Undergraduate Catalogue 2014

Faculty of

SCIENCE

Faculty Administration

Dean	Prof. Rajaa Fakhoury
Assistant Dean	Prof. Ghassan Younes
Director, Tripoli Branch	Prof. Sherif El-Gayar
Faculty Secretary	Ms. Najwa Hajjar

History

The Faculty of Science offers unique opportunities for innovative research and education. Founded in 1976 with the department of Physics, the faculty underwent a rapid expansion to include the Departments of Mathematics and computer science, Chemistry, Biological and Environmental sciences in 1978, 1988 and 1998 respectively. The postgraduate program was initiated in 1999. In line with its growth policy, and to accommodate the increasing number of students, the Faculty moved to Debbieh campus in 2008. The faculty is Located in the beautiful Chouf Mountains overlooking the Mediterranean, and a new branch was established in 2011 in northern of Lebanon, Tripoli.

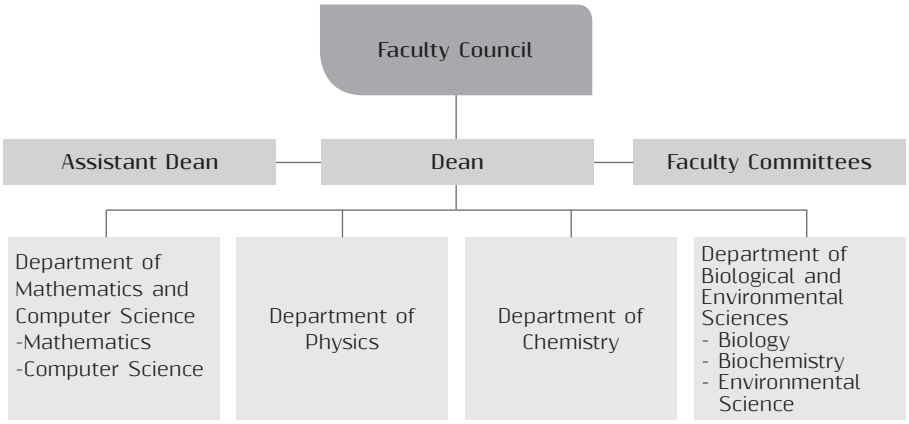
The Faculty in Debbieh now has 37 academic staff (full and part timers). The allumni body includes over 3700 BSc. graduates as well as 300 MSc. & PhD alumni.

The Faculty continues to strive for national recognition and prominence for all our programs. The bachelor of computer science program, Department of Mathematics and Computer Science is now accredited by the computing Accreditation Board for Engineering and Technology (ABET), a US accreditation body that evaluates academic curriculums worldwide.

Organizational Structure

The following four departments constitutes the faculty of science: Mathematics and Computer Science, Physics, Chemistry, Biological and Environmental Sciences. The Mathematics and Computer Science Department offers two programs: Mathematics and Computer Science. The Biological and Environmental Sciences department offers three programs: Biology, Biochemistry and Environmental Science.

The organizational chart of the Faculty is as follows:



Vision

To be recognized as the Middle East destination of choice for science students. To foster an environment of intellectual freedom as well as excellence in educational programs and scientific research.

Mission

The Faculty of Science is committed to sustain excellence in the creation and dissemination of knowledge by teaching, research, and scholarly publication in both basic and applied sciences. The centrality of the Faculty within the University is strengthened by the excellence of our academic staff, programs and laboratory facilities, as well as by our internal and external strategic collaborations.

Academic Programs

The Faculty of Science offers a Bachelor of Science Degree in the following seven specializations: Mathematics, Computer Science, Physics, Chemistry, Biology, Biochemistry and Environmental Science.

Admission Requirements

To be inrolled for an undergraduate degree, applicants must:

- Hold the official Lebanese Secondary School Certificate or its equivalent;
- Successfully pass an entrance exam to measure the level of proficiency in **English Language** , or provide evidence of English Language such as TOEFL, IELTS…

Graduation Requirements

To receive a Bachelor Degree in the Science programs, a student must satisfactorily complete 100 credit hours for Computer Science major and 97 credits for the other majors with an overall minimum grade point average (GPA) of 2.00 + ICDL (International Computer Driving License). The following table summarizes the number of credits required for each Bachelor granting program in the Faculty:

1. Department of Mathematics and Computer Science

Program	University Requirements		Program Requirements					Total Credit Hours
	Mandatory Courses	Elective Courses	Major Core Courses	Faculty Core Courses	Departmental Elective Courses	Free Elective Courses	General Science Elective Courses	
CMPS	5	11	50	17	9	-	8	100
MATH	5	16	41	17	12	6	-	97

CMPS: Computer Science
MATH: Mathematics

2. Department of Physics

Program	University Requirements		Program Requirements				Total Credit Hours
	Mandatory Courses	Elective Courses	Major Core Courses	Faculty Core Courses	Departmental Elective Courses	Free Elective Courses	
PHYS	5	16	44	17	9	6	97

PHYS: Physics

3. Department of Chemistry

Program	University Requirements		Program Requirements				Total Credit Hours
	Mandatory Courses	Elective Courses	Major Core Courses	Faculty Core Courses	Departmental Elective Courses	Free Elective Courses	
CHEM	5	16	41	17	12	6	97

