeid, Pierre	Ph.D., Chemistry, University of Patras, Greece
Rastikian, Karabet	Ph.D., Chemical Engineering, Université de Technologie de Compiègne, France
Sbat, Mira	DEA, Mathematics, Université Saint Joseph, Lebanon
Tannous, Tony	Ph.D., Science, University of Sydney, Australia
Yaacoub, Guitta	DEA, Plant Production, Lebanese University, Lebanon

Yammine, Paolo	Ph.D., Organic Chemistry, Université Paris XIII, France
Zakhem, Imad	M.S., Computer Engineering, National Technical University of Athens, Greece

PROGRAMS OF STUDY

The Faculty of Sciences includes:

- The Department of Biology
- The Department of Chemistry
- The Department of Computer Science
- The Department of Environmental Sciences
- The Department of Mathematics
- The Department of Physics

The sequence of study proceeds from an education in both science fundamentals and humanities toward training designed to lead to the student's mastery of principles and arts central to science. The Faculty of Sciences offers the following degrees:

Major	**Years**	**Degree**	**Status**
Biology	3	BS	Offered
	3+1	Teaching Diploma	Offered
	3+2	MS	Offered
Chemistry	3	BS	Offered
	3+1	Teaching Diploma	Offered
	3+2	MS	Offered
Computer Science (Software Engineering OR Networking & Communication)	3	BS	Offered
	3+1	Teaching Diploma	Offered
	3+2	MS	Offered
Computer Science (Information Systems)	3	BS	Offered
	3+2	MS	Offered
Environmental Sciences	3	BS	Offered
	3+2	MS	Offered
Mathematics	3	BS	Offered
	3+1	Teaching Diploma	Offered
Physics	3	BS	Offered
	3+1	Teaching Diploma	Offered

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UNDERGRADUATE PROGRAM

1. ADMISSION REQUIREMENTS

Admission to the undergraduate program in the Faculty of Sciences is normally restricted to the first year. However, applicants from other accredited institutions may be considered with the approval of the Admissions Committee. In such cases, applications will be evaluated provided the following requirements are satisfied:

a- Enrollment quotas.

b- The applicant must have obtained a minimum average of 70 in at least 20 transferable credits, or must have successfully completed a whole year of study.

c- The applicant's Baccalaureate should qualify him/her for admission to the university.

d- The applicant must satisfy university admission requirements concerning English.

e- All transfers are subject to review by the Faculty Admissions Committee who evaluates the applicant's qualifications for academic success in scientific subjects.

2. ACADEMIC RULES AND REGULATIONS

Refer to Scholastic Standing, General Section, I

A. CHANGE OF MAJOR

To change a current major within the Faculty of Sciences or to transfer from any other Faculty of the University of Balamand to the Faculty of Sciences, a student must qualify for a clear standing status in the new department. Probationary acceptance may be granted to transferring students, who do not satisfy the above condition, upon the recommendation of the new department and approval of the Dean.

B. CREDIT LOAD

The full-time load ranges between 12 and 18 credits, with a recommended average of 15-16 credits per regular semester. A higher credit load is only considered under special circumstances (e.g. graduation) and requires the approval of the Dean. A maximum of 10 credits is acceptable for the Summer semester.

C. REGISTRATION IN GRADUATE COURSES

Undergraduate students enrolled in their final semester may register for up to two graduate courses if judged appropriate by the Department and approved by the Dean. Grades of such courses do not count towards their undergraduate average. Enrollment in graduate courses does not imply in any way an automatic admission to the corresponding Master program.

3. LABORATORY CHARGES

A. SUPPLIES

Each student taking laboratory subjects must furnish the necessary notebooks, blank forms, lab coat, and similar supplies at his/her expense. For regular students taking prescribed laboratory work no charge will be made for normal amounts of expendable material used in connection with the laboratory subject. Expendable materials are those that are necessarily consumed or rendered unfit for further use by 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 neglect. 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 should be requested to check the equipment's 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 immediately or as soon as it can be determined.

4. SUPPORT LABORATORIES

The laboratories that students will attend in support of the theoretical subjects include:

- Biology Labs.
- Chemistry Labs.
- Database Lab.
- Multimedia Lab.
- Networking Lab.
- Statistics Lab.
- UNIX Lab.

GRADUATE PROGRAM

To earn a Master's degree, a student must successfully complete 30 credits of course work and research/training approved by the Department.

1. ADMISSION REQUIREMENTS:

Applicants to the Master's degree program must hold a Bachelor's degree 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 and in the last two years of undergraduate study as per Admission Information in Section I. The candidate's file 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

e- Any other documentation requested by individual departments.

Graduate acceptance is granted upon recommendation of the Faculty Graduate Committee after the application is reviewed.

The Faculty Graduate Committee reserves the right to evaluate applicants with lesser average but whose files show particular strength in a relevant field of sciences. The Faculty Graduate Committee may subsequently admit such specific students and decide on their academic status on an individual basis. A student admitted on probation must achieve an average of 80 or above in the major courses during the first semester of graduate study with a full-time load. A failing grade in any course is disqualifying. Failure to satisfy these requirements will result in automatic dismissal from the graduate program.

Students not admitted on probation due to insufficiently high undergraduate average scores may repeat some courses to improve their average and reapply for admission to the graduate program.

2. ACADEMIC RULES & REGULATIONS:

A. TIME LIMITATIONS:

With careful planning, full-time students should be able to complete the MS program in two calendar years. Part-time students can complete the MS degree in up to three 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 the Graduate Committee in writing to request such exceptions.

B. TRANSFER CREDITS:

A maximum of 6 credits (two 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. The courses must not have been used as credit toward any other degree at UOB. Transfer credits will be granted for courses that 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 credits per semester. Students who are employed outside the university for more than 20 hours per week are not normally eligible for full-time status in the Faculty of Sciences.

E. GRADUATION REQUIREMENTS:

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

F. PROBATIONARY STATUS:

A student is placed on probation for any of the following reasons:

1- Having failed a course (grade less than 70).

2- Having a cumulative average less than 80.

G. DISMISSAL:

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

1- Failing 2 courses in one semester.

2- Failing to remove a probation or staying on probation for two consecutive semesters.

H. 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.

DEPARTMENT OF BIOLOGY

UNDERGRADUATE PROGRAM

The primary mandate of the Department of Biology is to provide excellence in teaching at the undergraduate and graduate levels. The Department offers a comprehensive program, which exposes students to the full range of biological sciences. Our undergraduate three-year curriculum introduces students to modern studies in general, molecular, cell, and environmental biology. It also emphasizes active, hands-on experience with modern technology. Small class sizes with an emphasis on laboratories and tutorials foster ongoing, productive interactions between students and faculty.

Graduates in Biology may go on to professional programs in medicine, medical sciences, biotechnology, or science education. They may also enter the workforce directly, as research assistants, data analysts and members of marketing teams in the pharmaceutical and health industries. Still others may choose to pursue graduate studies in biological sciences, with the aim of following a career in academia or industry.

The Department of Biology offers a Bachelor of Science Degree (B.Sc.) in Biology for students who have successfully undertaken a minimum of **96 credits** of required courses provided that they satisfy all other graduation requirements set by the University.

Students must complete the following:

I. 41 credits of Major Courses:

Thirty credits (30 cr) constituted of the following courses: BIOL 201, BIOL 202, BIOL 203, BIOL 204, BIOL 207, BIOL 213, BIOL 214, BIOL 245, BIOL 246, BIOL 251, BIOL 261, BIOL 262, BIOL 283, BIOL 284.

Plus eleven credits (11 cr) selected from: BIOL 208, BIOL 221, BIOL 222, BIOL 223, BIOL 224, BIOL 225, BIOL 226, BIOL 227, BIOL 229, BIOL 230, BIOL 231, BIOL 232, BIOL 233, BIOL 241, BIOL 242, BIOL 243, BIOL 244, BIOL 247, BIOL 249, BIOL 263, BIOL 264, BIOL 265, BIOL 266, BIOL 271, BIOL 272, BIOL 285, BIOL 286, BIOL 287, BIOL 291, BIOL 292

II. 28 credits of Major-Required Courses:

CHEM 202, CHEM 203, CHEM 240*, CHEM 245, CSIS 273, MATH 203, MATH 242, MATH 272, PHYS 211, PHYS 212, PHYS 213, PHYS 214

***Premedical students must replace** CHEM 240 **with** CHEM 242 **&** CHEM 244**, which subsequently are counted in the Major Average.**

III. 18 credits of University-Required Courses:

ENGL 203, ENGL 204, CVSQ 201, CVSQ 202, CVSQ 203, CVSQ 204.

IV. 09 credits of Free Electives**

****A Premedical Student, having substituted CHEM 240 with CHEM 242 & CHEM 244 (6 cr), must also take CHEM 222 (Analytical Chemistry) or an equivalent course as an elective. Such student may only choose ONE 3-credit course as a free elective.**

MINOR IN BIOLOGY

The minor in Biology allows students to gain valuable information in the field of biological sciences while completing their primary field of study. It also allows students to take advanced biology coursework related to the main discipline. The Faculty of Sciences offers a Minor in Biology for students who have successfully completed a minimum of **18** credits of biology courses as follows:

Code	Course Title	Credit
BIOL 201	General Biology I	3
BIOL 202	General Biology I Lab.	1
BIOL 203	General Biology II	3
BIOL 204	General Biology II Lab.	1

Any three courses (9 credits) and one lab (1 credit) picked from the following list*:

Code	Course Title	Credit
BIOL 207	Ecology	3
BIOL 213	Cell Biology	3
BIOL 214	Cell Biology Lab	1
BIOL 225	Animal Physiology	3
BIOL 226	Animal Physiology Lab	1
BIOL 229	Immunobiology	3
BIOL 245	Plant Physiology	3
BIOL 246	Plant Physiology Lab	1
BIOL 251	Principles of Biochemistry	3
BIOL 261	Microbiology	3
BIOL 262	Microbiology Lab	1
BIOL 263	Nutrition	3
BIOL 264	Nutrition Lab	1
BIOL 283	Genetics	3
BIOL 284	Genetics Lab	1
BIOL 285	Molecular Biology	3
BIOL 286	Molecular Biology Lab	1

* If carefully chosen, these courses may present a minor with a specific concentration.

SAMPLE COURSE DISTRIBUTION

FIRST YEAR

Semester 1

Course Code	Course Title	Credit
BIOL 201	General Biology I	3
BIOL 202	General Biology I Lab.	1
CHEM 202	Basic Chemistry	3
CHEM 203	Basic Chemistry Lab.	1
CSIS 273	Personal Computing for Applied Sciences	3
ENGL 203	English Communication Skills III	3
MATH 203	Mathematics for Applied Sciences	3
		17

Semester 2

Course Code	Course Title	Credit
BIOL 203	General Biology II	3
BIOL 204	General Biology II Lab.	1
CHEM 240	Basic Organic Chemistry*	3
ENGL 204	English Communication Skills IV	3
MATH 242	Statistics for Applied Sciences	3
PHYS 211	Fundamentals of Physics I	3
PHYS 212	Fundamentals of Physics I Lab.	1
		17

SECOND YEAR

Semester 3

Course Code	Course Title	Credit
BIOL 283	Genetics	3
BIOL 284	Genetics Lab.	1
CHEM 245	Organic Chemistry I Lab.	1
CVSQ 201	Early Formation of Civilization	3
PHYS 213	Fundamentals of Physics II	3
PHYS 214	Fundamentals of Physics II Lab.	1
	Free Elective	3
		15

***A Premedical student must replace CHEM 240 with CHEM 242 & CHEM 244 (6 cr), which subsequently are counted in the Major Average.**

Semester 4

Course Code	Course Title	Credit
BIOL 213	Cell Biology	3
BIOL 214	Cell Biology Lab.	1
BIOL 251	Principles of Biochemistry	3
CVSQ 202	The Religious Experience	3
MATH 272	Differential Equations for Applied Sciences	3
	Major Elective	3
		16

THIRD YEAR

Semester 5

Course Code	Course Title	Credit
BIOL 207	General Ecology	3
BIOL 261	Microbiology	3
BIOL 262	Microbiology Lab.	1
CVSQ 203	Introduction to Modernity	3
	Major Elective	3
	Major Elective Lab.	1
	Free Elective	3
		17

Semester 6

Course Code	Course Title	Credit
BIOL 245	Plant Physiology	3
BIOL 246	Plant Physiology Lab.	1
CVSQ 204	Contemporary Challenges in the Arab World	3
	Major Elective	3
	Major Elective Lab.	1
	Free Elective	3
		14

Electives in the Department of Biology

Code	Course Title	Credit
BIOL 208	GENERAL ECOLOGY LAB*	1
BIOL 221	ZOOLOGY	3
BIOL 222	ZOOLOGY LAB	1
BIOL 223	COMPARATIVE VERTEBRATE ANATOMY	3
BIOL 224	COMPARATIVE VERTEBRATE ANATOMY LAB	1
BIOL 225	ANIMAL PHYSIOLOGY*	3
BIOL 226	ANIMAL PHYSIOLOGY LAB*	1
BIOL 227	NEUROPHYSIOLOGY	3
BIOL 229	IMMUNOBIOLOGY*	3
BIOL 230	IMMUNOBIOLOGY LAB	1
BIOL 231	DEVELOPMENTAL BIOLOGY*	3
BIOL 232	DEVELOPMENTAL BIOLOGY LAB	1
BIOL 233	ENDOCRINOLOGY & REPRODUCTIVE BIOLOGY	3
BIOL 241	BOTANY	3
BIOL 242	BOTANY LAB	1
BIOL 243	PLANT ANATOMY	3
BIOL 244	PLANT ANATOMY LAB	1
BIOL 247	ECONOMIC PLANT BIOLOGY	3
BIOL 249	PLANT SECONDARY METABOLISM	3
BIOL 263	NUTRITION*	3
BIOL 264	NUTRITION LAB	1
BIOL 265	PARASITOLOGY & VIROLOGY	3
BIOL 266	PARASITOLOGY & VIROLOGY LAB	1
BIOL 271	PRINCIPLES OF SOIL SCIENCE	3
BIOL 272	PRINCIPLES OF SOIL SCIENCE LAB	1
BIOL 285	MOLECULAR BIOLOGY*	3
BIOL 286	MOLECULAR BIOLOGY LAB*	1
BIOL 287	BIOTECHNOLOGY & RECOMBINANT DNA*	3
BIOL 291	SPECIAL TOPICS IN BIOLOGY	3
BIOL 292	SEMINARS IN BIOLOGY*	1

* Electives in Biology that are offered presently.

COURSE DESCRIPTIONS

BIOL 101 INTRODUCTION TO BIOLOGY I **3.0: 3 cr. E**

This course is an introduction to the basic concepts of Genetics and Evolution, for students undertaking the Freshman Program.

BIOL 102 INTRODUCTION TO BIOLOGY I LABORATORY **0.3: 1 cr. E**

A set of experiments that introduce students to the world of Biology, including use of the microscope, introduction to DNA isolation and manipulation, and the safe use of biology lab equipment.

BIOL 103 INTRODUCTION TO BIOLOGY II **3.0: 3 cr. E**

This course complements BIOL 101 and introduces the students to the basic concepts of Immunology and Metabolism.

BIOL 104 INTRODUCTION TO BIOLOGY II LABORATORY **0.3: 1 cr. E**

A set of experiments that introduce students to metabolism, including anatomy of the nervous system, neurophysiology, testing for glycaemia, blood cells, blood typing, and an introduction to immunological techniques.

BIOL 201 GENERAL BIOLOGY I **3.0: 3 cr. E**

Principles of biology, including the cellular basis of life; evolution; energy transfer through living organisms and introduction to Systematics.

BIOL 202 GENERAL BIOLOGY I LABORATORY **0.3: 1 cr. E**

Required laboratory includes techniques such as microscopy, biochemical analysis, and use of the scientific method.

Co-requisite: BIOL 201.

BIOL 203 GENERAL BIOLOGY II **3.0: 3 cr. E**

An introduction to the study of anatomy, physiology and classification of plants and animals, which includes structure/function relationships, reproduction, development and control systems.

Prerequisite: BIOL 201.

BIOL 204 GENERAL BIOLOGY II LABORATORY **0.3: 1 cr. E**

Laboratory includes cytology, histology, and dissection.

Co-requisite: BIOL 203.

BIOL 205 PRINCIPLES OF HUMAN BIOLOGY **3.0: 3 cr. E**

Principles of Human Biology is designed to provide a basic overview of human biology, starting from the most elementary fabrics of life and moving up to the organ systems that make the sophisticated living marvel, the human body. The material of this course is intended to those who are in need of an encompassing view of the human body without necessarily going into the fine details that govern the functions of cells, organs and organ systems. This is an ideal bridging course for individuals coming from all backgrounds. This course is not offered to students majoring in Biology and cannot be counted as a Premedical course.

BIOL 207 GENERAL ECOLOGY **3.0: 3 cr. E**

Origin and evolution of the biosphere, introduction to climates, ecosystems and biomes. A study of the interrelations of organisms and their environments. Principles of growth, regulation, distribution, structure and energetics of populations and communities are explored.

Prerequisite: BIOL 203.

BIOL 208 GENERAL ECOLOGY LABORATORY **0.3: 1 cr. E**

Field and laboratory exercises illustrating concepts of general ecology.

Co-requisite: BIOL 207.

BIOL 213 CELL BIOLOGY **3.0: 3 cr. E**

A general description of the structure and function of cellular organelles and cell components, with emphasis on the interactions between cells and their environment.

Prerequisite: BIOL 203.

BIOL 214 CELL BIOLOGY LABORATORY **0.3: 1 cr. E**

Laboratory experiments include structure/function relationship in cell organelles. Introduction to basic techniques used in the field of cell biology.

Co-requisite: BIOL 213.

BIOL 221 ZOOLOGY **3.0: 3 cr. E**

A general introduction to protists and animals without backbones. Emphasis placed on evolutionary and ecological relationships that make an understanding and appreciation of this diverse group of animals possible. A study of the vertebrates with regard to their systematics, ecology, and behavior.

Prerequisite: BIOL 203.

BIOL 222 ZOOLOGY LABORATORY **0.3: 1 cr. E**

Exercises designed to introduce students to the 95 percent of all animals without a backbone. Identification of representative vertebrates through examination of specimens.

Co-requisite: BIOL 221.

BIOL 223 COMPARATIVE VERTEBRATE ANATOMY **3.0: 3 cr. E**

A comparative study of the functional adaptations, which caused structural changes in different chordate animals based on specific examples.

Prerequisite: BIOL 203.

BIOL 224 COMPARATIVE VERTEBRATE ANATOMY LABORATORY **0.3: 1 cr. E**

A practical comparison of the anatomy of different vertebrates ranging from simplest forms to the most complex.

Co-requisite: BIOL 223.

BIOL 225 ANIMAL PHYSIOLOGY **3.0: 3 cr. E**

A study of the functions of living things with emphasis on the chemical and physical properties of protoplasm, the conversion of energy and matter through cell respiration and synthesis, the transport of materials across membranes, cell excitability and contraction, and regulatory processes. A comparative study of physiological systems; nutrition, circulation, respiration, osmoregulation and excretion, nervous and endocrine coordination.
Prerequisite: BIOL 213.

BIOL 226 ANIMAL PHYSIOLOGY LABORATORY **0.3: 1 cr. E**

Experimental investigation of various functions of cells by isolation and characterization of subcellular parts and examination of cellular processes such as membrane transport and cell excitability. Experimental examination of the various vertebrate organ systems and how different animals deal with physiological problems.

Co-requisite: BIOL 225.

BIOL 227 NEUROPHYSIOLOGY **3.0: 3 cr. E**

An introduction to the nervous system with an organizational study of neural functions from molecular to organ level.

Prerequisite: BIOL 225.

BIOL 229 IMMUNOBIOLOGY **3.0: 3 cr. E**

A general description of the immune system, its components, the different types of immune responses, the defense mechanisms; description of immunological techniques and immune diseases.

Prerequisite: BIOL 213.

BIOL 230 IMMUNOBIOLOGY LABORATORY **0.3: 1 cr. E**

This course discusses subjects related to the mammalian immune system along with the application of various techniques used in the field of immunology such as leukocyte count, western blotting, immunoprecipitation, and ELISA.

Co-requisite: BIOL 229.

BIOL 231 DEVELOPMENTAL BIOLOGY **3.0: 3 cr. E**

Description of the major events of the embryonic development in many organisms. Study of the molecular mechanisms that control this development.

Prerequisite: BIOL 203.

BIOL 232 DEVELOPMENTAL BIOLOGY LABORATORY **0.3: 1 cr. E**

Thorough practical investigation of the different developmental stages in a number of animals belonging to different classes.

Co-requisite: BIOL 231.