CHEM: Chemistry

4. Department of Biological and Environmental Sciences

Program	University Requirements		Program Requirements				Total Credit Hours
	Mandatory Courses	Elective Courses	Major Core Courses	Faculty Core Courses	Departmental Elective Courses	Free Elective Courses	
BIOL	5	16	46	15	9	6	97
BCHM	5	16	46	15	9	6	97
ENVI	5	16	46	15	9	6	97

BIOL: Biology
BCHM: Biochemistry
ENVI: Environmental Science

Department of Mathematics and Computer Science

Academic Staff

Chairperson	Prof. Mohammad N. Abdulrahim
Associate Professors	Dr. Ali El-Zaart, Dr. Imad Al Ashmawy
Assistant Professors	Dr. Islam Elkabani, Dr. Ahmed Sherif, Dr. Toufic El Arwadi, Dr. Hala Idris, Dr. Houssam Shrayteh, Dr. Noura Yassin, Dr. Wassim El-Hajj Chehade, Dr. Riham Abdel Kader, Dr. Abdullah al-Chakik, Dr. Maher Jneid, Dr. Rola Mouallem
Part-time Lecturers	Dr. Hassan Tarrof, Dr. Mazen Falou, Dr. Nazek Al-Khoja, Dr. Jihan Khoder

A. Computer Science Program

Mission

The mission of the Computer Science program is to produce highly qualified professionals in computer science that are committed to lifelong learning, and make positive contributions to society. This will lead to achieve the national development goals through fostering an academic environment ideal for knowledge development, research, and innovation in the field of Computer science.

Objectives

A few years after graduation, graduates of the computer science program will:

- Have established a broad knowledge of computer science and mathematics to design innovative computer-related solutions for real world problems.
- Have demonstrated effective teamwork, oral and written communication skills as well as collaborative skills and have contributed to society by behaving ethically and responsibly.
- Be successfully employed or accepted into a graduate program, and demonstrate professional development and lifelong learning throughout their careers.

Learning Outcomes

Our CS program learning outcomes are consistent with the ABET criteria for Computer Science programs. The program enables students, by the time of graduation, to achieve:

- An ability to apply knowledge of computing and mathematics appropriate to the discipline.
- An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
- An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs.
- An ability to function effectively on teams to accomplish a common goal.
- An understanding of professional, ethical, legal, security and social issues and responsibilities.
- An ability to communicate effectively with a range of audiences.

- An ability to analyze the local and global impact of computing on individuals, organizations and society.
- Recognition of the need for and an ability to engage in continuing professional development.
- An ability to use the current techniques, skills and tools necessary for computing practice.
- An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
- An ability to apply design and development principles in the construction of software systems of varying complexity.

Degree Requirements

To obtain the Bachelor Degree in Computer Science, students must successfully complete a total of 100 credit hours + ICDL, where the standard duration of study is 6 semesters. There is **one general semester of study** for the students of the Computer Science Program.

Career Opportunities

The rapid development in the world of computer, including the introduction of new applications and the use of computer technologies in all domains of public and private organizations, academics, industry and research has led to more job vacancies for computer scientists. In particular, they may work as:
System Programmer, System Analyst, System Administrator, Internet Applications Programmer, User Interface Designer, Database Analyst, Database Administrator, Network Administrator, Computer Game Designer/Programmer, Computer Science Researcher and Computer Science Instructor.

Program Overview

The Computer Science curriculum consists of the following components:

Computer Science Program	
I. University Requirements	**Credits**
* University Mandatory Courses	5
* University Elective Courses	11
II. Program Requirements	**Credits**
Faculty Core Courses	17
Major Core Courses	50
Departmental Elective Courses	9
General Science Electives (MATH, PHYS, CHEM)	8
Total	**100**

* A total of 16 credits is required as General University Requirements: 5 credits are selected from the University Mandatory courses list , 4 credits from social sciences list, 4 credits from humanities list and 3 credits from other lists of the university elective courses + ICDL.

Faculty and Major Core Courses

Courses			crs.	Pro/Co-requisites
MATH	241	Calculus and Analytical Geometry	3	
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-req.: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-req.: PHYS 241
CMPS	241	Introduction to Programming	3	
MATH	242	Probability and Statistics	3	
CMPS	242	Object Oriented Programming	3	Co-req.: CMPS 241
CMPS	244	Digital Circuits	3	
CMPS	246	Web Programming	3	Pre-req.: CMPS 241
CMPS	248	Discrete Structures I	3	Pre-req.: CMPS 241
CMPS	347	Data Structures	3	Pre-req.: CMPS 242
CMPS	343	Computer Organization & Architecture	3	Pre-req.: CMPS 244
CMPS	345	Discrete Structures II	3	Pre-req.: CMPS 248
MATH	341	Linear Algebra	3	
CMPS	342	Database Systems	3	Pre-req.: CMPS 242
CMPS	344	Software Engineering	3	Pre-req.: CMPS 242
CMPS	346	Theory of Computation	3	Pre-req.: CMPS 248
MATH	348	Numerical Methods	3	Pre-req.: MATH 241
CMPS	441	Fundamentals of Algorithms	3	Pre-req.: CMPS 347 & CMPS 345
CMPS	445	Concepts of Programming Languages	3	Pre-req.: CMPS 347
CMPS	447	Computer Networks	3	Pre-req.: CMPS 347
CMPS	443	Senior Project I	1	
CMPS	442	Operating Systems	3	Pre-req.: CMPS 347
CMPS	444	Senior Project II	1	Pre-req.: CMPS 443

Description of Faculty Core Courses

CHEM 241 PRINCIPLES OF CHEMISTRY (3Crs.:3Lec):
A study of the fundamental concepts of chemistry including matter and measurement, atoms, molecules, ions, moles, nomenclature, atomic and molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, and solid states of matter. Properties of solutions, aqueous reactions and solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases and ionic equilibria, electrochemistry, nuclear chemistry and coordination chemistry.