BIOL 233 ENDOCRINOLOGY & REPRODUCTIVE BIOLOGY **3.0: 3 cr. E**

This course deals with hormones, their structure, synthesis, secretion, role, and regulation. It deals also with related diseases and disorders.

Co-requisite: BIOL 213.

BIOL 241 BOTANY **3.0: 3 cr. E**

An evolutionary survey of the plant kingdom: Classification, morphology and anatomy, adaptations for survival, and representative types and life cycles from the simplest to the most advanced groups.

Prerequisite: BIOL 203.

BIOL 242 BOTANY LABORATORY **0.3: 1 cr. E**

Field and laboratory exercises to study plants ranging from the simplest to the most advanced groups. Identification of structural features of lower and higher plants.

Co-requisite: BIOL 241.

BIOL 243 PLANT ANATOMY **3.0: 3 cr. E**

Origins, evolution and differentiation of plant tissues and organs with emphasis on the anatomy of vascular plants.

Prerequisite: BIOL 203.

BIOL 244 PLANT ANATOMY LABORATORY **0.3: 1 cr. E**

Preparation and examination of different fixed plant tissues using light microscopy. Practical study of structure-function relationships.

Co-requisite: BIOL 243.

BIOL 245 PLANT PHYSIOLOGY **3.0: 3 cr. E**

Selected aspects of the chemical and physical processes occurring in plants, including water relations and transpiration, photosynthesis, respiration, translocation of sugars, the assimilation of nitrogen and sulfur, mineral nutrition, growth and development, phytohormones and the metabolism of lipids and natural products.

Prerequisite: BIOL 203.

BIOL 246 PLANT PHYSIOLOGY LABORATORY **0.3: 1 cr. E**

Introduction to experimental techniques used to study the biochemistry and physiology of plant growth.

Co-requisite: BIOL 245.

BIOL 247 ECONOMIC PLANT BIOLOGY **3.0: 3 cr. E**

The importance of plants and their products in human life. Evolution and use of plant products in food and medicine with an overview of their potential use in biotechnology.

Prerequisite: BIOL 203.

BIOL 249 PLANT SECONDARY METABOLISM **3.0: 3 cr. E**

In depth description of plant natural products, their nature, metabolism and role in plant interactions with other living organisms.

Prerequisite: BIOL 245.

BIOL 251 PRINCIPLES OF BIOCHEMISTRY **3.0: 3 cr. E**

The course is designed to introduce the basic concepts of biochemistry. Coverage includes a thorough description of the biochemical framework: amino acids, proteins, enzymes, lipids, carbohydrates & nucleic acids. In addition, the course provides an overview of bioenergetics and metabolism of carbohydrates, lipids and amino acids.

Prerequisite: BIOL 203; Co-requisite CHEM 244 or CHEM 240.

BIOL 261 MICROBIOLOGY **3.0: 3 cr. E**

Structure and behavior of bacteria as well as selected fungi, algae, protozoa, and viruses; microbial genetics; microbial ecology and biotechnology; principles of immunity and disease.

Prerequisite: BIOL 203.

BIOL 262 MICROBIOLOGY LABORATORY **0.3: 1 cr. E**

Basic laboratory techniques for isolating, examining, and identifying bacteria, fungi, and viruses; elementary immunological techniques.

Co-requisite: BIOL 261.

BIOL 263 NUTRITION **3.0: 3 cr. E**

Study of basic human nutritional needs in energy, carbohydrates, fats, proteins, vitamins, and minerals with special emphasis on nutritional needs during various developmental stages in life (infant, adult, old age, and specific circumstances).

Prerequisite: BIOL 251.

BIOL 264 NUTRITION LABORATORY **0.3: 1 cr. E**

An investigation into the constituents of the major nutrients in the human diet. The laboratory includes testing of foods for composition and contamination.

Co-requisite: BIOL 263.

BIOL 265 PARASITOLOGY & VIROLOGY **3.0: 3 cr. E**

General description of animal parasites: classification, morphology, life cycles and physiology.

Prerequisite: BIOL 261.

BIOL 266 PARASITOLOGY & VIROLOGY LABORATORY **0.3: 1 cr. E**

Practical application to the course material including diagnosis, identification of the most widespread types of parasites.

Co-requisite: BIOL 265.

BIOL 271 PRINCIPLES OF SOIL SCIENCE **3.0: 3 cr. E**

Introduction to soil science with an emphasis on soil genesis and development. Overview of the physical and mechanical characteristics. Plant, soil, water relations, microbial activities, and organic matter will be discussed.

Prerequisites: BIOL 203, CHEM 202.

BIOL 272 PRINCIPLES OF SOIL SCIENCE LABORATORY **0.3: 1 cr. E**

Examination of structure and texture of soils, determination of biological, physical and chemical characteristics of various soil samples.

Co-requisite: BIOL 271.

BIOL 283 GENETICS **3.0: 3 cr. E**

Organization, expression and evolution of hereditary elements in Prokaryotes and Eukaryotes; principles of the classical Mendelian Genetics and extension to population analysis; principles of molecular genetics: DNA structure and organization in chromosomes and genes, mutations and gene expression.

Prerequisite: BIOL 203.

BIOL 284 GENETICS LABORATORY **0.3: 1 cr. E**

Applications of genetic principles are reviewed through demonstrations, problem solving, and research. Experimental techniques employed in the study of genetics utilizing plants, animals, and microorganisms. Co-requisite: BIOL 283.

BIOL 285 MOLECULAR BIOLOGY **3.0: 3 cr. E**

Molecular mechanisms involved in the expression of genetic information, the control of macromolecular synthesis, the aggregation of macromolecules into DNA-protein complexes, membranes, chromosomes and cell organelles, and an introduction to recombinant DNA technology.

Prerequisite: BIOL 283.

BIOL 286 MOLECULAR BIOLOGY LABORATORY **0.3: 1 cr. E**

Required laboratory includes an introduction to protein purification techniques, gene cloning, and recombinant DNA technology.

Co-requisite: BIOL 285.

BIOL 287 BIOTECHNOLOGY & RECOMBINANT DNA **3.0: 3 cr. E**

A course which deals with recombinant DNA technology and its uses in the various fields of Biology such as plant and animal amelioration, and bioremediation.

Prerequisite: BIOL 283.

BIOL 291 SPECIAL TOPICS IN BIOLOGY **3.0: 3 cr. E**

Course discussing various topics of Biology with special contemporary importance. Subjects may include advances in technical and theoretical knowledge as well as discussions of specific topics like cancer, cloning, theoretical biology, etc.

Prerequisite: BIOL 203.

BIOL 292 SEMINARS IN BIOLOGY **0.3: 1 cr. E**

Special course discussing topics of high interest presented by invited faculty or by students.

Prerequisite: Special permission from the Department.

CVSQ 201, 202, 203, 204

Refer to the Civilization Sequence Program.

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

Refer to the Department of Chemistry.

CSIS 273

Refer to the Department of Computer Science.

ENGL 203, 2xx

Refer to the Division of English Language & Literature.

MATH 203, 242, 272

Refer to the Department of Mathematics.

PHYS 211, 212, 213, 214

Refer to the Department of Physics.

GRADUATE PROGRAM IN BIOLOGY

The Department offers a two-year graduate program (30 credits) leading to the Master of Science (M.Sc.) degree in Biology and provides training in many areas with particular strengths in Biochemistry, Molecular Biology, Immunology, and Microbiology.

The emphasis in our program is on development of the intellectual and technical skills necessary for independent research. Formal course requirements (24 credits) are largely intended to fill gaps in the student's background and to bring him/her up to date with the most recent findings in the appropriate research areas. A primary component of the degree also is a thesis (6 credits) embodying the results of original research.

The Department's laboratory facilities are well equipped for graduate training and research in a wide variety of biological sciences. Our resources are further extended by association with other faculties, including the Faculty of Medicine and Medical Sciences and the Faculty of Health Sciences.

ADMISSION REQUIREMENTS

Candidates for the graduate program must submit an application along with all the official documentation required. The Test of English as a Foreign Language (TOEFL) is required of students who have graduated from a non-English-language university.

Prospective graduate students should have adequate background knowledge in biochemistry, cell and molecular biology. Final admission is based on an evaluation by the Department and on acceptance, in writing, by a research director who can provide adequate academic guidance throughout the study period. Prospective graduate students are encouraged to contact staff members with whom they wish to study before applying for admission.

Applicants must also provide a statement of purpose outlining their research interests.

MASTER'S DEGREE IN BIOLOGY

SAMPLE DISTRIBUTION OF CURRICULUM

SEMESTER I

Course Code	Course Title	Credit
BIOL 301	Techniques of Scientific Communication & Bioethics	3
BIOL 307	Advanced Molecular Biology	3
BIOL 308	Techniques in Biological Research	3
		9

SEMESTER II

Course Code	Course Title	Credit
BIOL 303	Quantitative Analysis & Biostatistics	2
BIOL 305	Enzymology & Metabolic Biochemistry	4
	Elective 1	3
		9

SEMESTER III

Course Code	Course Title	Credit
BIOL 399	Thesis	6
	Elective 2	3
		9

SEMESTER IV

Course Code	Course Title	Credit
BIOL 399	Thesis (continued)	
	Elective 3	3
		3

Grand Total **30 credits**

ELECTIVE COURSES:

BIOL 311	Advanced Cell Biology
BIOL 321	Advanced Topics in Cellular & Molecular Immunology
BIOL 323	Advanced Topics in Microbiology
BIOL 341	Plant Growth & Development
BIOL 343	Biochemistry of Plant Secondary Metabolism
BIOL 345	Biochemistry of Plant Cell Walls
BIOL 381	Recent Advances in Biological Research

Electives may be chosen from the above list to provide an in-depth knowledge of a specific field of research. Presently, the Department offers research options in the fields of plant and animal biochemistry, genetics, molecular biology and physiology, in addition to microbiology and immunology.

Alternatively, up to 6 credits of elective courses may be chosen from outside the Department, with the consent of the supervisor, to complement the knowledge within a related field of research.

COURSE DESCRIPTIONS

BIOL 301 TECHNIQUES OF SCIENTIFIC COMMUNICATION & BIOETHICS 3.0: 3 cr. E

A graduate-level overview of techniques for platform, poster and written scientific presentations, as well as an understanding of the fundamentals of environmental and bioethics. After having successfully completed this course, students will be able to form and critique a logical argument, discuss the mission of making scientific presentations, dissect and summarize scientific papers, constructively critique scientific presentations, and draft a scientific proposal.

BIOL 303 QUANTITATIVE ANALYSIS & BIOSTATISTICS 2.0: 2 cr. E

This course provides students in the field of biological sciences and health care disciplines with the statistical tools and skills necessary to organize and summarize data in a meaningful way and to interpret and analyze data intelligently to reach sound decisions. There is an emphasis on computer applications for most of the statistical techniques covered in the course using SPSS as statistical software.

BIOL 305 ENZYMOLOGY & METABOLIC BIOCHEMISTRY 4.0: 4 cr. E

This is a lecture and discussion course designed for graduate students whose educational goals require more extensive exposure to biochemistry. The course provides detailed insights into the mechanisms of catalysis of various classes of enzymes including kinetic analysis, catalytic mechanisms, transition state stabilization and regulation of activity, strategies for active site characterization and regulatory properties. Cellular metabolism of carbohydrates, lipids, amino acids and nucleotides are also studied.

BIOL 307 ADVANCED MOLECULAR BIOLOGY 3.0: 3 cr. E

Advanced Molecular Biology is a graduate lecture and discussion course. This course is based on critical reading and discussion of selected journal reviews and articles in Molecular Biology. The goals of the course are to (1) provide the student with an understanding of the biochemical processes fundamental to gene structure and function: DNA replication, transcription, translation, and regulation of gene expression; (2) explore the techniques and applications of recombinant DNA research, and to learn how this technology helped in elucidating the mechanisms of complex genetic control.

BIOL 308 TECHNIQUES IN BIOLOGICAL RESEARCH 3.0: 3 cr. E

This course covers specialized topics of current interest to graduate students in Biological Sciences with an emphasis on learning new research skills. Current laboratory techniques, literature searches, and hands-on practice of techniques are stressed. Laboratory with accompanying lectures give practical experience in the application of recombinant DNA technology, chromatography, microscopy and other basic and applied research. The aims of the course include improving practical skills in fundamental laboratory techniques in Biology.

BIOL 311 ADVANCED CELL BIOLOGY 3.0: 3 cr. E

Advanced Cell Biology is designed for graduate students who need in-depth knowledge in the areas of cell and molecular biology and related fields. The course is based on the critical reading and discussion of selected journal reviews and articles in cell biology. It is a discussion-based course. The goals include learning basic principles in cell structure and function and developing analytical skills in experimental cell biology.

BIOL 321 ADVANCED TOPICS IN CELLULAR & MOLECULAR IMMUNOLOGY 3.0: 3 cr. E

The course addresses recent topics in the development, signaling and function of hematopoietic stem cells, innate immune cells, and lymphoid cells. In addition, the genetic, molecular, and cellular basis of atopy, autoimmunity and immunodeficiencies are exposed. By the end of the course, students would have acquired

detailed knowledge of the mechanisms leading to the development of immune cells from hematopoietic stem cells, and of the activation, signaling, function, and regulation of innate immune cells (macrophages, dendritic cells, natural killer cells and natural T lymphocytes) as well as of adaptive immune cells and their subsets.

BIOL 323 ADVANCED TOPICS IN MICROBIOLOGY 3.0: 3 cr. E

The course provides an in-depth discussion of major intracellular bacteria and protozoa as well as 3 families of viruses, which commonly lead to chronic diseases. The pathogenesis and the immune evasion strategies used by these microbes are elucidated. By the end of the course, students would have acquired detailed description of key obligate and facultative intracellular bacteria (Mycobacteria, Listeria, Chlamidya, Brucella and Legionella), key intracellular protozoa (Plasmodium, Leishmania, Toxoplasma, and Trypanosoma) and key viral families (retroviruses, hepatitis viruses and herpes viruses) causing chronic diseases. The aspects of microbial growth, virulence, identification, and biological characteristics are elaborated. Disease epidemiology, pathology, diagnosis, treatment, and prevention are also discussed.

BIOL 341 PLANT GROWTH & DEVELOPMENT 3.0: 3 cr. E

This course focuses on developmental processes of plant growth from a structural and organismal approach. Biophysical and biochemical processes involved in plant growth are discussed: Synthesis, functions and mechanisms of action of phytohormones; endogenous rhythms: tropisms, circadian rhythms, and translocation. Exogenous signals (light and temperature) controlling plant development from seed germination to senescence are also covered. A student completing this course should have an understanding of the developmental processes of plant growth and how environmental factors affect plant growth and development.

BIOL 343 BIOCHEMISTRY OF PLANT SECONDARY METABOLISM 3.0: 3 cr. E

This course constitutes a detailed survey of the field of natural products, which are referred to as 'secondary metabolites'. The core focus will be on the structure and biosynthesis of the four main classes of plant secondary metabolites: polyketides, shikimate derivatives, isoprenoids and nitrogen-containing natural products. Synthesis and structure elucidation are covered only to the extent needed to understand how biosynthetic pathways are uncovered. The course will also touch on the various uses of secondary metabolites including medicinal use of plants, plant-insect interaction (chemical ecology), and the future of natural product research.

BIOL 345 BIOCHEMISTRY OF PLANT CELL WALLS 3.0: 3 cr. E

This course provides information in areas of biochemistry unique to the plant cell wall. Its objective is to describe the complexity of cell wall structure, study its biosynthesis, and to relate cell wall structure with different aspects of the life of the plant. It includes a discussion of recent developments emphasizing understanding of the research approaches used to elucidate major processes in plant cell wall biosynthesis. Each chapter has a required list of scientific papers to help the students learn how to read and analyze scientific papers.

BIOL 381 RECENT ADVANCES IN BIOLOGICAL RESEARCH 3.0: 3 cr. E

The course is focused on an in-depth analysis of the literature through critical analysis of original research articles in a contemporary and highly specialized field of biological sciences. Journal papers and review articles will be analyzed in terms of background, hypothesis, use of experimental methods, and interpretation of results. The course is not limited to any specific topic and is intended to cover a wide range of subjects in biochemistry, genetics, microbiology, cell, molecular and developmental biology.

BIOL 399 MASTER'S THESIS 6 cr.

DEPARTMENT OF CHEMISTRY

BACHELOR'S DEGREE

The Faculty of Sciences offers a Bachelor of Science Degree (in Chemistry) for students who have successfully undertaken a minimum of 91 credits of required courses provided that they satisfy the standards set by the University and the Faculty. Students must complete the following:

I- 38 credits of Major Courses: (in major and general averages)

CHEM 202, CHEM 203, CHEM 222, CHEM 223, CHEM 224, CHEM 242, CHEM 244, CHEM 245, CHEM 246, CHEM 247, CHEM 260, CHEM 262, CHEM 263, CHEM 264, CHEM 270, CHEM 272.

II- 17 credits of Major Required Courses: (in general average only)

CSIS 273, MATH 203, MATH 272, PHYS 211, PHYS 212, PHYS 213, PHYS 214.

III- 18 credits of University Required Courses: (in general average only)

ENGL 203, ENGL 204, CVSQ 201, CVSQ 202, CVSQ 203, CVSQ 204.

IV- 18 credits of Electives (in major and general averages if the elective is a Chemistry course, otherwise in general average only)

PRE-MED TRACK

The Bachelor's Degree Curriculum in Chemistry includes all courses required to prepare students for the MCAT. These courses are:

Biology*	***A minimum of 8 credits*** BIOL 201, 202, 203, 204
Chemistry	***A minimum of 13 credits including 7 credits of organic chemistry*** CHEM 202, 203, 222 (or equivalent), 242, 244, 245
Humanities and Social Sciences	***A minimum of 6 credits*** Chosen from CVSQ and / or English courses
Physics	***A minimum of 8 credits*** PHYS 211, 212, 213, 214

* The Bachelor's Degree Curriculum in Chemistry includes 18 credits of free electives which allow students to ***meet the Biology course requirement for the MCAT examination without the need for extra credits***.

MINOR IN CHEMISTRY

The Faculty of Sciences offers a Minor in Chemistry for students who have successfully completed a minimum of 18 credits of chemistry courses as follows:

Code	Course Title	Credit
CHEM 202	Basic Chemistry	3 cr
CHEM 203	Basic Chemistry Lab	1 cr
CHEM 222	Analytical Chemistry I	3 cr
CHEM 240 *	Basic Organic Chemistry	3 cr
CHEM 245	Organic Chemistry Lab I	1 cr
CHEM 260	Statistical Mechanics & Thermodynamics	3 cr
CHEM 246	Applied Molecular Spectroscopy	3 cr

And a selection of one laboratory course from:

CHEM 247	Organic Chemistry Lab II	1 cr
CHEM 223	Analytical Chemistry Lab	1 cr
CHEM 263	Physical Chemistry Lab	1 cr

* A student who is already registered for CHEM 242 and CHEM 244 to meet “pre-medical” requirements need not register for CHEM 240 to meet “ Minor in Chemistry “ requirements.

BACHELOR'S DEGREE

FIRST YEAR

Semester 1

Course Code	Course Title	Credit
CHEM 202	Basic Chemistry	3
CHEM 203	Basic Chemistry Lab	1
CSIS 273	Personal Computing for Applied Sciences	3
ENGL 203	English Communication Skills III	3
MATH 203	Mathematics for Applied Sciences	3
	Elective	3
		16

Semester 2

Course Code	Course Title	Credit
CHEM 222	Analytical Chemistry I	3
CHEM 242	Organic Chemistry I	3
ENGL 204	English Communication Skills IV (or Equivalent)	3
MATH 272	Differential Equations for Applied Sciences	3
PHYS 211	Fundamentals of Physics I	3
PHYS 212	Fundamentals of Physics I Lab	1
		16

SECOND YEAR

Semester 3

Course Code	Course Title	Credit
CHEM 245	Organic Chemistry Lab I	1
CHEM 244	Organic Chemistry II	3
CHEM 260	Statistical Mechanics and Thermodynamics	3
CVSQ 201	Early Formation of Civilization	3
PHYS 213	Fundamentals of Physics II	3
PHYS 214	Fundamentals of Physics II Lab	1
	Elective	3
		17

Semester 4

Course Code	Course Title	Credit
CHEM 224	Analytical Chemistry II	3
CHEM 246	Applied Molecular Spectroscopy	3
CHEM 247	Organic Chemistry Lab II	1
CHEM 262	Physical and Chemical Kinetics	3
CHEM 270	Inorganic Chemistry I	3
CVSQ 202	The Religious Experience: The Sacred	3
		16

THIRD YEAR

Semester 5

Course Code	Course Title	Credit
CHEM 223	Analytical Chemistry Lab	1
CHEM 272	Inorganic Chemistry II	3
CVSQ 203	Introduction to Modernity	3
	Electives	6
		13

Semester 6

Course Code	Course Title	Credit
CHEM 263	Physical Chemistry Lab	1
CHEM 264	Quantum Theory and Structure of Matter	3
CVSQ 204	Contemporary Challenges in the Arab World	3
	Electives	6
		13

CHEMISTRY ELECTIVE COURSES

I- Within the Department

Course Code	Course Title	Credit
CHEM 248	Introduction to Biochemistry	3
CHEM 280	Chemical Safety and Toxicology	3
CHEM 282	Food Chemistry	3
CHEM 284	Biogeochemistry	3
CHEM 286	Polymer Chemistry	3
CHEM 288	Methods of Analysis	3
CHEM 290	Industrial Chemistry	3
CHEM 292	Environmental Chemistry	3
CHEM 294	Green Chemistry	3
CHEM 296	Water and Soil Chemistry	3
CHEM 298	Special Topics in Chemistry	3

II- Outside the Department

*** Biochemistry

*** Biology

*** Computer Science

*** Environmental Sciences

*** Humanities

*** Mathematics

*** Physics

COURSE DESCRIPTIONS

CHEM 001 SOP CHEMISTRY **3.0: 3 cr. E**

This is a basic chemistry course for students in the Special Orientation Program (SOP). SOP students normally study Chemistry in Arabic. It is the aim of this course to make the students familiar with the English terminology. Accordingly, the course reviews the topics usually taken at the Third Secondary Level such as: Atomic theory, stoichiometry, oxidation & reduction, ideal gas laws, quantum chemistry, chemical equilibrium and an introduction to organic chemistry.

CHEM 100 INTRODUCTION TO CHEMISTRY I **3.0: 3 cr. E**

Basic Chemistry Level I for Freshman students in the Scientific section. An elective for Freshman students in the Literary section. Accordingly, the course covers the following topics: Atomic theory of matter, types of reactions, concepts of acids and bases, molecular and ionic equations, oxidation-reduction reactions, calculations with chemical formulas and equations, stoichiometry, empirical gas laws, the ideal gas law, introduction to quantum chemistry.

CHEM 101 INTRODUCTION TO CHEMISTRY I LABORATORY **0.3: 1 cr. E**

The aim of this course is to introduce and familiarize Freshman students with the laboratory environment. Students will learn how to safely handle chemical reagents, glassware and basic apparatus by carrying out experiments such as precipitation, electrical conductivity of solutions, acid-base titration, melting point determination, distillation, etc.

CHEM 102 INTRODUCTION TO CHEMISTRY II **3.0: 3 cr. E**

Basic Chemistry Level II for Freshman students in the Scientific section. Accordingly, the course covers the following topics: types of chemical bonds, electronegativity and polarity, rate of a chemical reaction, half life, chemical equilibrium, Le-Chaterlier's principle, Equilibrium in aqueous solutions (acids, bases, buffer), solubility, introduction to organic chemistry: hydrocarbons, hybridization, alkanes and cycloalkanes, alkenes, alkynes, aromatic hydrocarbons, reactions of hydrocarbons, organic compounds containing oxygen. Reaction of oxygen containing organic compounds, organic compounds containing nitrogen, and organic polymers.

Pre-requisite: CHEM 100.

CHEM 103 INTRODUCTION TO CHEMISTRY II LABORATORY **0.3: 1 cr. E**

In this laboratory course, Freshman students will carry out experiments such as precipitation, electrical conductivity of solutions, acid-base titration, melting point determination, distillation, etc.

Pre-requisite: CHEM 101.

CHEM 110 INTRODUCTION TO FOOD CHEMISTRY AND NUTRITION **3.0: 3 cr. E**

An introductory course for the exploration of the structure, properties, and chemical composition of food systems and the changes they undergo during processing and under storage. Basic food chemistry provides the student with knowledge of the three primary food constituents: carbohydrates, lipids and proteins and some of the main reactions between them. The Caloric concept of different food components is also discussed.

CHEM 150 INTRODUCTION TO THE SCIENCE OF COSMETICS **3.0: 3 cr. E**

This is an enjoyable course for all students regardless of their educational formation or background. Cosmetics and toiletries are products of our every day life, ranging from the use of toothpastes, hair gels, deodorants, facial soaps, shampoos, hair conditioners and many others. Understanding how these products are made and how they

work will enable you to decide which product to buy and which serves simply as a commercial tool. The student will also become familiar with basic perfume manufacturing process.

At the end of the course, each pupil will "manufacture" his/her own product they chose. The list includes shampoos, shaving creams, toothpastes, hand creams etc.

CHEM 200 GENERAL CHEMISTRY **3.0: 3 cr. E&F**

This course of chemistry is designed primarily for first year students in various health-related programs as nursing, laboratory technology, medical assisting, dental assisting... Emphasis is placed on practical aspects of inorganic chemistry, organic chemistry and biochemistry. Theoretic topics will be given in three parts: Part I "inorganic chemistry" stresses relationships with the life processes that are the subject of part III "biochemistry". Among theses related topics and processes acids, bases and electrolytes, solutions and redox reactions. Part II "organic chemistry" introduces the various classes of organic compounds. Part III "biochemistry" deals with the chemical and molecular basis of life itself.

Students can not receive credits for both CHEM 200 and either of CHEM 202, or CHEM 204 or CHEM 206.

CHEM 202 BASIC CHEMISTRY **3.0: 3 cr. E**

Origin of the atomic theory. Determination of atomic weights and molecular formulae. The mole concept. The chemical equation. Acid-base and oxidation-reduction concepts. Properties of gases and gas laws. Liquids and solutions. Types of solutions: ideal and non-ideal solutions. Chemical equilibrium. Ionic equilibrium in aqueous solutions. Solubility. Quantum theory of the atom. Electronic structure of atoms. The chemical bond: ionic and covalent bonds. Hybridization. The Valence-Shell Electron-Pair Repulsion (VSEPR) Model. Students can not receive credits for both CHEM 202 and either of CHEM 200, or CHEM 204 or CHEM 206.

CHEM 203 BASIC CHEMISTRY LABORATORY **0.3: 1 cr. E**

The aim of this introductory laboratory course is to introduce the students to the basic techniques and equipment of common use in a chemistry lab. Co-requisite: CHEM 202, or 204, or 206.

CHEM 204 GENERAL APPLIED CHEMISTRY **3.0: 3 cr. E**

This course is designed to give the students a basic knowledge of chemistry and chemical changes making them realize the importance of elements, components and mixture in everyday life. Also to show them how and why chemical reactions occur and the significance of such chemical changes in the fields of biology, medicine, industry, etc.

Students can not receive credits for both CHEM 204 and either of CHEM 200, or CHEM 202 or CHEM 206.

CHEM 206 CHEMICAL PRINCIPLES **3.0: 3 cr. E**

This course is designed to cover the basic concepts in Chemistry that are of interest to students majoring in Mechanical and Aeronautical Engineering. Students will especially learn about Electrochemistry, Chemical Thermodynamics in addition to chemical changes and their significance in industry.

Students can not receive credits for both CHEM 206 and either of CHEM 200, or CHEM 202 or CHEM 204.

CHEM 208 BASIC CHEMISTRY FOR PUBLIC HEALTH (PDHP 202) **3.0:3 cr. E**

This course introduces Public Health students to the basic principles of chemistry. The course discusses basic general and organic chemistry, water chemistry, atmospheric chemistry, Inorganic and Organic pollutants as well as hazardous waste.

(Students who have already completed CHEM 202 may be granted equivalence)

CHEM 209 BASIC CHEMISTRYLABORATORY FOR PUBLIC HEALTH (PDHP 203) 0.3:1 cr. E

This is a laboratory course which introduces public health students to experiments in basic and applied chemistry.

(Students who have already completed CHEM 203 may be granted equivalence)

CHEM 220 BASIC ANALYTICAL CHEMISTRY 2.0: 2 cr. E

A brief discussion of: Gravimetric methods of analysis, titrimetric methods of analysis, aqueous solution chemistry, activities and activity coefficients, equilibrium calculations, precipitation titration, neutralisation titration, complex acid-base systems, complex-formation titration, electrochemistry, applications of oxidation-reduction titrations, and kinetics.

Students can not receive credits for both CHEM 220 and CHEM 222. Chemistry major students will not receive credits for CHEM 220.

Pre-requisite: CHEM 202.

CHEM 222 ANALYTICAL CHEMISTRY I 3.0: 3 cr. E

Errors in chemical analysis. Statistical evaluation of analytical data. Gravimetric methods of analysis. Titrimetric methods of analysis. Aqueous solution chemistry. Activities and activity coefficients. Equilibrium calculations. Precipitation titration. Neutralization titration. Complex acid-base systems. Complex-formation titration. Electrochemistry. Applications of oxidation-reduction Titrations. Kinetics. Students can not receive credits for both CHEM 220 and CHEM 222.

Pre-requisite: CHEM 202.

CHEM 223 ANALYTICAL CHEMISTRY LAB 0.3: 1 cr. E

The experiments are designed to familiarize the students with the manipulation of modern analytical instruments.

Pre-requisite: CHEM 203 & 222 (or 220).

CHEM 224 ANALYTICAL CHEMISTRY II 3.0: 3 cr. E

Potentiometric, Electrogravimetric and coulorimetric Methods of analysis. Voltametry. Introduction to spectroscopic methods of analysis. Instruments for optical spectroscopy. Molecular absorption spectroscopy. Molecular fluorescence spectroscopy. Atomic spectroscopy: UV & IR. Kinetic methods of analysis. Chromatography: Gas-Liquid and HPLC.

Pre-requisite: CHEM 222.

CHEM 240 BASIC ORGANIC CHEMISTRY 3.0: 3 cr. E

This course outlines the combined theories and fundamental concepts of organic chemistry, including structure, shape, IUPAC nomenclature, stereoisomerism, optical activity, absolute configuration and properties of the following groups: alkanes, alkenes, alkynes and aromatic hydrocarbons; compounds containing functional groups such as halogen, hydroxyl, carbonyl, carboxylic acids and amines. Emphasis is put on important synthesis methods and reagents, basic reaction mechanisms, important naturally-occurring and synthetic organic compounds, and physical methods used in structure determination.

Students cannot receive credit for both CHEM 240 and CHEM 242. Students cannot receive credit for both CHEM 240 and CHEM 244. Chemistry major students will not receive credits for CHEM 240.

Pre-requisite: CHEM 202.

CHEM 242 ORGANIC CHEMISTRY I **3.0: 3 cr. E**

Atomic and molecular orbitals; hybridization and bonding between two carbon atoms. Electronegativity and Resonance. Inductive effect. Stereochemistry: Optical and geometrical isomerism. Substitution, elimination and addition reaction. Properties of alkane, alkene and alkyne. Chemistry of the aromatic hydrocarbons. Students cannot receive credit for both CHEM 240 and CHEM 242.

Pre-requisite: CHEM 202.

CHEM 244 ORGANIC CHEMISTRY II **3.0: 3 cr. E**

Study of the main functional groups: alcohols, phenols, ethers and epoxides, aldehydes and ketones, carboxylic acids and derivatives, amine and amides. Spectroscopy and structures. Carbanions. Aryl halides.

Students cannot receive credit for both CHEM 240 and CHEM 244.

Pre-requisite: CHEM 242.

CHEM 245 ORGANIC CHEMISTRY LAB I **0.3: 1 cr. E**

Experiments are intended to introduce students to basic techniques in organic chemistry, synthesis and extraction, chromatography and identification of functional groups.

Pre-requisite: CHEM 202, CHEM 203 & CHEM 242. Co-requisite: CHEM 244. or

Pre-requisite: CHEM 202, CHEM 203 & CHEM 240.

CHEM 246 APPLIED MOLECULAR SPECTROSCOPY **3.0: 3 cr. E**

Principles and instrumentation of Ultraviolet, Visible, Infrared, Raman Spectroscopy, Nuclear Magnetic Resonance Spectroscopy and Mass Spectrometry. Analysis of IR, UV, NMR and mass spectra.

Pre-requisite: CHEM 244 or CHEM 240.

CHEM 247 ORGANIC CHEMISTRY LAB II **0.3: 1 cr. E**

Synthesis and structure determination of complex organic compounds. The aim of this course is to familiarize the students with advanced techniques used in organic chemistry laboratories.

Co-requisite: CHEM 245.

CHEM 248 INTRODUCTION TO BIOCHEMISTRY **3.0:3 cr. E**

This course introduces students to Biochemistry, a field of science that pertains to the scene of life processes. Introduction to Biochemistry deals with the chemical structures and functions of important biomolecules, relationship between structure and function as well as some important key reactions of such molecules. The course lays the foundation for a fundamental understanding of biological concepts for students pursuing a career in the field of life sciences.

Pre-requisite: CHEM 240 or CHEM 244.

CHEM 260 STATISTICAL MECHANICS AND THERMODYNAMICS **3.0: 3 cr. E**

The properties of gases. The First Law of thermodynamics: concepts and machinery. The Second Law of thermodynamics: concepts and machinery. Change of state. Equilibrium electrochemistry.

Pre-requisite: CHEM 202.

CHEM 262 PHYSICAL AND CHEMICAL KINETICS **3.0: 3 cr. E**

The kinetic theory of gases. Ion transport and molecular diffusion. Rates of chemical reactions. Kinetics of complex reactions. Molecular reaction dynamics. Processes at solid surfaces. Dynamic electrochemistry.

Pre-requisite: CHEM 202.

CHEM 263 PHYSICAL CHEMISTRY LAB **0.3: 1 cr. E**

Kinetic properties of reacting systems. Rate of a reaction. Application of electronic spectroscopy to vibrational, rotational and electronic properties of simple molecules.

Pre-requisite: CHEM 203, CHEM 260 & Co-requisite: CHEM 262 or CHEM 264.

CHEM 264 QUANTUM THEORY AND STRUCTURE OF MATTER **3.0: 3 cr. E**

Quantum theory: introduction, principles, techniques and applications. Atomic structure and atomic spectra. Molecular structure. Rotational and vibrational spectra. Electronic transitions. Magnetic resonance. Diffraction techniques. Statistical thermodynamics. Electrical and magnetic properties of molecules.

Pre-requisite: CHEM 202.

CHEM 270 INORGANIC CHEMISTRY I **3.0: 3 cr. E**

Bohr's nuclear model of the atom. Waves mechanics and the Schrödinger equation. Energy levels and Lines spectra. Chemical bonds. Acids and bases in inorganic reactions. Study of some regular types of elements.

Pre-requisite: CHEM 202.

CHEM 272 INORGANIC CHEMISTRY II **3.0: 3 cr. E**

Theory of chemical bonds in coordination compounds; isomerism and stability. Organometallic Chemistry, Review of experimental techniques used in structure determination.

Pre-requisite: CHEM 202.

CHEM 273 INORGANIC CHEMISTRY LAB **0.3: 1 cr. E**

Preparation of some inorganic compounds and study of their properties.

Pre-requisite: CHEM 270, Co-requisite: CHEM 272.

CHEM 280 CHEMICAL SAFETY AND TOXICOLOGY **3.0: 3 cr. E**

This course provides an outline of the toxicological, occupational hygiene and environmental aspects of chemical hazards and exposures. Metals, solvents, toxic and irritant gases, pesticides, carcinogens, hazardous wastes and dioxins will also be discussed.

CHEM 282 FOOD CHEMISTRY **3.0: 3 cr. E**

Chemical composition of food; their physical and sensory properties. Preservation of food.

Pre-requisite: CHEM 202.

CHEM 284 BIOGEOCHEMISTRY **3.0: 3 cr. E**

An interdisciplinary science course encompassing chemical reactions in the atmosphere, oceans, soil and sediment, and living organisms. It is a study about effects exerted by living systems on quality of the environment, impact on the global system, and the link existing between the atmosphere, the ocean and land.

Pre-requisite: CHEM 202.

CHEM 286 POLYMER CHEMISTRY **3.0: 3 cr. E**

Basics of polymer chemistry. Importance of polymers to our life. Stoichiometry of flexible chain molecules. Some microscopic features of bulk polymers. Methods for molecular characterization of polymers. Step and chain polymerization reactions-mechanisms and kinetics. Investigation onto co-polymerization strategy. Different polymerization methods.

Co-requisite: CHEM 270 and 272.

CHEM 288 SAMPLING & METHODS OF ANALYSIS **3.0: 3 cr. E**

This course is a combination of class and laboratory work; theory and application. It dwells on the principles of chemistry underlying the various methods and procedures. It prepares students for professional career in human and animal nutrition, industry and environmental sciences, as they learn how to collect, treat, store and digest samples, and how to run elemental analysis on the digest. It is designed to allow each student to obtain "hands-on" experience with the primary instrumentation available to chemists working in academia, industry, and government research.

Co-requisite: CHEM 222.

CHEM 290 INDUSTRIAL CHEMISTRY **3.0: 3 cr. E**

Topics include different applications of organic and inorganic materials: glass, cement, ceramics, detergents, adhesives, fibers, biomaterials, electrical and electronic applications.

CHEM 292 ENVIRONMENTAL CHEMISTRY **3.0: 3 cr. E**

Physics and chemistry of the ozone layer, catalytic processes; the ozone hole; urban ozone; acid rain, indoor and outdoor air pollution; mechanism of the greenhouse effect; climate-modifying effects of aerosols; toxic organic chemicals; pollution and purification of water; modern waste water and air purification techniques; toxic heavy metals; municipal wastes; soils and sediments; hazardous wastes; renewable energy.

Pre-requisite: CHEM 202.

CHEM 293 ENVIRONMENTAL CHEMISTRY LAB **0.3: 1 cr. E**

This lab would provide students with basic skills needed for environmental chemistry, with a focus on the extraction and analytical method development to study the mechanisms of environmental fate, transport, and removal of pollutants.

Pre-requisites: CHEM 202, CHEM 203.

Co-requisite: CHEM 292.

CHEM 294 GREEN CHEMISTRY **3.0: 3 cr. E**

Principles and concepts of green chemistry; sustainable development, atom economy, reducing toxicity; waste production and problems; costs and waste minimization techniques; measuring environmental performance; environmental management, eco-labels and legislation; catalysis and green chemistry; organic solvents and volatile organic compounds; solvent-free systems; alternative solvents; emerging greener technologies; industrial case studies; society and sustainability.

Pre-requisite CHEM 292.

CHEM 296 WATER AND SOIL CHEMISTRY **3.0:3 cr. E**

Concepts in aquatic chemistry; chemical reactions and chemical equilibrium; combining chemical reactions; chemical potentials; adsorptions reactions; soil composition; ion exchange; soil acidity and buffering; mineral weathering and formation; oxidation-reduction reactions in soils; salt-affected and swelling soils; effects of salt-degraded soils on plants; availability and mobility of toxic elements in soils; organic pollutants in soils.

Pre-requisite CHEM 202.

CHEM 298 SPECIAL TOPICS IN CHEMISTRY **3.0: 3 cr. E**

CVSQ 201, 202, 203, 204

Refer to the Civilization Sequence Program.

CSIS 273

Refer to the Department of Computer Science.

ENGL 203, 2xx

Refer to the Division of English Language & Literature.

MATH 203, 272

Refer to the Department of Mathematics.

PHYS 211, 212, 213, 214

Refer to the Department of Physics.

MASTER'S DEGREE IN CHEMISTRY

The Department of Chemistry offers a Master of Science Degree for students who have successfully completed a minimum of thirty credits **(30 cr)** of required courses provided that they satisfy the standards set by the University and the Faculty. The credits are distributed as follows:

I- Core Courses

The core courses provide advanced knowledge in each of the main fields of Chemistry: Analytical, Inorganic, Organic and Physical Chemistry. These courses, a total of four, are obligatory and add up to twelve credits **(12 cr)**. The course codes and names are listed below:

CHEM 300	Advanced Analytical Chemistry	3 credits
CHEM 302	Advanced Organic Chemistry	3 credits
CHEM 304	Advanced Physical Chemistry	3 credits
CHEM 306	Advanced Inorganic Chemistry	3 credits

II- Elective Courses

Students are requested to choose four elective courses that constitute a total of twelve credits **(12 cr)**. Such courses are selected from the set of electives mentioned below to suit the area of specialty that each student is pursuing in the Master's degree.

III- Master's Thesis (CHEM 399)

Upon enrollment in the Master's Program, each student will be assigned an advisor(s) to help plan and supervise the Master's thesis. The thesis accounts for six credits **(6 cr)** and can be done in collaboration with other local or foreign universities. Students will officially register for CHEM 399 at the last year of the Master's Program, however, throughout the two years of the program, research group seminars will be held including discussion, oral presentation, problem solving and reading of current literature pertinent to research interests. (Upon a recommendation from the Curriculum Committee in the Department, a student may substitute **CHEM 399** by a 3 cr. elective course and a 3 cr Master's project **CHEM 390)**.