CHEM 241L PRINCIPLES OF CHEMISTRY LABORATORY (1Cr.:3Lab):
Selected experiments illustrate the topics discussed in CHEM 241. Co-req.: CHEM 241.

PHYS 241 PRINCIPLES OF PHYSICS (3Crs.:3Lec):
Mechanical properties of matter, Coulomb's law, electric field, electric potential, equipotential surfaces, Gauss' law, capacitors, energy of charged capacitors, electric current, resistivity, Kirchhoff's law, bridges, potentiometer, thermoelectricity, chemical effect of current, magnetic effect of current, magnetic force on current carrying conductors, galvanometers , Biot – Savart's law, Ampere's law, induced e.m.f., Faraday's law, Lenz's law, eddy currents.

PHYS 241L PRINCIPLES OF PHYSICS LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in PHYS 241. Co-req.: PHYS 241.

MATH 241 CALCULUS & ANALYTICAL GEOMETRY (3Crs.:3Lec):
Multivariable functions, partial derivatives, polar, cylindrical and spherical coordinates, indefinite and definite integrals, methods of integration, multiple integrals, sequences and series, power series, vector field integration.

CMPS 241 INTRODUCTION TO PROGRAMMING (3Crs.: 2Lec.,2Lab):
Introduction to computer hardware and software. Binary system and data representation. The software life-cycle. Flow charts and IPO-charts. Introduction to computer programming and problem solving. Structured high level language programming with an emphasis on procedural abstraction and good programming style. The basic looping and selection constructs arrays, functions, parameter passing and scope of variables.

MATH 242 PROBABILITY AND STATISTICS (3Crs.:2Lec.,2 Lab):
Basic concepts in statistics (mean, variance and frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete and continuous distributions, central limit theorem, regression and correlation, confidence intervals.

Description of Major Core Courses

CMPS 242 OBJECT ORIENTED PROGRAMMING (3Crs.:2Lec,3Lab):
Object oriented concepts and techniques for analysis, design, and implementation. Topics include methods and parameters passing, recursive methods, objects and classes, UML representation of classes, abstraction, encapsulation, information hiding, message passing, overloading, classes relationships (aggregation, composition), inheritance, overriding, polymorphism, abstract classes, interfaces, Exception handling, Files. Pre-req.:CMPS 241.

CMPS 244 - DIGITAL CIRCUITS (3Crs.:2Lec,3Lab):
An introduction to digital electronics, integrated circuits, numbering systems, Boolean algebra, gates, flip-flops, multiplexers, sequential circuits, combinational circuits, and computer architecture. Introduction to hardware description language and programmable logic devices.

CMPS 246 WEB PROGRAMMING (3Crs.:2Lec,3Lab):
The course covers different techniques and technologies for developing dynamic web sites. Topics include introduction to internet infrastructure, PHP as the server-side scripting language, the MySQL database, JavaScript, DHTML, XML and AJAX for enriching web services, and page layout with HTML and CSS. This course includes a team project to deploy a dynamic website. Pre-req.: CMPS 241.

CMPS 248 DISCRETE STRUCTURES I (3Crs.:2Lec,3Lab):
The course introduces basic discrete structures that are backbones of computer science. In particular, this class is meant to introduce logic, proofs, sets, relations, functions, sequences, summations, counting techniques with an emphasis on applications in computer science. Pre-req.: CMPS 241.

MATH 341 LINEAR ALGEBRA (3Crs.: 3Lec.,1 Lab):
A rigorous introduction to linear algebra with emphasis on proof and conceptual reasoning, matrices, determinants, system of linear equations, vector spaces, linear transformations and their matrix representation, linear independence, bases and dimension, rank-nullity, brief discussion on inner product, projections, orthonormal bases, eigenvalues, eigenvectors, diagonalization.

CMPS 342 DATABASE SYSTEMS (3Crs.:2Lec,3Lab) :
Data models and database systems architectures. Conceptual data modeling using entity-relationship diagrams (ERD and Enhanced ERD). The relational database model. Mapping conceptual data models into physical relational design. Theory of functional dependencies and normalization. Relational algebra and tuple relational calculus. Data definition and retrieval using SQL language. Pre-req.: CMPS 242

CMPS 343 COMPUTER ORGANIZATION & ARCHITECTURE (3Crs.:2Lec,3Lab):
This course introduces the principles of computer organization and the basic architecture concepts. Topics include data representation, instruction set architectures, RISC processors, introduction to the MIPS instruction set, measuring performance, designing a simple processor, a single cycle datapath implementation, a multi-cycle implementation, Control Unit Design, Pipelining, cache design. Pre-req.: CMPS 244.