1. A Master's thesis represents the experimental or theoretical research studies that are anticipated to be completed within one academic year. However, if needed, this period can be extended for another year.
2. A Master's project represents the experimental or theoretical research studies that are anticipated to be completed within one semester. However, if needed, this period can be extended for another semester.

FOURTH YEAR

Semester 7

Course Code	Course Title	Credit
CHEM 300	Advanced Analytical Chemistry	3
CHEM 302	Advanced Organic Chemistry	3
	Elective I	3
		9

Semester 8

Course Code	Course Title	Credit
CHEM 304	Advanced Physical Chemistry	3
CHEM 306	Advanced Inorganic Chemistry	3
	Elective II	3
		9

FIFTH YEAR

Semester 9

Course Code	Course Title	Credit
	Elective III	3
CHEM 399	Master's Thesis	6
		9

Semester 10

Course Code	Course Title	Credit
CHEM 399	Master's Thesis	continued
	Elective IV	3
		3

COURSE DESCRIPTIONS

CHEM 300 ADVANCED ANALYTICAL CHEMISTRY 3.0: 3 cr. E

The course focuses on major separation techniques employed in chemistry, and illustrates the methodology applied for treating analytical data. Key issues will be covered in the areas of chromatography, extraction, electrochemical analysis and chemometrics. Optimization and qualification of several analytical tools will be also discussed.

CHEM 302 ADVANCED ORGANIC CHEMISTRY 3.0: 3 cr. E

Pinacol, Tiffeneau–Demjanov, Favorskii, Wolff, Curtius, Hofmann, Beckmann, Wittig, Benzylic, Schmidt, Sigmatropic rearrangement, Cope, Claisen, Allylic reactions, Fragmentation.

CHEM 304 ADVANCED PHYSICAL CHEMISTRY 3.0: 3 cr. E

The course is intended to provide the physical fundamentals of mass spectrometry (MS), nuclear magnetic resonance (NMR), X-ray diffraction (XRD) and interface chemistry. In-depth knowledge of these instruments, the interpretation of spectra and the applications (of such instruments) in different areas will be also revealed.

CHEM 306 ADVANCED INORGANIC CHEMISTRY 3.0: 3 cr. E

Reactions and descriptive chemistry of transition metal, organo-metallic and main group compounds. Chemistry of some of the less common elements, with correlations among structural, thermodynamic, kinetic, and chemical properties.

CHEM 320 ADVANCED POLYMER CHEMISTRY 3.0: 3 cr. E

New controlled polymerization methods for the synthesis of well defined materials. Some specialty polymers for future technologies (isomers, liquid crystals, active surfaces). Properties of common polymers in bulk. Crystallitic and amorphous polymers. Morphology. Mechanical, thermal and chemical properties. Polymer mixtures and composites. Soft polymer materials. Degradation and stabilizing of polymers.

CHEM 322 ADVANCED ORGANIC SYNTHESIS 3.0: 3 cr. E

Heterocyclic compounds, Organo-metallic compounds in organic synthesis, homogenous and heterogeneous catalysis, protection of functional groups, enols and enones: Michael and Robinson reactions, clean synthesis.

CHEM 324 PHYSICAL ORGANIC CHEMISTRY 3.0: 3 cr. E

Physical fundamentals of organic chemistry; thermodynamics, kinetics, molecular orbital theory, theory of concerted reactions, isotope effects, aromaticity, linear free energy relationships, acidity functions, photo- and free-radical chemistry.

CHEM 326 NUCLEAR CHEMISTRY 3.0: 3 cr. E

Properties of nucleons and nuclei, nucleus models, radioactivity, nuclear reactions, nuclear fission, nuclear reactors, detection and measurement of activity, applications of radioactivity, elements of radiation chemistry.

CHEM 328 SURFACE CHEMISTRY AND CATALYSIS 3.0: 3 cr. E

The structure of surfaces. Thermodynamics, dynamics and electrical properties of surfaces. The surface chemical bond. Catalysis by surfaces.

CHEM 330 ELECTROCHEMISTRY 3.0: 3 cr. E

Principles of electrochemistry and their relation to the newer Electro-Analytical methods. Electrochemistry applied to heterogeneous and homogeneous processes, with emphasis on cyclic voltammetry and AC polarography. Use of the Laplace transforms and infinite different methods. Students explore the kinetics and thermodynamics of fast reactions by computer simulation of electrochemical data.

CHEM 332 LAB-ON-A-CHIP: A REVOLUTION IN CHEMICAL AND BIOLOGICAL SCIENCES 3.0: 3 cr. E

State-of-the-art technology. Miniaturization of analytical techniques and instrumentation. Theory and applications. Downsizing Chemistry by introducing microchips. Benefits of miniaturization. Types of microchips, basic concepts and novel components used to construct the microchips as well as their applications. Micro-fluidics. Miniaturized total-analysis systems. DNA Micro-array Technology and its benefits

CHEM 334 BIOCHEMICAL TECHNIQUES AND INSTRUMENTATION 3.0: 3 cr. E

Theory and practice of advanced biochemical techniques. Topics may include buffer and reagent preparation, protein assay, protein purification, electrophoresis, enzyme kinetics, DNA isolation, and molecular visualization and modeling.

CHEM 336 CHEMISTRY AND BIOCHEMISTRY OF MACROMOLECULES 3.0: 3 cr. E

The course covers the basic concepts of molecular biology intended for discussion on the application of molecular techniques in the analysis and understanding of macromolecules (DNA, RNA, Proteins) as well as their diagnosis.

CHEM 338 SUPRAMOLECULAR CHEMISTRY 3.0: 3 cr. E

Starting from the basics, this course introduces the concepts as well as the historical development of supramolecular chemistry and its applications. The course will focus on the bottom up approach to prepare self-assembled nanomaterials by non-covalent interactions, which are employed in life chemistry as well as in potential industrial uses. The course also covers the most useful synthetic strategies to build such complex systems and the most practical techniques needed by supramolecular chemists.

CHEM 340 LIQUID CRYSTALS AND THEIR APPLICATIONS 3.0: 3 cr. E

Liquid crystals combine the material properties of solids with the flow properties of liquids. They have provided new photonic applications from which the flat-panel liquid crystal displays technology (LCD). In this course, the fundamentals of liquid crystals science are introduced and explained revealing the different phases that can be generated and the different molecular architectures that affect liquid crystalline properties. The course also spotlights the various applications of the liquid crystalline materials (displays, memory devices, switches, lasers).

CHEM 342 MOLECULAR MODELING 3.0: 3 cr. E

Molecular Modeling implies the use of methods of calculation (mechanic or semi-empirical) allowing the chemists to determine the chart of the geometry or the configuration of the atoms in a molecule and to evaluate some physical properties.

CHEM 344 SURFACE ANALYSIS: PRINCIPLES, INSTRUMENTATIONS, AND TECHNIQUES **3.0: 3 cr. E**

This course provides the chemist with the chief tools used to analyze surfaces, and thin films. The focus will be towards the principles, instrumentations and applications of such techniques based on electronic, ionic, and X-ray sources. Furthermore, microscopic methods, such as, scanning tunneling microscopy (STM), and atomic force microscopy (AFM) will be discussed.

CHEM 346 ENVIRONMENTAL FATE AND ECOTOXICOLOGY OF POLLUTANTS 3.0: 3 cr. E

Major classes of pollutants; routes by which pollutants enter ecosystems; discharge into the atmosphere; quantification of release of pollutants; long-range movements and global transport of pollutants; fate of metal and radioactive isotopes; fate of organic pollutants; toxicity testing; risk assessment; biochemical and physiological effects of pollutants; biomarkers; catastrophic exposure, localized contamination incidents, law, trends and issues in pollution legislation.

CHEM 348 ENVIRONMENTAL BIOTECHNOLOGY **3.0: 3 cr. E**

Areas of application of biotechnology, microbiology; microbial determination; relationship to the environment, sampling for environmental monitoring; physical, chemical and biological analysis; sewage treatment methods and disposal; modifications to existing processes; agricultural waste and industrial waste; bioremediation and phytoremediation; biotechnology and sustainable technology; microbial polymers and plastics; industrial processes and clean technology; natural resource recovery; agricultural biotechnology; biotechnology of the marine environment.

CHEM 350 ADVANCED TOPICS IN GREEN CHEMISTRY **2.1: 3 cr. E**

The course concentrates on discussion of real cases in green chemistry based on recent scientific articles and books (2 credits). Students' research (outside the class periods) and oral presentations (inside the class periods) on advanced topics in green chemistry related to recent publications in scientific journals and/or books (1 credit tutorial).

CHEM 380 Advanced Topics in Chemistry **3.0: 3 cr. E**

CHEM 390 Master's Project **3 cr. E**

CHEM 399 Master's Thesis **6 cr. E**

DEPARTMENT OF COMPUTER SCIENCE

The Department of Computer Science provides a fundamental education to prepare students for positions in industry, government, education, or commerce, or to pursue graduate study. It offers the following degrees:

- BS in Computer Science with 2 options:
  - o Software Engineering
  - o Information Systems
- BS in Computer Science with Teaching Diploma
- MS in Computer Science, with 2 options:
  - o Networking and Communications
  - o Information Systems

BACHELOR'S DEGREE in COMPUTER SCIENCE

Option SOFTWARE ENGINEERING

Program Features

Software Engineering is the discipline of developing and maintaining software systems that behave reliably and efficiently, are affordable to develop and maintain, and satisfy all the requirements that customers have defined for them. This is achieved with an integration of the Mathematics principles and Computer Science with the Engineering practices.

Learning outcomes

Graduates are expected to:

- Effectively apply knowledge of programming, algorithms, data structures, and software engineering to the development of software systems
- Communicate technical concepts effectively in both written documents and oral presentations
- Design and analyze software at all levels and make informed, sound, software design decisions
- Understand the social and ethical issues that arise in their work and deal with them professionally
- Understand the importance of all phases of the software lifecycle, with emphasis on the need to plan for change and continuously vie to improve the software process
- Work effectively in a software development team and with other professionals
- Appreciate the need for lifelong learning and adapt to rapid technological changes
- Be able to analyze, design, verify, validate, implement, apply and maintain software systems.

Career Opportunities

Software Engineering graduates excel as software developers and can quickly become experts at developing large scale software, working in teams and producing robust products that meet customer needs. They are prepared to work in a diverse marketplace and find opportunities in a wide variety of careers in IT, business, education, government and the non-profit sectors.

BACHELOR'S DEGREE in COMPUTER SCIENCE

Option INFORMATION SYSTEMS

Program Features

The Information Systems option combines mastery of management processes and a thorough knowledge of Information Technology, offered in a dynamic framework, a multidisciplinary approach and state-of-the-art laboratories.

Learning Outcomes

Specific objectives of the Information Systems option are to produce graduates who can:

- Analyze, design, implement, and test a solution to real world problems, including appreciating the value of efficient design created to meet clearly developed requirements
- Write technical documents such as specifications, design and use manuals in appropriate formats
- Orally present deliverables related to their specialization
- Blend their Software Engineering abilities with skills specific to Management to solve problems in Business
- Have a basic understanding of information science and business and their linkages to key technologies
- Have an enthusiasm for the educational process and for professional practices
- Work in interdisciplinary groups consisting of non-technical and technical members.

Career Opportunities

Information Technology is used practically in all fields of administration, from small businesses to large corporations and from governmental and non-governmental organizations to private institutions, such as hospitals, schools, universities, etc.

MASTER'S DEGREE in COMPUTER SCIENCE
Option NETWORKING and COMMUNICATIONS

Program Features

This is a 30-credit, 3-semester graduate degree, including a final project, suitable for BS holders in either Computer Science or related Engineering disciplines. The program offers a rich theoretical content applied in state-of-the-art laboratories.

Learning Outcomes

Specific objectives of the Networking option are to have graduates:

- Mastering networking principles and technologies to develop and manage networking solutions for business using industry standards
- Thoroughly grounded in networking and wireless standards, routing and switching concepts and other fundamental areas
- Equipped with expertise in planning, configuring and troubleshooting networks
- Equipped with an up-to-date understanding of network security practices
- Able to respond effectively and efficiently to current and emerging demands such as, but not limited to, wireless and security
- Able to communicate effectively both orally and in writing
- Able to apply research and problem-solving skills.

Career Prospects

Career opportunities for holders of the Master's Degree in Networking & Communications are widely available in institutions such as governmental and non-governmental organizations, local authorities, universities and cultural institutions as well as in banks, financial, industrial and commercial institutions.

MASTER'S DEGREE in COMPUTER SCIENCE
Option INFORMATION SYSTEMS

Program Features

The primary goal of the program is to meet the increasing demand for knowledgeable personnel who possess a balanced combination of technical and managerial skills. The interdisciplinarity of the program and its integration of the different fields help reducing the training needed by the graduates. Upon completing the first year, the student has the choice of selecting one of two alternative paths: A Thesis (6 credits) or a Project (3 credits) with one elective (3 credits). Selecting the thesis path would necessitate extending the registration for a fourth semester, making the duration of the program 2 years. The thesis option normally prepares students for doctoral studies or for a career with a more research-oriented flavor.

Learning Outcomes

Specific objectives of the Information Systems option are to have graduates that are able to:

- Focus on organizational and managerial issues at the level of the enterprise as a whole in order to support

an integrated view of the functional applications that meet business needs

- Understand and evaluate how to align IS needs with the strategies and policies of the enterprise
- Manage the IS functions as they relate to the enterprise's policy and strategies on a day-to-day basis
- Develop an integrated enterprise architecture consonant with organizational policies and strategies, including the evaluation and selection from architectural and platform choices, priorities, and policies
- Manage the IS function taking into consideration the implications of digitization ranging from security to ethics, to telecommuting to near-shoring and offshoring.

Career Prospects

Graduates of this program are expected to fill a growing demand for professional IT managers who have the technical knowledge, business acumen, and management skills to deliver IT solutions in a rapidly changing business environment.

BACHELOR'S DEGREE in COMPUTER SCIENCE
Option SOFTWARE ENGINEERING

FIRST YEAR

Semester 1

Course Code	Course Title	Credit
CSIS 200	Introduction to Computing	3
ENGL 203	English Communication Skills III	3
MATH 200	Calculus I	3
MATH 211	Linear Algebra I	3
ACCT 202	Survey of Accounting & Finance	3
		15

Semester 2

Course Code	Course Title	Credit
CSIS 201	Programming Methodology	3
CSIS 270	Databases	3
CSIS 222	Networking Principles and Design	3
MATH 246	Probability	3
ENGL 204	English Communication Skills IV	3
		15

SECOND YEAR

Semester 3

Course Code	Course Title	Credit
CVSQ 201	Early Formation of Civilization	3
CSIS 204	Object Oriented Programming	3
CSIS 210	Computer Organization & Assembly Language	3
CSIS 271	Database Technologies	3
MATH 230	Numerical Analysis	3
Elective		3
		18

Semester 4

Course Code	Course Title	Credit
CVSQ 202	The Religious Experience	3
CSIS 202	Data Structures	3
CSIS 220	Systems Programming	3
CSIS 231	Java Technology	3
CSIS 223	Network Configuration and Programming	3
Elective		3
		18

{Four-Week Training followed by a report submitted to the Department}

THIRD YEAR

Semester 5

Course Code	Course Title	Credit
CVSQ 203	Introduction to Modernity	3
CSIS 276	Systems Analysis and Design	3
CSIS 221	Operating Systems	3
CSIS 207	Senior Topics in Computer Science	3
CSIS 250	Computer Graphics	3
		15

Semester 6

Course Code	Course Title	Credit
CVSQ 204	Contemporary Challenges in the Arab World	3
CSIS 278	Software Engineering and Quality Assurance	3
CSIS 260	Introduction to Artificial Intelligence	3
CSIS 290	Senior Project	3
Elective		3
		15

TOTAL : 96 credits

Major Courses:

The following courses are counted in the major average:

CSIS 200, CSIS 201, CSIS 202, CSIS 204, CSIS 207, CSIS 210, CSIS 220, CSIS 221, CSIS 222, CSIS 223, CSIS 231, CSIS 250, CSIS 260, CSIS 270, CSIS 271, CSIS 276, CSIS 278, CSIS 290, MATH 200, MATH 211, MATH 230, MATH 240 and MATH 246

Elective Courses

Free electives.

BACHELOR'S DEGREE in COMPUTER SCIENCE

Option INFORMATION SYSTEMS

FIRST YEAR

Semester 1

Course Code	Course Title	Credit
ACCT 202	Survey of Accounting and Finance	3
CSIS 200	Introduction to Computing	3
CSIS 274	End User Computing	3
ENGL 203	English Communication Skills III	3
MATH 201	Mathematics for Computation	4
		16

Semester 2

Course Code	Course Title	Credit
CSIS 201	Programming Methodology	3
CSIS 270	Databases	3
MATH 240	Probability and Statistics	4
CSIS 222	Networking Principles and Design	3
ENGL 204	English Communication Skills IV	3
LISP200	Library Use and Research Methods	1
		17

SECOND YEAR

Semester 3

Course Code	Course Title	Credit
CVSQ 201	Early Formation of Civilization	3
CSIS 204	Object Oriented Programming	3
CSIS 271	Database Technologies	3
MATH 261	Operations Research	3
ECON 201	Survey of Economics	3
		15

Semester 4

Course Code	Course Title	Credit
CVSQ 202	The Religious Experience	3
CSIS 202	Data Structures	3
CSIS 231	Java Technology	3
CSIS 272	Database Systems Management	3
MGMT 220	Principles of Management	3
MRKT 220	Principles of Marketing	3
		18

{Four-Week Training followed by a report submitted to the Department}

THIRD YEAR

Semester 5

Course Code	Course Title	Credit
CVSQ 203	Introduction to Modernity	3
CSIS 276	Systems Analysis and Design	3
CSIS 207	Senior Topics in Computer Science	3
CSIS 232	Electronic Commerce	3
Elective		3
		15

Semester 6

Course Code	Course Title	Credit
CVSQ 204	Contemporary challenges in the Arab World	3
CSIS 278	Software Engineering and Quality Assurance	3
CSIS 277	Information Systems Management	3
CSIS 290	Senior Project	3
Elective		3
		15

TOTAL : 96 credits

Major Courses:

The following courses are counted in the major average:

CSIS 200, CSIS 201, CSIS 202, CSIS 204, CSIS 207, CSIS 222, CSIS 231, CSIS 232, CSIS 270, CSIS 271, CSIS 272, CSIS 274, CSIS 276, CSIS 277, CSIS 278, CSIS 290, MATH 201, MATH 240, MATH 261, ACCT 202, ACCT 220, ECON 201, MGMT 220, MRKT 220.

Elective Courses

Free electives.

MASTER'S DEGREE in COMPUTER SCIENCE
Option NETWORKING and COMMUNICATIONS

Semester 1

Code	Course Title	Credit
CSIS 321	Computer Networks: Architecture & Protocols	3
CSIS 325	Data Communication and Telecommunication	3
CSIS 305	Distributed Programming	3

Semester 2

Code	Course Title	Credit
CSIS 374	Advanced Database Applications	3
CSIS 320	Advanced Operating Systems	3
CSIS 329	Network Management & Security	3
	Elective	3

Summer Training

Eight (8) weeks of field experience in networking companies

Semester 3

Code	Course Title	Credit
CSIS 355	Multimedia Communications	3
CSIS 390	Project	3
	Elective	3

MASTER'S DEGREE IN COMPUTER SCIENCE
Option INFORMATION SYSTEMS

Semester 1

Code	Course Title	Credit
CSIS 322	IT Infrastructure	3
CSIS 374	Advanced Database Applications	3
MATH 343	Time Series and Forecasting	3

Semester 2

Code	Course Title	Credit
CSIS 373	Information Systems Policy	3
CSIS 376	Human-Computer Interaction	3
CSIS 379	Emerging Technologies and Issues	3
BUSN 322	Game Theory	3

Summer Training

Eight (8) weeks of field experience in networking companies

Path 1

Semester 3

Code	Course Title	Credit
ISYS 330	Enterprise Systems	3
CSIS 390	Project	3
	Elective	3

Path 2

Semester 3

Code	Course Title	Credit
ISYS 330	Enterprise Systems	3
CSIS 399	Thesis	6

Semester 4

Code	Course Title	Credit
CSIS 399	Thesis (Continued)	

COURSE DESCRIPTIONS

CSIS 200 INTRODUCTION TO COMPUTERS & PROGRAMMING 3.3: 3 cr. E

This course provides students with a foundation of computing and algorithmic principles. It is intended to establish concrete skills in the constructs and algorithmic methods as an essential part of the software development process. Teaching is carried out by way of a lecture-and-homework agenda that emphasizes the design, construction, and analysis of algorithms, coupled to a lab-and-project agenda focused on the application of those principles in the use of software packages. Lecture-and-homework topics include: pseudo-language, algorithms, programming life cycle, procedural programming versus object-oriented programming, abstraction, objects and classes, decision constructs and repetition structures. Lab-and-project topics include: Windows and UNIX/Linux environments, databases, problem solving using spreadsheets and/or Matlab.

CSIS 201 PROGRAMMING METHODOLOGY 3.0: 3 cr. E

This course introduces students to the foundation of the software development process. Programming is introduced as a problem solving activity by introducing students to a full-featured programming language (Java). Students learn all the skills in program design, implementation, and debugging necessary to solve computational problems. Emphasis is put on effective use of abstraction and the acquisition of software development skills. Topics include: Flow control, object-oriented analysis and design, abstraction, methods, arrays, encapsulation, inheritance.

Prerequisite: CSIS 200.

CSIS 202 DATA STRUCTURE 3.0: 3 cr. E

The aim of this course is to provide an introduction to computer algorithms and data structures, with an emphasis on foundational material. Students will learn how to model data in a computer, how to specify and use standard ADTs, and how to implement such ADTs with standard data structures. An object-oriented approach to data structures and algorithms using C++ language is adopted. Topics include: Precondition/Postcondition specifications, Time/Complexity analysis techniques, different data structure such as array and dynamic arrays, pointer based structure, and linked list, stacks, queues, recursive thinking, trees, sorting and searching techniques and graphs.

CSIS 203 FUNCTIONAL PROGRAMMING 3.0: 3 cr. E

Programming with functions, top-down decomposition and stepwise refinement, higher-order functions, referential transparency, Lazy evaluation. The application language is LISP.

Prerequisite: CSIS 200.

CSIS 204 OBJECT-ORIENTED PROGRAMMING 3.0: 3 cr. E

This is an advanced programming course. It covers the programming paradigms with examples, and the transition between modular programming and object-oriented programming. The course also covers data categorization and subdivision into classes and discusses inheritance of operations from one class to another. The language used is C++.

Prerequisite: CSIS 201.

CSIS 205 FORMAL SPECIFICATION & VERIFICATION OF PROGRAMS 3.0: 3 cr. E

Mathematical and logical backgrounds, program specifications, program derivation, theories and tools for program derivation, proofs of correctness.

Prerequisite: CSIS 202.

CSIS 206 PRINCIPLES OF PROGRAMMING **3.0: 3 cr. E**

Informal specifications of programs, program development as a problem solving activity, development of algorithms and implementations, practical programming experience through a conventional programming language. Offered only to Civil, Mechanical and Chemical Engineering undergraduate students.

CSIS 207 SENIOR TOPICS IN COMPUTER SCIENCE **3.0: 3 cr. E**

The course covers topics of current interest in Computer Science that do not fall into a standard subarea of the curriculum. The course load involves lectures and a project. Through this project students will get hands-on experience, designing and implementing an interesting application. It is expected that the course will help students develop software design, analysis and implementation abilities through working with innovative tools and methodologies in some emerging area of high importance. Course content is revised and topics are selected on a yearly basis.

CSIS 210 COMPUTER ORGANIZATION & ASSEMBLY LANGUAGE **3.0: 3 cr. E**

An introduction to computer organization and assembly programming covering the general structure of a microprocessor-based computer with detailed description of the data, address, and control buses used on the 8086 microprocessor. It also covers the assembly process and the instruction set of the 8086. In addition, it discusses I/ O and memory management.

Prerequisite: CSIS 200.

CSIS 213 COMPILER DESIGN & CONSTRUCTION **3.0: 3 cr. E**

Overview of compilers including component functions and classification. Symbol table construction and operations; lexical analysis, parsers, code generation, and error handling. Intermediate code generation and compiler generators.

Prerequisite: CSIS 202.

CSIS 214 COMPUTER ARCHITECTURE **3.0: 3 cr. E**

A quantitative approach to the study of computer architecture with emphasis on the basics of the RISC processors. Instructions set principles, pipelining, and principles of memory-hierarchy design, I/O, and storage systems.

Prerequisite: CSIS 210.

CSIS 220 SYSTEMS PROGRAMMING **3.0: 3 cr. E**

The UNIX operating system is introduced as a programming environment. Topics include: the C language and libraries, history and overview of the UNIX operating system, the file structure, the shell, graphical user interfaces, the vi editor, programming the Bourne, the C and the Korn shell, UNIX utility programs, and UNIX networking.

Pre-requisite: CSIS 210.

CSIS 221 OPERATING SYSTEMS **3.0: 3 cr. E**

This course is a comprehensive survey of operating systems principles. Topics covered include: process description and control, threads, process and disk scheduling, file and memory and I/O management, concurrency, networking and distributed processing, security.

Prerequisite: CSIS 220 (or Advisor's Permission).

CSIS 222 PRINCIPLES OF COMPUTER NETWORKING AND COMMUNICATION 3.0: 3 cr. E

This course is an introduction to network principles and network design. Topics include: Basic concepts and terminology of computer networks, networking models and theory, networking protocols, LAN, WAN, MAN, wireless and mobile network technologies, network performance, network security, layers of the Internet Protocol Suite (the TCP/IP family of protocols), Internet addressing (IPv4, IPv6), and network applications and services (such as DNS, HTTP, peer-to-peer networks, web servers, VPN, openSSL.)

Prerequisite: CSIS 200.

CSIS 223 NETWORK CONFIGURATION AND PROGRAMMING 3.0:3 cr. E

This course provides a foundation of network administration including account administration, resource allocation and optimization, and service management. Strategies for maintaining robust and secure networks are explored. Topics include, but are not limited to: Network administration and configuration, network management (SNMP), network security, access controls, error correction, routing protocols, congestion control (TCP, UDP), selection of topics including DHCP, ICMP, VPNs, and multicast. Programming assignments include developing client and server software using sockets, RMI or CORBA.

Prerequisite: CSIS 222.

CSIS 230 INTRODUCTION TO CONCURRENT AND DISTRIBUTED PROCESSING 3.0: 3 cr. E

Design and analysis of concurrent programs with emphasis on those used for parallel and distributed processing. Mutual exclusion and deadlock detection. Communication and synchronization. Computational models: shared memory and message passing.

Prerequisite: CSIS 220.

CSIS 231 JAVA TECHNOLOGY 3.0: 3 cr. E

This course introduces Java as a technology and a development and deployment platform (J2SE). It provides students with the skills to create applications that leverage the object-oriented features of Java, such as encapsulation, inheritance, and polymorphism. The course introduces students to GUI programming, multithreading, networking, and event-driven programming using Java technology GUI components. Students will develop classes to connect to SQL database systems by using the core aspects of JDBC API. Other topics include: Exception handling, multi-threading, RMI, two-tier and three-tier Java technology applications.

Prerequisite: CSIS 204.

CSIS 232 ELECTRONIC COMMERCE 3.0: 3 cr. E

The use of multimedia and the web for commercial applications is a vital opportunity. The course highlights the major areas of applications by selecting and analyzing real life examples. Students manipulate and design web pages using standard software packages. A term project is required.

Prerequisite: CSIS 270.

CSIS 240 SEMANTICS OF PROGRAMMING LANGUAGES 3.0: 3 cr. E

Methods of defining programming language semantics: axiomatic, denotational, and operational semantics.

Prerequisite: CSIS 202.

CSIS 250 COMPUTER GRAPHICS **3.0: 3 cr. E**

An introduction to computer graphics. The PHIGS and GKS graphics standards; geometrical transformation in 2D and 3D; viewing in 3D; projection; representing curves and surfaces; visible surface determination; advanced modeling techniques (factual models, spline, Bezier); color theory, realism, and rendering; elimination and shading.

Prerequisite: CSIS 202, MATH 200, MATH 212.

CSIS 251 COMPUTER GRAPHICS DESIGN I **3.0: 3 cr. E**

The student learns how to produce different kinds of illustrations and posters using computer software: advertising art, technical drawing, book illustration, and map production. Topics covered include: drawing, transformations, layers, color palette, 3D drawing, perspective, light, rendering, and texture. (Some projects will involve the use of OPENGL). Softwares used to design projects are: Corel Draw, Illustrator, 3D max and Freehand.

CSIS 252 COMPUTER GRAPHICS DESIGN II **3.0: 3 cr. E**

This course shows how professional artists use computer software (such as Photoshop or Painter) to manipulate, edit, and enhance scanned images to create a variety of special effects using artistic filters (such as KAI's power tools plug-in filter). Topics covered include: image editing, image enhancement, layers, construction of color palette, image mode (RGB, CMY,) light effects, transparency, mask, brushes, texture, and morphing.

CSIS 253 COMPUTER GRAPHICS DESIGN III **3.0: 3 cr. E**

This course permits students to acquire a good knowledge of multimedia technologies. The student learns through practical projects to edit and produce video clip with sound and animation. Topics include video morphing (dynamic imaging). The student studies the programming language LINGO for Macromedia Director to make the projects truly interactive. (Adobe Premiere will be available for these projects).

Prerequisites: CSIS 251/252.

CSIS 260 INTRODUCTION TO ARTIFICIAL INTELLIGENCE **3.0: 3 cr. E**

Overview of methods used in Artificial Intelligence selected from knowledge representation, search techniques, theorem proving, expert systems, and natural language understanding.

CSIS 270 DATABASES **3.0: 3 cr. E**

Data, DBMS architecture, schema and sub-schema, levels of data representation, database system life cycles. Relations within database architecture. Decomposition, normalization, hierarchy, and network. Data description language (DDL). Data manipulation language (DML); query languages and query optimization in centralization systems. Database security, integrity, and concurrence.

CSIS 271 DATABASE TECHNOLOGIES **3.0: 3 cr. E**

The course is designed as a second undergraduate course in databases. It is intended to cover both theory and application issues. Emphasis is placed on implementation more than design. Topics included: Database servers, transaction definition and properties, concurrency control, buffer management, reliability, query optimization, distributed architectures, and interoperability.

Prerequisite: CSIS 270.

CSIS 272 DATABASE SYSTEMS MANAGEMENT **3.0: 3 cr. E**

The course is an advanced one in database technologies and a continuation of the course dealing with database design. Topics included are: Storage and file structure, indexing and hashing, query processing, transaction concept, concurrency control, and recovery systems. Open only for seniors.

Prerequisite: CSIS 270.

CSIS 273 PERSONAL COMPUTING FOR APPLIED SCIENCES **3.0: 3 cr. E**

This course helps the student become a power user of several software packages used in daily problem solving. Topics covered include: personal productivity tools, statistical software for data analysis, database querying and Internet use. The course employs a combination of lecture-based delivery of material and experimental hands-on problem solving workshops.

CSIS 274 END USER COMPUTING **3.0: 3 cr. E**

This course helps the student become a power user of several software packages used in business problem solving. Topics covered include: personal productivity tools, what-if analysis, business charting and graphing, Internet browsing, and web page creation and maintenance. The course employs a combination of lecture-based delivery of material and experimental hands-on problem solving workshops.

CSIS 276 SYSTEMS ANALYSIS & DESIGN **3.0: 3 cr. E**

Analysis concepts (fact-finding, interview, feasibility study, user requirements, structured system analysis, documentation). Design concepts (design of I/O, file specification, database, algorithms, software and hardware specifications). Project management. Practical applications. Schedule and cost.

Prerequisite: CSIS 270.

CSIS 277 INFORMATION SYSTEMS MANAGEMENT **3.0: 3 cr. E**

The course is an advanced study in Information Systems requiring a solid background in systems analysis and design, and information technology. Professional issues are treated at both theoretical and practical levels. Topics covered: the managerial functions, the role of information, its sources and pricing, project management, IT sourcing, TQM in Information Systems management, IT role in organizational change. Project management.

Prerequisite: CSIS 276.

CSIS 278 SOFTWARE ENGINEERING AND QUALITY ASSURANCE **3.0: 3 cr. E**

The course covers methods and tools for achieving software quality assurance at various levels of a software system including at the module, subsystem, and system levels. State of the art tools and techniques are covered. The course will prepare students to develop a software quality assurance program in structured, organized ways.

Prerequisite: CSIS 276.

CSIS 280 INTRODUCTION TO THE THEORY OF COMPUTATION **3.0: 3 cr. E**

This course introduces the basics of the theory of computation. Topics covered include: automata theory and formal languages, computability by Turing machines and recursive functions, computational complexity, and mathematical logic.

Prerequisite: CSIS 200.

CSIS 290 SENIOR PROJECT **3.0: 3 cr. E**

The purpose of the course is to provide an opportunity to finish a project under the direct supervision of a faculty member. The project should cover a practical aspect of a research for students to work on its design from conception through implementation and testing. Students meet regularly with the instructor to track technical and project management issues. Complete project documentation, written reports and oral presentations are required.

Prerequisite: Advisor consent.

CSIS 295 DIRECTED STUDY IN DATABASES **1.0: 1 cr. E**

The course's aim is to develop in students their mastery of new database technologies, and their ability to independently update their knowledge and its applications (forms, reports…). Tutorials on one specific database area, taking into consideration the new developments in technology, and lab notes will be provided by the Department. The course supervisor assigns weekly meetings with the students for follow up.

Prerequisite: CSIS 271.

CSIS 296 DIRECTED STUDY IN NETWORKING **1.0: 1 cr. E**

The course's aim is to develop in students their mastery of new techniques and methods in networking and their applications. Tutorials and lab notes are provided by the Department. A supervisor is assigned for the course. The content might vary from one semester to another, taking into consideration the new developments in technology. There are no set lectures; instead, the students and the supervisor meet once a week for follow up.

Prerequisite: CSIS 222.

CSIS 297 DIRECTED STUDY IN PROGRAMMING **1.0: 1 cr. E**

The course's aim is to develop in students their ability to independently update their knowledge through tutorials and lab notes. A supervisor is assigned for the course. The offered language is selected by the Department taking into consideration the market demand. Instead of lectures, the students and the supervisor meet once a week for follow up.

Prerequisite: CSIS 204.

CSIS 298 SEMINARS IN COMPUTING **1.0: 1 cr. E**

This course provides an opportunity to meet with experts or people working on new developments in the computing field. Upon completion, students should be able to demonstrate an understanding of a specific area of study through a project, paper and a presentation.

Prerequisite: Senior standing and advisor consent.

CSIS 305 DISTRIBUTED PROGRAMMING **3.0: 3 cr. E**

This course aims to develop an in-depth understanding of both the programming tools and the paradigms necessary to develop complex distributed systems. It covers the fundamental concepts and techniques of distributed programming needed to build reliable, scalable, and highly flexible and dynamic distributed computing framework with emphasis on systems-level technologies that create a homogeneous view of the network. The model introduced in this course leverages the student's ability, as a programmer, to safely move code during runtime and make it possible to add new services or devices with minimum configuration requirements.

CSIS 310 REAL-TIME COMPUTATIONS 3.0: 3 cr. E

Software design in real-time systems, software design methods, verification and validation of real-time systems, real-time structured analysis and design, applications of real-time systems, steps for applying real-time systems, design of interactive and distributed systems with real-time methods. Parallel computations.

CSIS 311 ADVANCED COMPILER CONSTRUCTION 3.0: 3 cr. E

Advanced topics in the design and implementation of programming language translators. Data flow analysis and optimization, code generation and register allocation, attribute grammars and their evaluation, translation within programming environments, and the implementation of advanced language features.

CSIS 312 ADVANCED COMPUTER ARCHITECTURE 3.0: 3 cr. E

A quantitative study of RISC architecture. Advanced pipelining and instruction-level parallelism (ILP): Hazards detection, and solutions such as using dynamic scheduling, dynamics hardware, prediction and compiler support for exploring ILP. Memory-hierarchy design: cache issues and virtual memory. Multiprocessors.

CSIS 320 ADVANCED OPERATING SYSTEMS 3.0: 3 cr. E

This course explores both advanced topics and in-depth design and analysis of operating systems concepts. Advanced topics may include security and access control, object and capability-based systems, multiprocessor support, and fault-tolerant systems, transaction processing systems, and distributed operating systems. Laboratory sessions include programming and modification of operating systems components.

CSIS 321 COMPUTER NETWORKS: ARCHITECTURE & PROTOCOL 3.0: 3 cr. E

The course introduces the design of protocols for error recovery, reliable delivery, routing, and congestion control, store-and-forward networks, satellite networks, local-area networks, and locally distributed systems. Case studies of networks, protocols, and protocol families. Emphasis is on software design issues in computer communication. In addition, students are exposed to fundamental knowledge and hands-on exercise of the UNIX networking software design and in-depth client/server applications development.

CSIS 322 IT INFRASTRUCTURE 3.0: 3 cr. E

The course aims at enabling the students to develop an integrated technical architecture (hardware, software, networks, and data) to serve organizational needs in a rapidly changing competitive and technological environment. Topics covered comprise telecommunications fundamentals including data, voice, image, and video. The concepts, models, architectures, protocols, standards, and security for the design, implementation, and management of digital networks, server architectures, server farms, cluster computing, and grid computing,. Storage area networks and network attached storage, data center design and implementation.

CSIS 324 TELECOMMUNICATION SYSTEM PRINCIPLES 3.0: 3 cr. E

This course with its integrated lab gives Computer Science students the understanding of both analog and digital communication principles in general and their direct applications on networking devices and systems. Different signaling, coding, and transmission methods will be demonstrated in the lab.

CSIS 325 DATA COMMUNICATION & TELECOMMUNICATIONS 3.0: 3 cr. E

Data communications, networks and protocols are discussed in this course. Topics include networks and protocols as well as the integration of those networks, the protocols used for signaling in the telecommunication networks. It aims to make the students familiar with the principal signaling protocols implemented in the general telecommunication networks.

CSIS 326 TELECOMMUNICATION PROTOCOLS **3.0: 3 cr. E**

This course is directed towards the protocols used for signaling in the telecommunication networks and uses the GSM network as an example. It aims to make the students familiar with the principal signaling protocols implemented in the general telecommunication networks. The main signaling protocols covered are ISDN, SS7, ATM and WAP.

Prerequisite: CSIS 325 or advisor's permission.

CSIS 327 NETWORK PROGRAMMING **3.0: 3 cr. E**

This course gives the students a fundamental knowledge and hands-on exercise of the UNIX networking software design and client/server applications development. Topics include the TCP/IP model, UNIX model, communication protocols, Berkeley sockets, Unix transport layer interface (TCP & UDP), client and server software design, introduction to Remote Procedure Calls, and network applications development.

CSIS 329 NETWORK MANAGEMENT & SECURITY **3.0: 3 cr. E**

This course is an introduction to network management and security. Topics include TMN concepts such as what is TMN, different TMN architectures, interfaces and reference points, as well as management protocols used in TMN such as ACSE, CMISE, SNMPv1, SNMPv2, and SNMPv3. Topics related to computer security will be also covered like encryption, digital signatures, s-http, ssl, Kerberos, and firewall.

CSIS 332 PARALLEL PROGRAMMING **3.0: 3 cr. E**

This course examines how to program parallel processing systems. Various parallel algorithms are presented to demonstrate different techniques for mapping tasks onto parallel machines. Parallel architectures to be considered are: SIMD (synchronous), MIMD (asynchronous), and mixed-mode (SIMD/MIMD hybrid). Emphasis will be on MPI parallel programming language.

CSIS 350 DIGITAL IMAGE PROCESSING **3.0: 3 cr. E**

Image acquisition and storage. Imaging geometry: transformations and camera models. Image transforms: Fourrier transform FT and FFT. Image enhancement: in frequency domain and spatial domain (filtering). Image restoration. Image compression. Image segmentation.

CSIS 351 ADVANCED COMPUTER GRAPHICS **3.0: 3 cr. E**

Morphing. 3D graphics. Bezier and B-Spline modeling surfaces. Hidden surface elimination algorithms (Painter algorithm, Robert algorithm, Z-buffer algorithm). Color theory, illumination, and shading models. Rendering. Texture. Introduction to ray tracing. Virtual Reality.

CSIS 352 COMPUTER VISION **3.0: 3 cr. E**

Introducing fundamental techniques for low-level and high-level computer vision. Examining image formation, early processing, boundary detection, image segmentation, texture analysis, shape from shading, photometric stereo, motion analysis via optic flow, object modeling, shape description, and object recognition. Models of human vision, subjective contours, visual illusions, apparent motion, mental rotations, and cyclopean vision.

CSIS 353 COMPUTER SIMULATION **3.0: 3 cr. E**

Introduction to simulation and examples. General principles and programming languages. Statistical models in simulation. Queuing models. Random number generation. Input modeling. Input data analysis. Verification and validation of simulation models. Output analysis for a single model. Alternative system designs. Virtual reality.