CMPS 344 SOFTWARE ENGINEERING (3Crs.:2Lec,3Lab):
Different phases of large-scale software development with emphasis on analysis, design, testing, and documentation. Topics include: introduction to software engineering, ethics in software engineering, development processes, requirements developments, object oriented analysis and design using UML, architectural design, testing, and project management. Students work in groups on realistic projects to apply covered techniques. Pre-req.: CMPS 242.

CMPS 345 DISCRETE STRUCTURES II (3Crs.:2Lec,3Lab):
The course covers advanced topics in discrete structures. Topics include Recurrence Relations, some topics from Graph Theory: Paths, Components, Connectivity, Euler Paths, Hamiltonian Paths, Isomorphism of Graphs, Trees and topics from Number Theory including computer arithmetic with large integers and Cryptography. Pre-req.: CMPS 248.

CMPS 346 THEORY OF COMPUTATION (3Crs.:2 Lec,2 Tut):
This course is an introduction to the fundamental models of computation used throughout computer science. Topics include deterministic finite automata (DFA), regular languages, non-deterministic finite automata (NFA), equivalence of NFAs and DFAs, closure properties, regular expressions, the pumping lemma, pushdown automata, context free languages, context free grammar, ambiguity, Chomsky normal form, Turing machines, decidability, the halting problem and topics related to time complexity, P, NP and NP-Completeness. Pre-req.: CMPS 248.

CMPS 347 DATA STRUCTURES (3Crs.:2Lec,3Lab):
Fundamental concepts of data structures. Performance measurement of algorithms. Specification, representation and implementation of linear and non-linear data structures: arrays, lists, stacks, queues, priority queues, trees, heaps, hash tables and graphs. Pre-req.: CMPS 242.

MATH 348 NUMERICAL METHODS (3Crs.:2Lec.,2Lab):
Solutions of nonlinear equations in one variable: Bisection, Newton, Fixed point and Secant methods, interpolation and approximation: Lagrange Polynomial, divided differences, Hermite interpolating polynomial, numerical differentiation and integration (quadrature formulas), direct method for solving linear system, numerical methods for solving nonlinear systems of equations, numerical solutions of ODEs. Pre-req.: MATH 241.

CMPS 441 FUNDAMENTALS OF ALGORITHMS (3Crs.:2Lec,3Lab):
A systematic study of algorithms and their complexity. Topics include techniques for designing efficient computer algorithms, proving their correctness, analyzing their run-time complexity; as well as Divide and Conquer algorithms, Greedy algorithms, Dynamic Programming algorithms, Sorting and Searching algorithms (Binary search, Radix sort, Bucket sort, Count Sort, Insertion sort, Merge sort, Quick sort and Heap sort), Order statistics, Graph algorithms (Graph traversal, Minimum spanning trees and Shortest path problems). Prerequisites: CMPS 347 & CMPS 345.

CMPS 442 OPERATING SYSTEMS (3Crs.:2Lec,3Lab):
Operating systems concepts and functions. Operating systems structures and system Calls. Processes and threads scheduling. Inter-process communication. CPU scheduling algorithms. Process synchronization. Deadlocks. Main memory management. Virtual memory management. File management. I/O subsystem and device management. Selected topics in networking, protection and security, distributed systems. Pre-req.: CMPS 347.

CMPS 443 SENIOR PROJECT I (1Cr.:1Lec,0Lab):
In this course, students choose a senior project subject; define problem statements and system requirements, make feasibility study, define design and time table schedule. In this course, students must deliver a preliminary report and present the project report at the end of the semester.

CMPS 444 SENIOR PROJECT II (1Cr.:1Lec,0Lab):
This course is the continuation of the senior project I. Senior project II course offers students an opportunity to assemble their knowledge acquired throughout their BS curriculum to realize a final project. In this course, students must deliver a software product and final senior project report, which passes through the requirements, analysis, design, implementation, testing, and evaluation stages. Students must present the senior project report at the end of the semester. Pre-req.: CMPS 443.

CMPS 445 CONCEPTS OF PROGRAMMING LANGUAGES (3Crs.:2Lec,3Lab):
This course will define, analyze and evaluate important concepts found in current programming languages. Its goals are to build an ability to evaluate and compare programming languages, both from the user's and implementor's view. Topics include: syntax, operational semantics, scope of objects and time of binding, type checking, module mechanisms (e.g., blocks, procedures, coroutines), data abstraction, data types, expressions, control structures, subprograms, implementation of subprograms, functional programming, logic programming and object-oriented programming languages. This course includes a team project to learn a novel programming language and use it in implementing an application. Pre-req.: CMPS 347.

CMPS 447 COMPUTER NETWORKS (3Crs.:2Lec,3Lab):
Fundamental principles in computer networks are applied to obtain practical experience and skills necessary for designing and implementing computer networks, protocols, and network applications. Various network design techniques, simulation techniques, and UNIX network programming are covered. Pre-req.: CMPS 347.