CSIS 355 MULTIMEDIA COMMUNICATIONS **3.0: 3 cr. E**

This course provides an overview of enabling multimedia communications technologies with a goal of better understanding the Internet's support for popular applications. Core topics will include voice over IP, media server architectures and enabling speech technologies, media server control interfaces, session control protocols, and multimedia applications support. In addition to the technologies covered, the course will provide insight to the commercial application of such technologies through consideration of market drivers and industry trends. Students taking the course will gain practical experience of developing applications using such technologies and enjoy exposure to a host of established and emerging Internet protocols.

CSIS 360 EXPERT SYSTEMS **3.0: 3 cr. E**

Symbolic computation. Knowledge representation formalisms. Associative nets and frame systems. Logic and inference. Automated reasoning. Heuristics. Representing Uncertainty. Quantitative models of plausible inference. Knowledge acquisition.

CSIS 361 ADVANCED ARTIFICIAL INTELLIGENCE **3.0: 3 cr. E**

Foundational issues in the construction of intelligent machines. The first half of the course covers forms of inductive inference, including machine learning, Bayesian networks, speech perception, machine vision, discussion of simulated annealing and genetic algorithms as optimization techniques for inductive inference. The second half covers deductive inference including reasoning from constraints, automated theorem proving, syntax and semantics of natural language, and the relationship between language and reasoning.

CSIS 362 NEURAL NETWORKS **3.0: 3 cr. E**

Neural dynamics: architecture and signals, activation model, unsurprised learning, surprised learning, architectures and equilibrium. The Hopfield model and recurrent networks. The self- organizing map. Adaptive resonance theory.

CSIS 363 OPTIMIZATION THEORY AND STOCHASTIC PROCESSES **3.0: 3 cr. E**

This course covers various methods in optimizations: Deterministic models, probabilistic models, and non-linear models. It discusses the concept of stochastic theory, Queuing systems, and Markov processes.

CSIS 364 NATURAL LANGUAGE & SPEECH PROCESSING **3.0: 3 cr. E**

This course is an introduction to computational linguistics and Speech. It requires the ability to program and assumes the student is familiar with basic computer science terminology. The course will be covering traditional foundations of computational linguistics areas such as finite-state methods, context-free and extended context-free models of syntax, parsing, and semantic interpretation; basics of more recent corpus-based and stochastic methods such as n-gram models, hidden Markov models, probabilistic grammars, and statistical methods for word sense disambiguation; traditional foundations of Speech Processing, computational phonology, models of pronunciation and spelling, text to speech and speech recognition; and some selection of application areas from among such topics as information retrieval, machine translation, computational psycholinguistics, and computational lexicography. Concepts taught in class will be reinforced in practice by hands-on programming assignments.

CSIS 370 DISTRIBUTED DATABASE SYSTEMS **3.0: 3 cr. E**

This course discusses the concept of distributed databases and handles data distribution, distributed query optimization and transaction concurrency control. It also deals with recovery, integrity, and security in distributed databases. In addition, it covers the concepts of next generation databases such as object-oriented databases, expert, and multimedia systems.

CSIS 371 SOFTWARE TESTING, VERIFICATION & VALIDATION 3.0: 3 cr. E

Software quality and diversity. Specification and design. Unit testing, including testing and its relationships to specifications, structural testing, error-oriented testing and analysis, and managerial aspects of unit testing and analysis. Verification and validation, including objectives, theoretical limitations, integration and systems testing, regression testing, simulation and prototyping, requirements tracing, proof of correctness, code reviews, and planning for verifications and validation. Formal verification methods including Hoare logic, weakest preconditions and others.

CSIS 372 DATA-FLOW ARCHITECTURE & LANGUAGES 3.0: 3 cr. E

The data-flow model as a basis for the design of parallel systems. Static and dynamic data-flow graphs. Implicit parallel programming using functional languages and their extensions. Higher-order functions, non-strictness, polymorphism. Nondeterministic programming and resource managers. Operational semantics and term rewriting systems. Optimizations and static analysis. Compiling into data flow graphs. Cryptography and computer security: design and use of cryptographic systems and cryptanalytic attacks; a history of cryptographic systems and the mathematics behind them; shift register sequences; random number generators: DES, public systems, and theft applications.

CSIS 373 INFORMATION SYSTEMS POLICIES 3.0: 3 cr. E

The course is intended to provide a layout of the IS policies foundation and the major areas they address. The course covers the process of starting, writing and maintaining the policies. Topics include: determination of policy needs, physical security, authentication and network, Internet, Email, viruses, encryption, software development, and acceptable use policies.

CSIS 374 ADVANCED DATABASE APPLICATIONS 3.0: 3 cr. E

This course handles the different aspects of data warehousing and data mining, data warehouse building, the difference between data warehouses and OLTP systems, the business requirements to build a data warehouse, information analysis: OLAP and ROLAP, star schema design and its variants.

CSIS 375 SOFTWARE ENGINEERING 3.0: 3 cr. E

The objective of this course is to provide a well-engineered software development process from software requirements and specification towards software delivery through system modeling, requirement specification, software design, software validation, and programming techniques and tools. Project planning and scheduling as well as software quality assurance for software development will be also discussed.

CSIS 376 HUMAN-COMPUTER INTERACTION 3.0: 3 cr. E

The course presents the techniques facilitating effective human-computer interaction including the basic elements, procedures, tools, and environments contributing to the development of a successful user interface. Design principles, guidelines, and methodologies for building, installing, managing, and maintaining interactive systems that optimize user productivity are reviewed. Topics include the multidisciplinary dynamics of human-computer interaction, current and projected developments in HCI research, usability engineering, computer-supported cooperative work, and strategies for implementing and evaluating human-computer dialogues.

CSIS 379 EMERGING TECHNOLOGIES AND ISSUES **3.0: 3 cr. E**

This course addresses emerging technologies, how they evolve, how to identify them and the effect of international, political, social, economic and cultural factors on them. Topics covered in the course include accuracy of past technology forecasts, how to improve them, international perspectives on emerging technologies, future organizational and customer trends, and forecasting methodologies including monitoring, expert opinion, trend analysis and scenario construction.

CSIS 380 ADVANCED THEORY OF COMPUTATION **3.0: 3 cr. E**

Computational complexity, abstract complexity, NP and PSPACE completeness, polynomial hierarchy, cryptography, Kolgomorov complexity, parallel algorithms, and random algorithms.

CSIS 390 GRADUATE PROJECT **3 cr**

CSIS 399 MASTER'S THESIS **6 cr**

ACCT 202, BUSN 230, BUSN 322, ECON 201, ECON 211, ECON 212, FINE 220, ISYS 330

Refer to the Faculty of Business and Management.

CVSQ 201, 202, 203, 204

Refer to the Civilization Sequence Program.

ENGL 203, 204

Refer to the Division of English Language and Literature.

MATH 200, 201, 212, 230, 240, 246, 261, 340

Refer to the Department of Mathematics.

DEPARTMENT OF ENVIRONMENTAL SCIENCES

The Department of Environmental Sciences offers a Bachelor of Science (B.Sc.) degree to students who have successfully undertaken a minimum of **96 credits** of required courses provided that they satisfy the standards set by the University and the Faculty.

The Department of Environmental Sciences trains students to understand the scientific basis of the environmental crisis, as well as the social, political and economic factors that affect environmental problems and solutions. The B.Sc. in Environmental Sciences provides breadth in the physical and life sciences and depth in a chosen area of scientific concentration, either aquatic resources or land resources management. Students can also choose the premedical track, and thus have the opportunity to pursue a career in Medicine. Initiated in the proper research and scientific approaches, our students have the option of becoming scientists, managers, planners, decision makers, community activists, or pursue graduate studies.

To graduate with a B.Sc. in Environmental Sciences, students must complete the following:

I. 50 credits of Major Courses (in Major & General Averages):

BIOL 201, 202, 203, 204, 207, 208, CHEM 202, 203, 292, EVSC 201, 207, 211, 213, 233, 234, 237, 239, 241, 243, 249.

II. 19 credits of Department-Required Courses (in General Average only):

CHEM 240, CSIS 273, MATH 203, 242, 272, PHYS 211, 212.

III. 18 credits of University-Required Courses (in General Average only):

ENGL 203, 204, CVSQ 201, 202, 203, 204.

IV. 09 credits of Elective Courses (in General Average only).

BACHELOR OF SCIENCE IN ENVIRONMENTAL SCIENCES

SAMPLE COURSE DISTRIBUTION

FIRST YEAR

Semester 1

Code	Course Title	Credit
BIOL 201	General Biology I	3
BIOL 202	General Biology I Lab	1
CHEM 202	Basic Chemistry	3
CHEM 203	Basic Chemistry Lab	1
CSIS 273	Personal Computer for Applied Sciences	3
ENGL 203	English Communication Skills III	3
MATH 203	Mathematics for Applied Sciences	3
		17

Semester 2

Code	Course Title	Credit
BIOL 203	General Biology II	3
BIOL 204	General Biology II Lab	1
CVSQ 201	Early Formation of Civilization	3
ENGL 204	English Communication Skills IV	3
MATH 272	Differential Equations for Applied Sciences	3
BIOL 207	General Ecology	3
BIOL 208	General Ecology Lab	1
		17

SECOND YEAR

Semester 3

Code	Course Title	Credit
PHYS 211	Fundamentals of Physics I	3
PHYS 212	Fundamentals of Physics I Lab	1
CHEM 240	Basic Organic Chemistry	3
EVSC 201	Environmental Sciences: Creating a Sustainable Future	3
EVSC 213	Restoration and Reclamation Ecology	3
EVSC 249	Writing for Environmental Professionals	3
		16

Semester 4

Code	Course Title	Credit
CHEM 292	Environmental Chemistry	3
MATH 242	Statistics for Applied Sciences	3
EVSC 237	Ecotourism Planning and Development	3
EVSC 233	Pollution Sources and Transport in Ecosystems	3
EVSC 234	Pollution Sources and Transport in Ecosystems Lab	1
CVSQ 202	The Religious Experience: The Sacred	3
		16

SECOND YEAR

Summer Semester

Code	Course Title	Credit
EVSC 211	Project Residency	3
		3

THIRD YEAR

Semester 5

Code	Course Title	Credit
EVSC 207	Coastal Zone Management	3
EVSC 239	Environmental Economics and Development	3
CVSQ 203	Introduction to Modernity	3
Electives		6
		15

Semester 6

Code	Course Title	Credit
CVSQ 204	Contemporary Challenges in the Arab World	3
EVSC 241	Natural Resources Planning and Policy	3
EVSC 243	Special Topics for Environmental Sciences	3
Electives		3
		12

Total Credits: 96

ENVIRONMENTAL SCIENCE ELECTIVE COURSES

I- Within the Department

IA- Aquatic Resources Concentration

Code	Course Title	Credit
EVSC 221	Assessment and Management of Fish Populations	3
EVSC 222	Assessment and Management of Fish Populations Lab	1
EVSC 247	Environmental Risk Perception	3

IB- Land Resources Concentration

Code	Course Title	Credit
EVSC 219	Wildlife Resources Management	3
EVSC 247	Environmental Risk Perception	3
EVSC 251	Protected Areas Management and Planning	3

IC- Additional Electives

Code	Course Title	Credit
EVSC 209	Introduction to Aquaculture	3
EVSC 235	Environmental Communication Approaches	3

II- Premedical Track

Students wishing to follow the Premedical track are requested to register for the following as electives:

Code	Course Title	Credit
CHEM 242*	Organic Chemistry I	3
CHEM 244*	Organic Chemistry II	3
CHEM 222	Analytical Chemistry or equivalent	3
PHYS 213	Fundamentals of Physics II	3
PHYS 214	Fundamentals of Physics II Lab	1

* Replace CHEM 240 (refer to the Department of Chemistry)

Students will have to register for three additional credits to the required number for the BS in Environmental Sciences.

Minor in Environmental Sciences

The Department of Environmental Sciences offers a Minor available to all Faculties at the University. This minor presents students the opportunity to focus on a growing national and international issue by taking only 18 credits at the Department. In addition to the 4 mandatory courses, students may choose between any of the remaining EVSC courses for completing the requirements for the Minor.

Refer to the table below for details.

Environmental Sciences Courses	Credit	Mandatory	Electives
EVSC 201: Creating a Sustainable Future	3	X	
EVSC 207: Coastal Zone Management	3		X
EVSC 209: Introduction to Aquaculture	3		X
EVSC 211: Project Residency	3		X
EVSC 213: Restoration and Reclamation Ecology	3		X
EVSC 219: Wildlife Resources Management	3		X
EVSC 221: Assessment and Management of Fish Populations	3		X
EVSC 222: Assessment and Management of Fish Populations Lab	1		X
EVSC 233: Pollution Sources and Transport in Ecosystems	3	X	
EVSC 235: Environmental Communication Approaches	3		X
EVSC 237: Ecotourism Planning and Development	3		X
EVSC 239: Environmental Economics and Development	3		X
EVSC 241: Natural Resources Planning and Policy	3	X	
EVSC 243: Special Topics for Environmental Sciences	3		X
EVSC 245: Marine Ecosystems	3	X	
EVSC 246: Marine Ecosystems Lab	1		X
EVSC 247: Environmental Risk Perception	3		X
EVSC 249: Writing for Environmental Professionals	3		X
EVSC 251: Protected Areas Management and Planning	3		X

COURSE DESCRIPTIONS

EVSC 100 INTRODUCTION TO ENVIRONMENTAL SCIENCE 3.0: 3 cr. E

This course will introduce the principles of basic-science and technology involved in processes of environmental change, pollution and protection of natural resources, and their implications to economic and human systems. (For Freshman students only).

EVSC 200 INTRODUCTION TO ENVIRONMENTAL STUDIES 3.1: 1 cr. E

The course introduces the student to the natural environment as it relates to people's lives. Aspects of the natural environment such as relationships between living and non living elements are discussed. The course also looks into environmental degradation and causes of pollution as well as ways to control them. The course will expose students to practical knowledge on environmental conversation which they will use in their daily lives as the course emphasizes the role of individuals in this area. (For Arts and Social Sciences students only).

EVSC 201 ENVIRONMENTAL SCIENCES: CREATING A SUSTAINABLE FUTURE 3.0: 3 cr. E

This course introduces students to the root causes of the environmental crisis, explains how to critically analyze all of the issues and competing viewpoints, provides in depth case studies and the latest statistics and scientific findings within the field. It examines the interactions between humans, social systems, and environmental damage across the globe, emphasizes the need for fundamental changes in human behavior and shows how systems can be redesigned to be sustainable.

Prerequisite: BIOL 207.

EVSC 207 COASTAL ZONE MANAGEMENT 3.0: 3 cr. E

This course introduces the student to a wide range of coastal environments including studies on rocky and sandy beaches. The course mixes theory and practice of coastal planning and management and demonstrates the importance of combining abstract and technical elements to achieve the best outcome for the coastal zone. Case studies will show examples of sound practice and differences in approaches around the world as well as the linkage between scales of coastal planning.

EVSC 209 INTRODUCTION TO AQUACULTURE 3.0: 3 cr. E

This course introduces the history of Aquaculture and its importance. Covers the fundamentals of engineering, nutrition, husbandry, diseases of cultured fishes and management of fish farms.

EVSC 211 PROJECT RESIDENCY 3.0: 3 cr. E

This course provides students with practical experience through their participation in on-going projects at organizations or institutions working in the fields of environment and development. Students are required to complete their residency over a period of two months under the supervision of a Faculty member.

EVSC 213 RESTORATION AND RECLAMATION ECOLOGY 3.0: 3 cr. E

Theory and case studies of disturbances, restoration and reclamation; character and processes of ecological systems; types of natural systems; types of disturbance and their impact; restoration and reclamation strategies for forests, deserts, watersheds, riparian zones, streams and rivers.

Prerequisite: BIOL 207.

EVSC 219 WILDLIFE RESOURCES MANAGEMENT 3.0: 3 cr. E

This course provides a study of the ecological principles governing wild animal populations and their habitats and the relationship of these principles to management programs and decisions. This course will introduce techniques that can be used at the different levels of wildlife management: field, regional, national, international.

Prerequisite: BIOL 207

EVSC 221 ASSESSMENT AND MANAGEMENT OF FISH POPULATIONS 3.0: 3 cr. E

This course introduces the theory and methods for estimating vital statistics of fish populations, the use of computers and statistical software to describe, analyze, and model attributes of fish populations, applied aquatic and fish ecology related to fisheries, the role of planning in fisheries management and the application of management tools and assessment of their efficacy.

EVSC 222 ASSESSMENT AND MANAGEMENT OF FISH POPULATIONS LAB 1.0: 1 cr. E

Laboratory sessions include giving the students hands on experience with different fishing techniques, tagging studies and fish population sampling. Involves ½ day field trips out at sea.

Co-requisite: EVSC 221.

EVSC 233 POLLUTION SOURCES AND TRANSPORT IN ECOSYSTEMS 3.0: 3 cr. E

This course introduces students to the different sources of pollutions and their means of transport in air, soil and water. Toxic action and fate of environmental pollutants, pollution control, eco-toxicological impact and standard testing methods will be covered.

Prerequisite: EVSC 201.

EVSC 234 POLLUTION SOURCES AND TRANSPORT IN ECOSYSTEMS LAB 1.0: 1 cr. E

Laboratory sessions and field trips to appropriate locations where the theoretical information can be consolidated into practical knowledge.

Co-requisite: EVSC 233.

EVSC 235 ENVIRONMENTAL COMMUNICATION APPROACHES 3.0: 3 cr. E

This course is based on cooperative learning activities. Students will learn how to organize environmental workshops and will get introduced to the theories and skills of alternative dispute resolution approaches, citizen participation strategies, public participation structures and dynamics, public policy decision making and implementation, risk communication, leadership styles and small group dynamics.

EVSC 237 ECOTOURISM PLANNING AND DEVELOPMENT 3.0: 3 cr. E

This course offers students a study of the fundamental concepts of nature based tourism planning and its contribution to community development. The course emphasizes the negative and positive economic, social, and environmental impacts of nature based tourism.

EVSC 239 ENVIRONMENTAL ECONOMICS AND DEVELOPMENT 3.0: 3 cr. E

Significant environmental destruction is caused by insufficient and incorrect attention to economics. Examples include subsidized prices for natural resources, neglect of external costs and benefits, and an excessive commitment to GNP growth and its neglect of the biophysical system in which the economy is embedded. In this class, students will be introduced to basic micro- and macroeconomics, distribution and trade, and the application of economic and social science principles and techniques to production, consumption, and valuation of natural resources. Students will also study differences between standard economists and the more interdisciplinary ecological economists.

EVSC 241 NATURAL RESOURCES PLANNING AND POLICY 3.0: 3 cr. E

Students will study scientific, environmental, social and institutional factors affecting planning and policy making, with a focus on community-based natural resource management. The course focuses on ecosystem-based planning and policy issues through development of a multiple-use plan. Sources and use of environmental data are discussed and illustrated. A general overview of environmental laws on the national scale will be attempted.

Prerequisites: EVSC 201, 239.

EVSC 243 SPECIAL TOPICS FOR ENVIRONMENTAL SCIENCES 3.0: 3 cr. E

This course introduces students to the new and current topics in the environmental sciences. Sessions will include exposure to environmental impact assessment methodologies, GIS systems, remote sensing and modeling and their applications to the environmental sciences and decision making. An overview of Lebanese environmental laws, policies and legal processes will also be covered.

Prerequisite: EVSC 201.

EVSC 245 MARINE ECOSYSTEMS 3.0: 3 cr. E

The course will present a broad overview of the field of marine biology. It will introduce the student to the marine environment, the physical forces governing marine organisms, the different marine ecosystems, the diversity of marine life, and techniques of investigation of marine systems.

Prerequisite: EVSC 201.

EVSC 246 MARINE ECOSYSTEMS LAB 1.0: 1 cr. E

This lab will provide students with hands-on experience in gathering and analyzing field data on marine ecosystems, and in gaining skills using a range of research tools and techniques.

Co- requisite: EVSC 245.

EVSC 247 ENVIRONMENTAL RISK PERCEPTION 3.0: 3 cr. E

Concepts, problems, and research related to the assessment and management of environmental hazards, current psychological, sociological and cultural theories in risk perception, communication and policy. Emphasis will be placed on the interplay between science, politics, law, cultural values and public opinion.

EVSC 249 WRITING FOR ENVIRONMENTAL PROFESSIONALS 3.0: 3 cr. E

This course introduces students to the principles and practice of writing skills required of environmental professionals. Students will develop proficiency in determining the purpose of a document, analyzing the audience; selecting, developing and organizing the information in an appropriate design, and writing clearly, precisely, and effectively.

Prerequisite: ENGL 203.

EVSC 251 PROTECTED AREAS MANAGEMENT AND PLANNING 3.0: 3 cr. E

This course introduces principles and methods of management of protected areas. Current principles and practices relevant to the planning of protected areas and recreational environments in wild settings. It includes the integration of biological and sociological criteria in the management of protected areas and recreational environments.

Prerequisites: BIOL 207, and EVSC 201, 241.

BIOL 201, BIOL 202, BIOL 203, BIOL 204, BIOL 207, BIOL 208
Refer to the Department of Biology.

CHEM 202, CHEM 203, CHEM240, CHEM 245, CHEM 248, CHEM 292, CHEM 293
Refer to the Department of Chemistry.

CVSQ 201, CVSQ 202, CVSQ 203, CVSQ 204
Refer to the Civilization Sequence Program.

CSIS 273
Refer to the Department of Computer Science.

ENGL 203, ENGL 204
Refer to the Division of English Language and Literature.

MATH 203, MATH 242, MATH 272
Refer to the Department of Mathematics.

PHYS 211, PHYS 212
Refer to the Department of Physics.

MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCES

The Department of Environmental Sciences, in collaboration with the Université du Littoral, Côte D'Opale (ULCO), France, offers a two year **Master of Science degree in Environmental Sciences**. Students successfully completing the requirements of the Program will receive a **Double Master's Degree**, one from each institution. Students must complete a total of **24 credits** or equivalent of core courses and **6 credits** or equivalent of either a **Master Research Thesis** or **Master Professional Project.**

Master Research Thesis/Master Professional Project

Upon admission, each student will be supported by an advisor to aid in the planning, implementation and successful completion of the requirements for graduation.

The Program offers students, in parallel to the regular **Master Research Thesis,** the option to graduate with a **Professional Master** by carrying out a **Master Professional Project**. Both alternatives are available in the last two semesters where the student will have to choose between the two options to fill the **6-credit** requirement for graduation. The **Master Research Thesis/Master Professional Project** can be carried out in collaboration with any Faculty/Institute within the UOB or ULCO as well as at external research centers, government institutions, industries and community-based organizations.

In addition, and **according to performance**, students will have the option to follow their Master Research Thesis/Master Professional Project **at the premises of ULCO in France**.

Courses

Semester I

Code	Course Title	Credit
EVSC 301	Advanced Ecology	3 cr
EVSC 303	Pollutants and their impacts on ecosystems	3 cr
EVSC 305	Climate Change: The Science and Local Impact of a Global Environmental Crisis	3 cr

Semester II

Code	Course Title	Credit
EVSC 311	Principles of Environmental Remediation and Restoration	3 cr
EVSC 313	Environmental Statistics: Methods and Research	3 cr
EVSC 315	Advances in Coastal Zone Management	3 cr

Semester III

Code	Course Title	Credit
EVSC 321	Air Pollution Impacts and Analysis	3 cr
EVSC 331	Environmental Management and Policy	3 cr

Semester IV

Code	Course Title	Credit
EVSC 390	Master's Professional Project	6 cr
or		
EVSC 399	Master's Thesis	6 cr

COURSE DESCRIPTIONS

EVSC 301 ADVANCED ECOLOGY 3.0: 3 cr. E

Students will study the interaction of organisms with their environment, the basic concepts of exponential and logistic population growth, age-structured demography, competition, predation, succession, and factors that control growth and dispersal. Students will examine current topics in ecology, including environmental and demographic stochasticity, ecosystem and landscape ecology, evolutionary ecology and behavioral ecology.

EVSC 303 POLLUTANTS AND THEIR IMPACTS ON ECOSYSTEMS 3.0: 3 cr. E

This course investigates the effects pollutants have on the structure and function of ecosystems, humans, animals and plants. Emphasis will be placed on the transformation of pollutants in the natural environment while stressing the environmental toxicology of heavy metals, pesticides, insecticides and organic solvents. Topics include dose-response relationships, absorption, distribution, mechanisms of toxicity and risk assessment.

EVSC 305 CLIMATE CHANGE: THE SCIENCE AND LOCAL IMPACT OF A GLOBAL ENVIRONMENTAL CRISIS 3.0: 3 cr E

This course will introduce students to the science of climate change, drawing attention to the latest research and evolving patterns of scientific data on climate that has emerged in recent years. Emphasis will be given to analyzing the social changes and adaptations that human communities have already made and those they will most likely have to make as the Earth's climate continues to change in the coming years. Special attention will be given to the expected changes in the Mediterranean Region.

EVSC 311 PRINCIPLES OF ENVIRONMENTAL REMEDIATION AND RESTORATION 3.0: 3 cr. E

This course provides students with an overview of environmental remediation and restoration technologies and techniques, including best practices for addressing contaminants in soil, groundwater, surface and marine waters. Course discussions will address site characterization requirements for effective remediation and restoration system designs. Emphasis will be placed on the current remediation and restoration issues in Lebanon. Case studies, including successes and failures, will be discussed.

EVSC 313 ENVIRONMENTAL STATISTICS: METHODS AND RESEARCH 3.0: 3 cr. E

Ecology and environmental science disciplines increasingly require training in sophisticated statistical thinking and methodology. Students will examine how statistical principles and methods can be used to study environmental issues. Concern will be directed to: probabilistic, stochastic and statistical models; data collection, monitoring and representation; drawing inferences about important characteristics of the problem; and using statistical methods to analyze data to aid policy and action.

EVSC 315 ADVANCES IN COASTAL ZONE MANAGEMENT 3.0: 3 cr. E

Students will learn how to integrate marine sciences with planning, designing, and executing effective solutions to coastal zone problems. Accordingly, students will understand both the scientific nature of contemporary issues affecting the coastal zone and the socio-economic, political, legal and practical approaches to solving conflicting interests of the different sectors.

EVSC 321 AIR POLLUTION IMPACTS AND ANALYSIS 3.0: 3 cr. E

This course will cover air pollution impacts, and focuses on pollution characterization and movement, principles and operation of pollution measuring instruments, air sampling techniques, and interpretation and analysis of data obtained. Measurement methods will include the fundamental principles of spectroscopy and diagnosis of the origin of suspended particles in urban and rural environments.

EVSC 331 ENVIRONMENTAL MANAGEMENT AND POLICY 3.0: 3 cr. E

The course will examine the principles, procedures and methods of good environmental management against the background of Lebanese, European Union and international policy requirements and market instruments. Students will be provided with an opportunity for more in-depth study of selected areas of environmental management, as related to current needs. They will be enabled to develop the research and management skills required to collect, analyze and present information in the context of environmental policy, monitoring and auditing.

EVSC 390 PROFESSIONAL PROJECT 6 cr. E

EVSC 399 MASTER'S THESIS 6 cr. E

DEPARTMENT OF MATHEMATICS

The Department of Mathematics offers a program leading to a Bachelor of Science in Mathematics. The program aims at:

1. Providing students with a robust and extensive background in mathematics
2. Preparing students for graduate and further higher level studies
3. Preparing students to pursue a profession in mathematics or mathematics education or careers in various industries where there is a demand for a rigorous understanding of mathematics or statistics
4. Developing the student's ability to pursue knowledge independently by acquiring skills in problem solving, critical thinking, and logical analysis
5. Enabling students to understand the power of mathematics and its role in human culture
6. Emphasizing the close association of mathematics with the real world and its role in the fields of social sciences, physical and life sciences, engineering, and business.

The program of study leads to a Bachelor of Science in Mathematics with the following tracks:

1. General Mathematics
2. Applied Mathematics
3. Actuarial Science
4. Statistics

Students in each of these tracks may obtain teacher certification by including in their programs the teaching diploma requirements; see Department of Education.

To qualify for a BS degree in Mathematics the student must complete a minimum of 91 credits. These include:

a- 30 credits in general University requirements

- 12 credits of the Civilization Sequence, namely CVSQ 201, CVSQ 202, CVSQ 203, CVSQ 204.
- 6 credits of English Language courses including ENGL 203 and another higher level English Language course.
- 12 credits in general elective courses chosen from within the Department of Mathematics or from outside the Department.

b- 22 credits in mandatory core courses, namely:

Course Code	Course Title	Credit
MATH 200	Calculus I	3
MATH 202	Calculus II	3
MATH 211	Linear Algebra I	3
MATH 230	Numerical Analysis I	3
MATH 240	Probability and Statistics	4
MATH 279	Differential Equations	3
CSIS 206	Principles of Programming	3

c- 39 credits in major courses from the Department depending on the concentration track being pursued by the student.

CONCENTRATION TRACK COURSES

1- The General Mathematics Track

This track is designed to provide a strong mathematical background for students who are interested in pursing a higher degree in mathematics or those who are interested in teaching Mathematics at high school level.

Course Code	Course Title	Credit
MATH 205	Real Analysis	3
MATH 206	General Topology	3
MATH 207	Set Theory	3
MATH 208	Complex Analysis	3
MATH 213	Linear Algebra II	3
MATH 214	Combinatorics	3
MATH 221	Number Theory	3
MATH 271	Partial Differential Equations	3
MATH 280	Foundations of Geometry	3
MATH 281	Differential Geometry	3
MATH 290	History of Mathematics	3
MATH 299	BS Project or Major Elective	3
PHYS 211	Fundamentals of Physics I	3

2- The Applied Mathematics Track

This track is a professionally oriented program designed to provide opportunities for students to develop functional competence in mathematics and an appreciation for the contribution of mathematics to science and engineering. With this track, the Department aims to prepare students to pursue graduate studies in Mathematics or other related fields or embark on a career in industry or education.

Course Code	Course Title	Credit
MATH 205	Real Analysis	3
MATH 208	Complex Analysis	3
MATH 213	Linear Algebra II	3
MATH 215	Graph Theory	3
MATH 216	Algorithms and Data Structure	3
MATH 231	Numerical Analysis II	3
MATH 241	Statistics I	3
MATH 261	Operations Research	3
MATH 271	Partial Differential Equations	3
MATH 274	Calculus of Variation	3
MATH 299	BS Project or Major Elective	3
PHYS 211	Fundamentals of Physics I	3
PHYS 213	Fundamentals of Physics II	3

3- The Actuarial Science Track

One of the most rewarding professions for a person with mathematical talent is that of being an actuary. An actuary is a financial expert who specializes in the Mathematics and laws of the insurance industry. Actuaries need a strong background in Mathematics in order to understand the behavior of insurance claims and investments. Most actuaries work for insurance companies, but others work in the public sector or in private consulting firms. Students trained as actuaries are also prepared for jobs as statisticians, demographers, and mathematicians.

Students following this track will have a solid educational background to take the actuary exams set by the Society of Actuaries (www.soa.org) which is a professional accrediting body in Actuary Mathematics. Students enrolled in the program will be ready to take Actuarial Exam I after the second year of study and Actuarial Exam II upon graduation. Students will also be prepared to take the more advanced actuarial exams.

Course Code	Course Title	Credit
MATH 241	Statistics I	3
MATH 242	Statistics II	3
MATH 251	Life Contingencies I	3
MATH 252	Life Contingencies II	3
MATH 254	Risk and Reserves in Casualty Insurance	3
MATH 255	Methods for Ratemaking	3
MATH 256	Actuarial Estimation Methods	3
MATH 261	Operations Research	3
MATH 262	Math for Finance	3
MATH 264	Game Theory and Decision Analysis	3
MATH 299	BS Project or Major Elective	3
ECON 211	Microeconomics	3
ECON 212	Macroeconomics	3

4- The Statistics Track

The world is becoming more and more quantitative. Many professions depend on numerical measurements to make decisions in the face of uncertainty. Statisticians use quantitative abilities, statistical knowledge, and communication skills to work on many challenging problems. The BS Statistics program provides students with a sound understanding of statistical methods, their underlying theories, and their applications. It aims to prepare students for immediate work as statisticians in public sector, industry, and research institutions. The program also aims to provide students with a good foundation in pursuing graduate studies in Statistics or other related fields.

Course Code	Course Title	Credit
MATH 221	Graph Theory	3
MATH 241	Statistics I	3
MATH 242	Statistics II	3
MATH 244	Categorical Data Analysis	3
MATH 245	Stochastic Processes	3
MATH 249	Statistical Computing	3
MATH 251	Life Contingencies I	3
MATH 261	Operations Research	3
MATH 262	Math for Finance	3
MATH 264	Game Theory and Decision Analysis	3
MATH 265	Optimization	3
MATH 271	Partial Differential Equations	3
MATH 299	BS Project or Major Elective	3

Students majoring in Statistics can have a Biostatistics option by substituting three general elective courses with the following courses: General Biology I (BIOL 201), General Biology II (BIOL 203), and Principles of Epidemiology and Biostatistics (FHSC 282) or equivalent courses.

COURSE DESCRIPTIONS

MATH 111 INTRODUCTION TO CALCULUS I **3.0: 3 cr. E**

The course introduces the basic trigonometric functions and their inverses. It discusses the basic ideas of functions including limits, continuity, derivatives, variations, and symmetry of functions leading to the graphs of polynomial and rational functions. The course then introduces indefinite integrals, the rules for antiderivatives and the substitution method before definite integrals and their application to areas are discussed. The course ends by introducing vectors within a three dimensional coordinate system and by defining sets of points such as planes and lines in space.

MATH 112 INTRODUCTION TO CALCULUS II **3.0: 3 cr. E**

This course has been organized to present the calculus of logarithmic and exponential functions. Separable variables, linear first and second order differential equations follow. Basic operations in complex numbers are covered in detail. Combinatory analysis that involves combinations and permutations follows. Topics in analytical geometry such as angles between lines and planes and the orthogonal projection of a point on a plane are presented.

Prerequisite: MATH 111.

MATH 113 INTRODUCTION TO CALCULUS III **4.0: 4 cr. E**

The basic ideas concerning sequences of numbers and their limits are covered in the first part of the course. Algebraic manipulation and substitution integration techniques are carried a step further by introducing powerful techniques such as integration by parts and the integration of rational and inverse trigonometric functions. The concept of probability is then introduced. Basic operations in complex numbers are developed to cover applications to Demoivre and Euler formulas and solutions to differential and second order complex equations. At the end of the course a detailed analysis of conic sections is presented.

Prerequisite: MATH 111.

MATH 200 CALCULUS I **4.0: 3 cr. E**

This course covers techniques of integration for definite and indefinite integrals as well as applications of definite integrals. Sequences and their limits and the convergence and divergence of infinite series and power series follow. The course then gives an overview of first order differential equations and their solution sets. Polar coordinates are introduced. The course finally presents functions of several variables, limits and continuity of multivariable functions, partial derivatives, the chain rule and multiple integrals. Multivariable functions.

MATH 201 MATHEMATICS FOR COMPUTATION **4.0: 4 cr. E**

This course includes topics from algebra, linear algebra, and calculus. It contains: laws of logic, sets and relations, functions, induction and recursion, Boolean algebra, matrix algebra, solution of linear systems, power series, functions of several variables.

MATH 202 CALCULUS II **4.0: 3 cr. E**

The course covers the following topics: multi-variable functions, multiple integrals, cylindrical and spherical coordinates, line integrals, circulation and flux, Fourier series, and Laplace Transform.

Prerequisite: MATH 200.

MATH 203 MATHEMATICS FOR APPLIED SCIENCES **3.0: 3 cr. E**

This course covers techniques of integrations, infinite series, polar coordinates, functions of several variables, partial derivatives, chain rule, multiple integrals with applications.

MATH 204 ENGINEERING TOPICS IN MATHEMATICS **3.0: 3 cr. E**

This is a remedial course that covers: Multiple integrals, vector fields, Fourier series, Laplace Transform, power series solutions of ODE, partial differential equations, numerical algorithms, finite difference calculus, interpolation and extrapolation, roots of equations, numerical solution of simultaneous linear algebraic equations, least-squares approximation, numerical integration, numerical solution of ordinary differential equations.

Prerequisite: MATH 200.

MATH 205 REAL ANALYSIS **3.0: 3 cr. E**

The real number system, sequences and subsequences, Cauchy sequences, supremum and infimum, accumulation points, pointwise and uniform convergence, limits and continuity of functions.

Prerequisite: MATH 200.

MATH 206 GENERAL TOPOLOGY **3.0: 3 cr. E**

Metric spaces and topological spaces, completeness, compactness, connectedness, separation, topological properties.

Prerequisite: MATH 205.

MATH 207 SET THEORY **3.0: 3 cr. E**

Countable and uncountable sets, cardinality and cardinal arithmetic, the construction of the real numbers, the continuum hypothesis, transfinite numbers, the axiom of choice.

Prerequisite: MATH 206.

MATH 208 COMPLEX ANALYSIS **3.0: 3 cr. E**

Complex numbers, analytic functions, derivatives, Cauchy-Reimann equations, complex integrations, Cauchy integral theorem, power series, Taylor and Laurent series, residue theorem, conformal mappings.

Prerequisite: MATH 200.

MATH 210 ALGEBRA **3.0: 3 cr. E**

The construction of N, Z, Q, R, and C. Elementary algebraic structures like groups, rings, fields, and integral domains. Reducibility and unique factorization. Ideals and quotient rings.

MATH 211 LINEAR ALGEBRA I **3.0: 3 cr. E**

Linear systems, matrix operations, echelon form, vector spaces, linear transformations, determinants, eigenvalues and eigenvectors, diagonalization of matrices.

MATH 213 LINEAR ALGEBRA II **3.0: 3 cr. E**

The geometry of linear transformations, quadratic forms and conic sections, inner product spaces, orthogonality, the Gram-Schmidt orthogonalization process, orthogonal projections, normed spaces, diagonalization and orthogonal diagonalization.

Prerequisite: MATH 211.

MATH 214 COMBINATORICS **3.0: 3 cr. E**

Permutations and combinations, counting principles, inclusion-exclusion, recurrence relations and generating functions, graphs and trees. Combinatorial designs and coding theory, combinatorial existence theorems. Prerequisite: MATH 200 and MATH 210.

MATH 215 GRAPH THEORY **3.0: 3 cr. E**

This course covers: Paths, circuits, cuts, trees, chains, Euler graphs, matrix representation, spanning trees, connectivity of a graph, Hamiltonian graphs, graph factorization. Topics may include planar graphs, external graph theory, directed graphs, enumeration, algebraic graph theory, probabilistic graph theory, graph embedding, graph coloring problems and applications.

MATH 216 ALGORITHMS AND DATA STRUCTURE **3.0: 3 cr. E**

This course covers the concept of data structure algorithms: Lists, graphs, rooted trees, heaps, and disjoint set structures. Topics may include Greedy algorithm, probabilistic algorithm, dynamic programming, efficiency and complexity of algorithms

Prerequisite: MATH 215.

MATH 221 NUMBER THEORY **3.0: 3 cr. E** .

Divisibility, congruences, arithmetic functions, Chinese remainder theorem, Fermat theorem, quadratic forms, quadratic reciprocity, Diophantine equations.

Prerequisites: MATH 211.

MATH 230 NUMERICAL ANALYSIS I **3.0: 3 cr. E**

Analysis and implementation of several numerical methods: Finite difference calculus, interpolation and extrapolation, solution of systems of linear equations, root of equations, least square curve fitting, numerical integration, numerical solution of ordinary differential equations.

Prerequisites: CSIS 200, MATH 200, and MATH 211.

MATH 231 NUMERICAL ANALYSIS II **3.0: 3 cr. E**

Finite elements methods, solution of elliptic, hyperbolic and parabolic equations, approximation, matrix representation, solution of non-linear systems, solution of non stationary systems, numerical methods to calculate eigenvalues and eigenvectors.

Prerequisites: MATH 230 and MATH 271.

MATH 240 PROBABILITY AND STATISTICS **4.0: 4 cr. E**

Introduction to descriptive statistics, random variables and probability distribution, mathematical expectation. Discrete probability distributions: Uniform, Binomial and Multinomial, Hyper-geometric, Negative Binomial, Geometric and Poisson distributions. Continuous probability distribution: Normal distribution, Gamma and Exponential distributions, c2 distribution. Topics from inference statistics: Sampling theory, estimation theory, tests and significations.

Prerequisite: MATH 200.

MATH 241 STATISTICS I **3.0: 3 cr. E**

This course is an introduction to inferential statistics. It covers sampling theory, estimation of the mean, variance, and proportion parameters for one and two groups. Bayesian estimation, maximum likelihood estimation, hypothesis tests and significations.

MATH 242 STATISTICS FOR APPLIED SCIENCES **3.0: 3 cr. E**

This course introduces students to statistical inferences and applications. Topics covered include: Sampling theory, estimation theory, confidence intervals, hypothesis tests and significations, t test (Student), F test (Fisher) and □2 test (Pearson) , linear regressions, and correlation. This course is not offered for Mathematics students.

Prerequisite: MATH 203.

MATH 243 STATISTICS II **3.0: 3 cr. E**

This course covers one and two-factor analysis of variance (ANOVA), regression and multiple regressions, nonparametric statistics, introduction to time series.

Prerequisite: MATH 241.