Departmental Elective Courses

Courses			crs.	Pro/Co-requisites
CMPS	325	Computer and Society	3	
CMPS	326	Introduction to Human-Computer Interaction	3	Pre-req.: CMPS 242
CMPS	327	Image Processing	3	Pre-req.: CMPS 242
CMPS	348	Compiler Construction	3	Pre-req.: CMPS 347
CMPS	349	File Structures	3	Pre-req.: CMPS 347
CMPS	450	Computer Graphics	3	Pre-req.: CMPS 347
CMPS	451	Software Design and Quality	3	Pre-req.: CMPS 344
CMPS	452	Introduction to Data Mining	3	Pre-req.: CMPS 342 & MATH 242
CMPS	453	Artificial Intelligence	3	Pre-req.: CMPS 347 & CMPS 345
CMPS	454	Logic and Automated Reasoning	3	Pre-req.: CMPS 445 & CMPS 248
CMPS	455	Computer Security	3	Pre-req.: CMPS 447
CMPS	456	Topics in Computer Science	3	

Description of Departmental Elective Courses

CMPS 325 COMPUTER AND SOCIETY (3Crs.:2Lec,3Lab):
Technology and Humanity, Social and Political impacts of computers. Privacy and Information: wire tapping and encryption, internet security, communication in cyberspace, censorship. Protecting software and their intellectual property: patent, cyberspace copyright. Computer crimes.

CMPS 326 INTRODUCTION TO HUMAN-COMPUTER INTERACTION (3Crs.:2Lec,3Lab):
Mapping. Affordances. Constraints. Seven Stages of Action. Schneiderman's 8 Golden Rules. Information Visualization. Model Human Processor. Keystroke Level Model. Fitt's law. Input devices (Keyboard, Pointing, Voice). Output devices (Displays, Color, Sound). Interaction Styles (direct manipulation, menu selection, form-fill-in, command languages) .Windows. Icons. Menus. Dialogue Boxes. Concepts (grids, simplicity, consistency, white space).Context Sensitive Help. Tutorials. Reference Material. Cognitive Walkthrough. Heuristic Evaluation. Expert Reviews. Controlled Experiments (subjects, dependant & independent variables, statistics). Synchronous / Asynchronous tools. Audio / Video. Shared Workspaces. Pre-req.: CMPS 242.

CMPS 327 IMAGE PROCESSING (3Crs.:2Lec,3Lab):
The goal of the course is to introduce the student to theoretical foundations and modern applications in Digital Image Processing. Topics include image digitization and representation, image enhancement in spatial and frequency domain, image segmentation, edge detection, features extraction and classification. Pre-req.: CMPS 242.

CMPS 348 COMPILER CONSTRUCTION (3Crs.:2Lec,3Lab):
Compiler functions. Language elements. BNF grammars, regular expressions. Finite state machines. Lexical analyzers. Context free grammars. Grammar ambiguity problem. Parse trees. Parsing methods (Top-down, recursive descent, LL, LR). Symbol table construction. Code generation. Code optimization techniques. Pre-req.: CMPS 347.

CMPS 349 FILE STRUCTURES (3Crs.:2 Lec,3Lab):
Language essentials for file processing. Access methods, processing algorithms; I/O devices; sequential files, indexed and tree structured files (B-Trees), Hashed files. Pre-req.: CMPS 347.

CMPS 450 COMPUTER GRAPHICS (3Crs.:2 Lec,3Lab):
Raster and vector graphics system. Video display devices. Physical and logical input devices. Issues facing the developer of graphical systems. Hierarchy of graphics software. User interface. Half-toning. Font generation: outline vs. bitmap. Representation of polyhedral objects. Scan conversion of 2D primitive, forward differencing. Tessellation of curved surfaces. Homogeneous coordinates. Affine transformations (scaling, rotation, translation).Viewing transformation. Clipping. Hidden surface removal methods. Z-buffer and frame buffer, color channels (a channel for opacity).Color models (RGB, HVS, CYM).Light source properties; material properties; ambient, diffuse, and specular reflections. Phong reflection model. Rendering of a polygonal surface, flat shading, Gouraud shading, and Phong shading. Texture mapping, bump texture, environment map. Ray tracing. Image synthesis, sampling techniques, and anti-aliasing. Parametric polynomial curves and surfaces. Implicit curves and surfaces. Bézier curves and surfaces, control points, de Casteljau algorithm. B-spline curves and surfaces, local editing, knots, control points. NURBS curves and surfaces. Constructive Solid Geometry (CSG) for solid modeling. Boundary Representation of solids (B-Rep). Pre-req.: CMPS 347.

CMPS 451 SOFTWARE DESIGN AND QUALITY (3Crs.:2Lec,3Lab):
Critical aspects of the software lifecycle, Quality of software system, Techniques and approaches to software design, quality and reliability, Domain Engineering and Software Reuse. Pre-req.: CMPS 344.

CMPS 452 INTRODUCTION TO DATA MINING (3Crs.:2Lec,3Lab):
This course introduces and studies the concepts, issues, tasks and techniques of data mining. Topics include data preparation and feature selection, decision tables, decision trees, classification rules, association rules, clustering, statistical modeling, and linear models. Pre-req.: CMPS 342 & Math 242.

CMPS 453 ARTIFICIAL INTELLIGENCE (3Crs.:2Lec,3Lab):
Definitions of intelligent systems. Optimality vs. speed tradeoff. Problem spaces. Brute-force search (DFS, BFS, uniform cost search). Heuristic search (best-first, A*, IDA*).Local search (hill-climbing, simulated annealing, genetic search).Game-playing methods (minimax search, alpha-beta pruning).Constraint satisfaction (backtracking and heuristic repair).Representation of space and time. Predicate calculus and resolution. Logic programming and theorem proving. Design and development of knowledge-based systems. Knowledge representation mechanisms. Tools for knowledge-based system development. Pre-req.:CMPS 347 & CMPS 345.