MATH 244 CATEGORICAL DATA ANALYSIS **3.0: 3 cr. E**

This course focuses on analyzing categorical response data in scientific fields. The topics include performing stratified data analysis, using model-building strategies, assessing the fit of a binary logistic regression model, and detecting interactions and nonlinear effects. It covers the two-way and three-way contingency tables, logistic regression, loglinear models for contingency tables, collapsibility, ordinal associations, multicategory logistic models.

MATH 245 STOCHASTIC PROCESSES **3.0: 3 cr. E**

This course covers the analysis and modeling of stochastic processes. Topics include measure theoretic probability, martingales, filtration, and stopping theorems, elements of large deviations theory, Brownian motion and reflected Brownian motion, stochastic integration. In addition, the course will cover some applications to finance theory, insurance, queuing and inventory models.

MATH 246 PROBABILITY **3.0: 3 cr. E**

Introduction to descriptive statistics, random variables and probability distribution, mathematical expectation. Discrete probability distributions: Uniform, Binomial and Multinomial, Hyper-Geometric, Negative Binomial, Geometric and Poisson distributions. Continuous probability distribution: Normal distribution, Gamma and exponential distributions, C2 distribution.

Prerequisite: MATH 200.

MATH 249 STATISTICAL COMPUTING **3.0: 3 cr. E**

The combination of more powerful microcomputers and statistical software designed specifically for them has revolutionized the world of Statistics and Data Analysis. Use of statistical software helps students to understand the theoretical results better and gives them a chance to apply the techniques to real world problems. Introduction to the use of major statistical packages such as SAS, SPSS, Statistica, and Minitab.

MATH 251 LIFE CONTINGENCIES I **3.0: 3 cr. E**

The mortality table, life annuities, pensions, life insurance premiums, reserves, cash value, loss premiums, dividends.

Prerequisite: MATH 211.

MATH 252 LIFE CONTINGENCIES II **3.0: 3 cr. E**

The measurement of mortality, life annuities, life insurance, net annual premiums, net level premium reserves, population theory, and special topics.

Prerequisites: MATH 243 and MATH 249.

MATH 253 HUMAN RELATIONS IN THE ORGANIZATION **3.0: 3 cr. E**

An examination of the theories and applications of managing human relations and the dynamics of interaction within organizations.

MATH 254 RISK AND RESERVES IN CASUALTY INSURANCE **3.0: 3 cr. E**

The economics of insurance, utility functions, utility and insurance, compound distribution of aggregate claims, premiums, loss and expense reserves, loss reserving methods, known claims, IBNR claims, all incurred claims.

Prerequisite: MATH 243.

MATH 255 METHODS FOR RATEMAKING **3.0: 3 cr. E**

Full and partial credibility, Bayesian credibility, empirical Bayes credibility, claims frequency and claims severity, aggregate claim distributions, modeling loss distributions, application of distributional models, principles of ratemaking, data for ratemaking.

Prerequisite: MATH 243.

MATH 256 ACTUARIAL ESTIMATION METHODS **3.0: 3 cr. E**

Measures of mortality and morbidity, fitting parametric survival distribution, mortality assumptions, individual record formula, practical aspects of mortality table construction.

Prerequisites: MATH 243 and MATH 249.

MATH 261 OPERATIONS RESEARCH **3.0: 3 cr. E**

This course covers general linear programming, the simplex method and sensitivity analysis, duality, network models including minimum spanning trees, the shortest route problem and CPM and PERT computations as well as deterministic and non-deterministic inventory methods.

MATH 262 MATH FOR FINANCE **3.0: 3 cr. E**

This course includes topics such as fractional exponents and radicals, simple interest, compound interest and compound amount, compound discount and present value, simple annuities, effective annual rate of interest, amortization and equity, and sinking funds.

MATH 264 GAME THEORY & DECISION ANALYSIS **3.0: 3 cr. E**

Matrix games, relation to linear programming; non-zero sum games, decision trees, models for groups decisions, utility theory.

Prerequisite: MATH 261.

MATH 265 OPTIMIZATION **3.0: 3 cr. E**

This course covers various methods in optimizations: Deterministic and probabilistic models. Unconstrained optimization methods: one dimensional search, gradient, Newton, and conjugate direction. Genetic algorithms. Nonlinear optimization.

Prerequisite: MATH 261.

MATH 270 DIFFERENTIAL EQUATIONS **3.0: 3 cr. E**

This course covers Ordinary Differential Equations (ODE) and Partial Differential Equations (PDE). Part I includes second order linear differential equations, higher order, and power series solutions. Part II illustrates the importance of partial differential equations in science and engineering and discusses the solution of parabolic, hyperbolic, and elliptic type problems.

Prerequisite: MATH 200.

MATH 271 PARTIAL DIFFERENTIAL EQUATIONS **3.0: 3 cr. E**

Linear Partial Differential Equations, separation of variables method, calculus of Fourier series. Closed form solutions for the homogeneous and nonhomogeneous problem: Heat equation, Wave equation, Laplace equation. The Sturm Liouville Eigenvalue problem.

Prerequisites: MATH 202 and MATH 270.

MATH 272 DIFFERENTIAL EQUATIONS FOR APPLIED SCIENCES **3.0: 3 cr. E**

This course covers first and higher order differential equations. Topics include separable and exact first order equations. Bernoulli and Euler-Cauchy equations. Undetermined coefficient, variation of parameters and power series solutions of higher order linear equations. Introduction to linear systems of equations.

Prerequisite: MATH 203.

MATH 274 CALCULUS OF VARIATIONS **3.0: 3 cr. E**

Variation of a functional, variational derivative, invariance of Euler's equation, variational problems in parametric form, the Weierstrass-Erdmann conditions, the canonical form of Euler equations, the Legendre transformation, the Hamilton-Jacobi equation, the second variation of a functional, the field of a functional, Hilbert invariant, and variational problems involving multiple integrals.

Prerequisite: MATH 200.

MATH 280 FOUNDATIONS OF GEOMETRY **3.0: 3 cr. E**

Axiom systems, Euclidean geometry, parallel postulate, non-Euclidean geometry (elliptic, parabolic, and hyperbolic), affine geometry, projective geometry.

Prerequisites: MATH 200.

MATH 281 DIFFERENTIAL GEOMETRY **3.0: 3 cr. E**

Curves in space, regular surfaces, tensors, the geometry of the Gauss map, normal curvature, the geometry of surfaces, Gauss-Bonnet theory.

Prerequisite: MATH 202.

MATH 290 HISTORY OF MATHEMATICS **3.0: 3 cr. E**

Roots of modern mathematics in ancient Babylonia and Greece, early number systems, the development of arithmetic, geometry, algebra and analysis.

MATH 292 TECHNICAL PLATFORM COMPUTING **3.0: 3 cr. E**

This course develops working knowledge of comprehensive technical platforms such as Mathematica, Matlab or Maple. Introduction to Mathematica: symbolic manipulation, numerics, graphics, word-processing aspects, typesetting and programming. Application to numerical analysis and graphics.

Prerequisite: MATH 230.

MATH 299 BS PROJECT **3.0: 3 cr. E**

MATH 340 MULTIVARIATE STATISTICS **3.0: 3 cr. E**

Multiple regression, factor analysis, principal components analysis (hierarchical cluster and k-means). Applications with SPSS software.

MATH 343 TIME SERIES AND FORECASTING **3.0: 3 cr. E**

Least squares smoothing and prediction, linear systems, Fourier analysis, and spectral estimation. Impulse response and transfer function. Fourier series, the fast Fourier transform, autocorrelation function, and spectral density. Detection of seasonality, exponentional smoothing, Holt-Winters methods, ARMA process. Computing is an integral part of the course.

CSIS 206

Refer to the Department of Computer Science.

PHYS 211, PHYS 213

Refer to the Department of Physics.

BIOL 201, BIOL 203

Refer to the Department of Biology.

FHSC 282

Refer to the Faculty of Health Sciences.

ECON 211, ECON 212

Refer to the Department of Economics.

ENGL 203, ENGL 204

Refer to the Division of English Language & Literature.

CVSQ 201, CVSQ 202, CVSQ 203, CVSQ 204

Refer to the Civilization Sequence Program.

DEPARTMENT OF PHYSICS

BACHELOR'S DEGREE

FIRST YEAR

Semester1

Course Code	Course Title	Credit
CSIS 200	Introduction to Computers & Programming	4
ENGL 203	English Communication Skills III	3
MATH 200	Calculus I	4
MATH 210	Algebra I	3
PHYS 201	General Physics I	3
		17

Semester 2

Course Code	Course Title	Credit
ENGL 204	English Communication Skills IV	3
MATH 202	Calculus II	4
MATH 211	Linear Algebra I	3
PHYS 202	General Physics II	3
ELEN 221	Circuit Analysis	3
ELEN 201	Electrical Instrumentation Lab	1
		17

SECOND YEAR

Semester 3

Course Code	Course Title	Credit
MATH 270	Differential Equations	3
CHEM 202	Basic Chemistry	3
PHYS 222	Electricity & Electromagnetism	3
CSIS 211	Introduction to Logic Circuits	3
PHYS 203	General Physics Lab	1
CVSQ 201	Early Formation of Civilization	3
		16

Semester 4

Course Code	Course Title	Credit
CHEM 222	Analytical Chemistry I	3
CHEM 203	Basic Chemistry Lab	1
PHYS 223	Electricity Lab	1
PHYS 241	Physical Optics	3
PHYS 245	Modern Physics I	3
CVSQ 202	The Religious Experience: The Sacred	3
CSIS 212	Digital Lab	1
		15

THIRD YEAR

Semester 5

Course Code	Course Title	Credit
PHYS 281	Modern Physics II	3
PHYS 232	Thermal & Statistical Physics	3
ELEN 231	Electronics I	3
CVSQ 203	Introduction To Modernity	3
PHYS 251	Introduction to Solid State Physics	3
	Elective	3
		18

Semester 6

Course Code	Course Title	Credit
ELEN 332	Electronics II	3
ELEN 304	Electronics Lab	1
CVSQ 204	Contemporary Challenges in The Arab World	3
PHYS 247	Experiments in Modern Physics	1
	Electives	9
		17

List of Electives

Course Code	Course Title	Credit
PHYS 216	Theoretical Mechanics	3
PHYS 291	Computational Physics	3
PHYS 283	Nuclear Physics	3
MECH 243	Fluid Mechanics	3
CSIS 250	Computer graphics	3
PHYS 265	Astrophysics	3
PHYS 282	Atomic & Molecular Physics	3
PHYS 248	Quantum Mechanics	3
MECH 321	Heat Transfer	3
PHYS 227	Electromagnetic Wave Theory	3

Minor in Physics

The Faculty of Sciences offers a Minor in Physics for students who have successfully completed a minimum of 17 credits of Physics courses as follows:

Course Code	Course Title	Credit
PHYS 211	Fundamentals of Physics I	3
PHYS 212	Fundamentals of Physics I Laboratory	1
PHYS 213	Fundamentals of Physics II	3
PHYS 214	Fundamentals of Physics II Laboratory	1
PHYS 222	Electricity & Electromagnetism	3
PHYS 241	Physical Optics	3
+ one of the following courses:		
PHYS 232	Thermal & Statistical Physics	3
PHYS 245	Modern Physics I	3
PHYS 251	Introduction to Solid State Physics	3
PHYS 281	Modern Physics II	3

COURSE DESCRIPTIONS

PHYS 100 INTRODUCTION TO PHYSICS I **3.0: 3 cr. E**

Physical quantities, standards and units. Vectors and scalars. Velocity and acceleration. Motion in one, two and three dimensions. Newton's laws, falling bodies, uniform circular motion. Work and energy, power, Kinetic energy theorem. Conservation of total energy. Rectilinear sinusoidal motion, angular sinusoidal motion. Linear and angular momentum collisions. Gravitation.

PHYS 102 INTRODUCTION TO PHYSICS II **3.0: 3 cr. E**

Fluids, statics, pressure, Pascal's principle and Archimede's Principle. Wave motion, interference of waves. Sound waves. Temperature, kinetic theory, Brownian motion. Thermodynamics, first and second laws. Alternating current, R-L-C circuits, power in A/C circuits. Light nature and propagation, reflection and refraction at plane surfaces. Spherical mirrors, interference of light. Diffraction, polarization, photoelectric effect, X-rays.

Pre-requisite: PHYS 100.

PHYS 201 GENERAL PHYSICS I **3.0: 3 cr. E**

Elements of vector calculus, position, velocity, and acceleration. Motion in one, two, and three dimensions. Dynamics of point particles, Newton's laws, gravitation, concept of force, concept of field, falling bodies. Projectile motion, non-uniform circular motion. Work, energy, and power. Kinetic energy, conservation of total energy. Linear momentum and collision. The center of mass; rotation, angular momentum and its conservation. Torque work and energy in rotational motion. Elements of hydrostatics and hydrodynamics.

PHYS 202 GENERAL PHYSICS II **3.0: 3 cr. E**

Oscillatory motion. Simple harmonic motion. The pendulum. Damped oscillation. Wave motion, sound waves, superposition of waves, standing waves. First and second laws of thermodynamics. The nature of light, the laws of geometric optics, interference of light waves, diffraction polarization.

Pre-requisite: PHYS 201.

PHYS 203 GENERAL PHYSICS LAB **0.3: 1 cr. E**

This lab provides firsthand knowledge of physical principles and experimental methods through the handling of various types of apparatus designed to demonstrate the meaning and applications of these principles. In this lab, the student performs different types of fundamental physical experiments:

a- Mechanics: motions, laws of collisions, free fall, torsion.

b- Optics: laws of lenses and optical instruments, interference diffraction.

c- The vibrations of strings and the velocity of sound using Kundt's tube.

Pre-requisites: PHYS 201/202.

PHYS 211 FUNDAMENTALS OF PHYSICS I **3.0: 3 cr. E**

The course introduces some of the basic fundamentals of physics, including: kinematics of a particle, relative motion analysis, Newton's laws of motion, work, energy, center of mass, linear impulse and momentum, collision, torque, equilibrium, elasticity, gravity, properties of fluids, simple harmonic motion, transverse and longitudinal waves, resonance, sound waves, Doppler effect, thermal expansion, first and second laws of thermodynamics, entropy.

Pre-requisite: MATH 203.

PHYS 212 FUNDAMENTALS OF PHYSICS I LABORATORY 0.3: 1 cr. E

This laboratory introduces students to the types of basic apparatus used in physics. Experiments are designed to demonstrate the meaning and applications of the physical concepts included in the "Fundamental of Physics I" course.

Co-requisite: PHYS 211.

PHYS 213 FUNDAMENTALS OF PHYSICS II 3.0: 3 cr. E

The course introduces some of the basic fundamentals of physics, including: electric charge, Coulomb's law, electrostatic force, electric field, electric potential, Gauss' Law, capacitors, capacitance, electric current, resistance, Ohm's law, power, emf, internal resistance, magnetic field, magnetic force, magnetic materials, alternating current, rms voltage and current, polarization, reflection, refraction, mirrors, thin lenses, interference, diffraction, photoelectric effect, blackbody radiation, Hydrogen atom, fluorescence, atomic and mass numbers, isotopes, alpha, beta and gamma decays, nuclear fission, nuclear fusion.

Pre-requisite: MATH 203.

PHYS 214 FUNDAMENTALS OF PHYSICS II LABORATORY 0.3: 1 cr. E

This laboratory introduces students to the types of basic apparatus used in physics. Experiments are designed to demonstrate the meaning and applications of the physical concepts included in the "Fundamental of Physics II" course.

Co-requisite: PHYS 213.

PHYS 221 PHYSICS I 3.0: 3 cr. E

Fundamentals of electricity. Introduction to electricity study of charges, electric forces, electric field and electric flux. potential and potential difference. Study of the fundamentals of direct current including Ohm's law, kirchoff's laws and circuit analysis techniques. Emphasis on circuit analysis of resistive networks and DC measurements. Includes steady state analysis of inductance and capacitance. Alternating current study of the fundamentals of alternating current including series and parallel AC circuits, phasors, capacitive and inductive networks, transformers, and resonance. Electronic devices. A study of diodes, bipolar, mos semiconductor devices, including analysis of static characteristics.

PHYS 222 ELECTRICITY & ELECTROMAGNETISM 3.0: 3 cr. E

Charge and matter. Electric fields. Gauss's law, electric potential, capacitors, dielectrics, DC circuits, magnetic field, Biot-Savart law, Faraday's law, Ampere's law, inductors, Paramagnetism, AC circuits, Maxwell's equations, and electromagnetic waves.

Pre-requisite: PHYS 221.

PHYS 223 ELECTRICITY LAB 0.3: 1 cr. E

This laboratory is an introduction to the basic techniques used in the study of electricity and electromagnetism.

Co-requisite: PHYS 222.

PHYS 225 BASIC ELECTRONICS **3.0: 3 cr. E**

Electrical circuits. Semiconductors diode. Transistors and integrated circuits. Field-effect transistors (FET): JFET. MOSFET, transfer characteristics. Signal processing circuits: Waveshaping circuits. Digital electronic circuits: DTL, HTL, TTL, RTL, DCTL, ECL. Small signal models.

Pre-requisite: PHYS 221.

PHYS 231 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.

PHYS 232 THERMAL AND STATISTICAL PHYSICS **3.0: 3 cr. E**

The laws of thermodynamics, elementary probability theory, kinetics theory of gases and Brownian motion, equilibrium, statistical mechanics of ideal systems: statistical origins of heat, temperature, and entropy are stressed. Equilibrium between phases.

Prerequisite: PHYS 231.

PHYS 241 PHYSICAL OPTICS **3.0: 3 cr. E**

Optical instruments, electromagnetic waves, interference, diffraction, polarization, lasers, holography, Fourier transform optics, and non-linear optics.

Prerequisite: PHYS 202.

PHYS 245 MODERN PHYSICS I **3.0: 3 cr. E**

Elements of special relativity. Black body radiation, atomic spectra, Bohr Model. Basic principles of quantum theory, the Schroedinger equation. One-dimensional problem, orbital angular momentum. The harmonic oscillator. The hydrogen atom.

PHYS 247 EXPERIMENTS IN MODERN PHYSICS **0.3: 1 cr. E**

Measurement of c, e, e/m, h/e, G, g; contemporary experiments in microwave and optical diffraction and interference; optical fibers; temperature-dependent properties of conductors.

PHYS 251 INTRODUCTION TO SOLID STATE PHYSICS **3.0: 3 cr. E**

Lattices, reciprocal lattice and diffraction; thermal and elastic properties; cohesive energy of solids; electrons in metals; semiconductors; superconductivity; magnetism.

PHYS 281 MODERN PHYSICS II **3.0: 3 cr. E**

General formalism of spin and addition of angular momenta. Elements of atomic and molecular physics. Radioactivity and nuclear physics. Nuclear reactions. Elementary particles. Solid state physics. Astrophysics. Prerequisite: PHYS 213.

CHEM 202, 203, 222

Refer to Department of Chemistry.

CVSQ 201, 202, 203, 204

Refer to the Civilization Sequence Program.

CSIS 200, 211, 212
Refer to the Department of Computer Science.

ELEN 201, 221, 231, 332, 304
Refer to the Department of Electrical Engineering.

MATH 200, 202, 210, 211, 270
Refer to the Department of Mathematics.

MECH 243
Refer to the Department of Mechanical Engineering.

TEACHING DIPLOMA IN APPLIED SCIENCES:

This degree is offered to students having a BS degree in applied sciences: Mathematics, Biology, Chemistry, Environmental Sciences or Computer Science and are planning to become teachers of intermediate or high school levels.

The diploma counts 27 credits distributed among the following courses:

Course Code	Course Title	Credit
EDUC 213	Fundamentals of Education: History and Methods	3
EDUC 216	Test and Measurement	3
EDUC 220	Educational Psychology	3
EDUC 227	Sociology of Education	3
EDUC 250A	Assisted Learning	3
PSYC 214	Adolescence Development	3
PRAC 201	Practicum I	3
PRAC 202	Practicum II	3

In addition, one specialized course (3 Credits) of the following : EDUC 251 Teaching Mathematics in the Elementary School, EDUC 264 Teaching Applied Sciences in the Elementary School, EDUC 280 Teaching of Computer

For course descriptions, refer to the Department of Education.

PREMEDICAL PROGRAM

The Premedical Program is offered to students who intend to enter the Faculty of Medicine & Medical Sciences and gives them the opportunity to apply for the Medical College Admission Test (MCAT) after successfully taking a minimum of **35 credits** distributed as follows:

Biology	a minimum of 8 credits: normally BIOL 201, 202, 203, 204
Chemistry	a minimum of 13 credits, including 7 credits of Organic Chemistry: normally CHEM 202, 203, 222 (or equivalent), 242, 244, 245
Humanities and Social Sciences	a minimum of 6 credits
Physics	a minimum of 8 credits: normally PHYS 211, 212, 213, 214

NB: English communication skills are required but not credited.