CMPS 454 LOGIC AND AUTOMATED REASONING (3Crs.:2Lec,3Lab):
Elementary set theory. Propositional logic. Propositional logic reasoning using resolution. Normal forms, clauses, resolution. First-order/predicate logic introduction. Quantifiers, first order models, validity and satisfiability. First-order reasoning using unrestricted resolution. Normal forms, clauses, Skolemization. Elimination of quantifiers, unification, resolution, simplification techniques. Orderings. Well-founded orderings, lexicographic combinations of orderings, multi-sets, multi-set orderings, reduction orderings, lexicographic path orderings. Refutational completeness of propositional resolution. Herbrand interpretations, soundness, clause orderings, construction of candidate models, reduction of counter-examples, model existence theorem, refutational completeness, compactness of propositional logic. Refutational completeness of first-order resolution. Horn clauses, SLD resolution. Pre-req.: CMPS 445 & CMPS 248.

CMPS 455 COMPUTER SECURITY (3Crs.:2Lec,3Lab):
General concepts and applied methods of computer security, especially as they relate to confidentiality, integrity, and availability of information assets. Topics include system security analysis, access control and various security models, identification and authentication, protection against external and internal threats, communication protocols and internet security. Pre-req.: CMPS 447.

CMPS 456 TOPICS IN COMPUTER SCIENCE (3Crs.:2Lec,3Lab):
Selected recent topics in computer science. Course content will vary from year to year.

Study Plan

B.Sc. Degree in Computer Science (100 credits)

First Semester (17 Credits)			Crs.	Pre-/co-requisites
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-Req: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-Req: PHYS 241
MATH	241	Calculus and Analytical Geometry	3	
CMPS	241	Introduction to Programming	3	
		University Requirements	3	

Second Semester (17 Credits)			Crs.	Pre-/co-requisites
CMPS	242	Object Oriented Programming	3	Pre-Req: CMPS 241
CMPS	244	Digital Circuits	3	
CMPS	246	Web Programming	3	Pre-Req: CMPS 241
CMPS	248	Discrete Structures I	3	Pre-Req: CMPS 241
MATH	242	Probability and Statistics	3	
		University Requirements	2	

Third Semester (17 Credits)			Crs.	Pre-/co-requisites
MATH	341	Linear Algebra	3	
CMPS	347	Data Structures	3	Pre-Req: CMPS 242
CMPS	343	Computer Organization & Architecture	3	Pre-Req: CMPS 244
CMPS	345	Discrete Structures II	3	Pre-Req: CMPS 248
		University Requirements	2	
		Departmental Elective	3	

Fourth Semester (17 Credits)			Crs.	Pre-/co-requisites
CMPS	342	Database Systems	3	Pre-Req: CMPS 242
CMPS	344	Software Engineering	3	Pre-Req: CMPS 242
CMPS	346	Theory of Computation	3	Pre-Req: CMPS 248
MATH	348	Numerical Methods	3	Pre-Req: MATH 241
		University Requirements	2	
		Departmental Elective	3	

Fifth Semester (17 Credits)			Crs.	Pre-/co-requisites
CMPS	441	Fundamentals of Algorithms	3	Pre-Req: CMPS 347, CMPS 345
CMPS	445	Concepts of Programming Languages	3	Pre-Req: CMPS 347
CMPS	447	Computer Networks	3	Pre-Req: CMPS 347
CMPS	443	Senior Project I	1	
		University Requirements	3	
		Elective (General Science)	4	

Sixth Semester (15 Credits)			Crs.	Pre-/co-requisites
CMPS	442	Operating Systems	3	Pre-Req: CMPS 347
CMPS	444	Senior Project II	1	Pre-Req: CMPS 443
		University Requirements	4	
		Elective (General Science)	4	
		Departmental Elective	3	

* A total of 16 credits is required as General University Requirements: 5 credits are selected from the University Mandatory courses list , 4 credits from social sciences list, 4 credits from humanities list and 3 credits from other lists of the university elective courses.
- The list of University Requirement courses and their descriptions are presented in the introductory pages of this catalogue.

B. Mathematics Program

Mission

The program provides students with the opportunity to study the primary areas of contemporary mathematics, provides physical and social science majors with the necessary mathematical tools for work in their disciplines, and introduces all students to serious and interesting mathematical ideas and their applications.

Objectives

The program strives to enable students to:

- Build a foundation of basic knowledge of mathematics.
- Improve analytical and problem-solving skills.
- Develop research skills and be aware of the variety problems related to the field of study.
- Enhance professional thinking.

Learning Outcomes

The mathematics program enables students, by the time of graduation, to achieve the following learning outcomes:

a- Knowledge and understanding of:

- The basic theorems and concepts in the different areas of mathematics.
- The implementation of theories in problem solving.
- The different areas of research in mathematics.

b- Intellectual abilities:

- Ability to understand the different math concepts and be able to implement them in our everyday problems.
- Ability to consider problems that could be solved by implementing concepts from different areas in mathematics.
- Ability to identify, formulate, and solve problems.

c- Professional and Practical competencies:

- Efficient use of computers, laboratories and software to handle problems that are difficult to be solved manually.
- Understanding of professional and ethical responsibilities.
- Efficient use of the techniques, skills and tools of modern mathematics.

d- General and Transferable Skills:

- Functioning in multi-disciplinary teams.
- Communicate ideas effectively in graphical, oral, and written media.
- Recognize and respond to the need for lifelong and self-learning for a successful career.

Degree Requirements

To obtain the Bachelor Degree in Mathematics' Program, students must successfully complete a total of 97 credit hours + ICDL, where the standard duration of study is 6 semesters. There is one general semester of study for the students of the Mathematics Program.

Career Opportunities

Teaching, Consultants to actuaries, Management Services & Computing, Accountancy, Statistical Work.

Program Overview

The Mathematics curriculum consists of the following components:

Mathematics Program	
I. University Requirements	**Credits**
* University Mandatory Courses	5
* University Elective Courses	16
II. Program Requirements	**Credits**
Faculty Core Courses	17
Major Core Courses	41
Departmental Elective Courses	12
**Free Electives	6
Total	**97**

Faculty and Major Core Courses

Courses			Crs.	Pre-/Co-requisites
MATH	241	Calculus and Analytical Geometry	3	
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-req.: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-req.: PHYS 241
CMPS	241	Introduction to Programming	3	

* A total of 21 credits is required as University Requirements: 5 credits are selected from the University Mandatory courses list, 6 credits from social sciences list, 6 credits from humanities list and 4 credits from other lists of the university elective courses.

** A total of 6 credits is required as free electives, student can enroll in any course offered by BAU faculties, with at least one course outside the department offering the program.

MATH	242	Probability and Statistics	3	
MATH	244	Ordinary Differential Equations	3	Pre-req.: MATH 241
MATH	246	Real Analysis I	3	Pre-req.: MATH 241
MATH	341	Linear Algebra	3	
MATH	342	Vector Calculus	3	Pre-req.: MATH 241
MATH	343	Special Functions	3	Pre-req.: MATH 244
MATH	344	Real Analysis II	3	Pre-req.: MATH 246
MATH	345	Discrete Mathematics	3	
MATH	346	Abstract Algebra I	3	Pre-req.: MATH 345
MATH	348	Numerical Methods	3	Pre-req.: MATH 241
MATH	441	Introduction to Complex Analysis	3	Pre-req.: MATH 241
MATH	442	Abstract Algebra II	3	Pre-req.: MATH 346
MATH	443	Topology	3	Pre-req.: MATH 246
MATH	444	Senior Project	2	
MATH	446	Fourier Series and Applications	3	Pre-req.: MATH 246

Description of Faculty Core Courses

CHEM 241 PRINCIPLES OF CHEMISTRY (3Crs.:3Lec):
A study of the fundamental concepts of chemistry including matter and measurement, atoms, molecules, ions, moles, nomenclature, atomic and molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, and solid states of matter. Properties of solutions, aqueous reactions and solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases and ionic equilibria, electrochemistry, nuclear chemistry and coordination chemistry.

CHEM 241L PRINCIPLES OF CHEMISTRY LABORATORY (1Cr.:3Lab):
Selected experiments illustrate the topics discussed in CHEM 241. Co-req.: CHEM 241.

PHYS 241 PRINCIPLES OF PHYSICS (3Crs.:3Lec):
Mechanical properties of matter, Coulomb's law, electric field, electric potential, equipotential surfaces, Gauss' law, capacitors, energy of charged capacitors, electric current, resistivity, Kirchhoff's law, bridges, potentiometer, thermoelectricity, chemical effect of current, magnetic effect of current, magnetic force on current carrying conductors, galvanometers , Biot – Savart's law, Ampere's law, induced e.m.f., Faraday's law, Lenz's law, eddy currents.

PHYS 241L PRINCIPLES OF PHYSICS LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in PHYS 241. Co-req.: PHYS 241.

MATH 241 CALCULUS & ANALYTICAL GEOMETRY (3Crs.:3Lec):
Multivariable functions, partial derivatives, polar, cylindrical and spherical coordinates, indefinite and definite integrals, methods of integration, multiple integrals, sequences and series, power series, vector field integration.

CMPS 241 INTRODUCTION TO PROGRAMMING (3Crs.:2Lec.,2Lab):
Introduction to computer hardware and software. Binary system and data representation. The software life-cycle. Flow charts and IPO-charts. Introduction to computer programming and problem solving. Structured high level language programming with an emphasis on procedural abstraction and good programming style. The basic looping and selection constructs arrays, functions, parameter passing and scope of variables.

MATH 242 PROBABILITY AND STATISTICS (3Crs.:2Lec.,2Lab):
Basic concepts in statistics (mean, variance and frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete and continuous distributions, central limit theorem, regression and correlation, confidence intervals.

Description of Major Core Courses

MATH 244 ORDINARY DIFFERENTIAL EQUATIONS (3Crs.:3Lec):
First order ordinary differential equations and applications, linear higher order differential equations, systems of linear differential equations, series solutions of differential equations, Laplace transforms. Pre-req.: MATH 241.

MATH 246 REAL ANALYSIS I (3Crs.:3Lec):
Metric spaces, basic topics in topology of the real line, numerical sequences and series, continuity and uniform continuity of functions, differentiation, the mean-value theorem, Taylor's theorem, Riemann-Stieljes integral. Pre-req.: MATH 241.

MATH 341 LINEAR ALGEBRA (3Cr.:3Lec.,1Lab):
A rigorous introduction to linear algebra with emphasis on proof and conceptual reasoning, matrices, determinants, system of linear equations, vector spaces, linear transformations and their matrix representation, linear independence, bases and dimension, rank-nullity, brief discussion on inner product, projections, orthonormal bases, eigenvalues, eigenvectors, diagonalization.

MATH 342 VECTOR CALCULUS (3Crs.:3Lec):
Vector fields, differentiation of vector functions, the derivation as a linear transform, gradient of scalar function, inverse and implicit function theorem, directional

derivative, divergence, curl, differential forms, linear integrals, Stoke's theorem and Green's Theorem with applications, orthogonal curvilinear coordinate systems, cylindrical, spherical and elliptic coordinate systems. Pre-req.: MATH 241.

MATH 343 SPECIAL FUNCTIONS (3Crs.:3Lec):
Legendre and Bessel functions, Hermite and Laguerre polynomials, hypergeometric functions, Gamma, Beta and Error functions. Pre-req.: MATH 244.

MATH 344 REAL ANALYSIS II (3Crs.:3Lec):
Riemann integral, convergence of sequences and series of functions, functions of several variables, limit of integral of a sequence of functions, contraction principle. Pre-req.: MATH 246.

MATH 345 DISCRETE MATHEMATICS (3Crs.:2Lec.,2Lab):
Logical reasoning and proof, sets, relations and functions, matrices, Boolean Algebra, mathematical induction, counting and simple finite probability theory, analysis of algorithms, truth table, graphs and trees, Euler's path and Euler's cycle.

MATH 346 ABSTRACT ALGEBRA I (3Crs.:3Lec):
Binary operations, groups, subgroups, normal subgroups, cyclic groups and subgroups, cosets, Lagrange's theorem, counting theorems, groups of permutations, quotient groups, homomorphisms, isomorphisms, homomorphism theorems. Direct product, fundamental theorem of finite abelian groups. Classification of groups of low order. Pre-req.: MATH 345.

MATH 348 NUMERICAL METHODS (3Crs.:2Lec.,2Lab):
Solutions of nonlinear equations in one variable: Bisection, Newton, Fixed point and Secant methods, interpolation and approximation: Lagrange Polynomial, divided differences, Hermite interpolating polynomial, numerical differentiation and integration (quadrature formulas), direct method for solving linear system, numerical methods for solving nonlinear systems of equations, numerical solutions of ODEs. Pre-req.: MATH 241.

MATH 441 INTRODUCTION TO COMPLEX ANALYSIS (3Crs.:3Lec):
Complex numbers, analytic functions, integration in the complex plane, Cauchy's integral theorem, Taylor's series, Laurent series, singularities, residues and contour integration. Pre-req.: MATH 241.

MATH 442 ABSTRACT ALGEBRA II (3Crs.:3Lec):
Rings, integral domains, fields, ideals, quotient rings, prime and maximal ideals. Divisibility theory, unique factorization domains, Euclidean domains. Polynomial rings, finite fields. Pre-req.: MATH 346.

MATH 443 TOPOLOGY (3Crs.:3Lec):
Topological spaces, open sets, closed sets, derived sets, interior and closure, continuous functions, separation axioms, compactness, connectedness, metrizable spaces and finite product spaces. Pre-req.: MATH 246.

MATH 444 SENIOR PROJECT (2Crs.:2Lec):
A topic in mathematics is chosen under the consent of an academic advisor, where the student has to write about it and submit a written project at the end of the semester.

MATH 446 FOURIER SERIES AND APPLICATIONS (3Crs.:3Lec):
Uniform and absolute convergence of infinite series and integrals, Gram-Shmidt orthogonalization, orthogonal polynomials, Fourier series, Fourier transform, Parseval and Plancherel theorems, some applications. Pre-req.: MATH 246.

Departmental Elective Courses

Courses			Crs.	Pre-/Co-requisites
MATH	351	Differential Geometry	3	Pre-req.: MATH 241
MATH	352	Number Theory	3	
MATH	353	Set Theory	3	
MATH	354	Introduction to Dynamics	3	Pre-req.: MATH 241
MATH	355	Calculus of Variations	3	Pre-req.: MATH 244
MATH	451	Differential Calculus	3	Pre-req.: MATH 246
MATH	452	Partial Differential Equations	3	Pre-req.: MATH 244
MATH	454	Mathematical Computation	3	Pre-req.: MATH 348
MATH	455	Topics in Linear Algebra	3	Pre-req.: MATH 341
MATH	456	Topics in Mathematics	3	

Description of Departmental Elective Courses

MATH 351 DIFFERENTIAL GEOMETRY (3Crs.:3Lec):
Vectors in Euclidean space, basic rules of vector calculus in Euclidean spaces,theory of curves: arc length, tangent and normal plane, osculating plane, principal normal, curvature, binomial, moving trihedron of a curve, torsion, formulas of Frenet, evolutes and involutes, cylindrical helices, curvature and torsion of involutes and evolutes, surfaces : curves on surfaces, tangent and normal planes, family of surfaces, envelope, edge of regression, Gaussian and mean curvatures, lines and curvature. Pre-req.: MATH 241.

MATH 352 NUMBER THEORY (3Crs.:3Lec.,1Lab):
Divisibility, greatest common divisor, prime factorization, congruence, quadratic residues, Legendre symbol, Jacobi symbol, quadratic reciprocity, linear Diophantine equations, binary quadratic forms.

MATH 353 SET THEORY (3Crs.:3Lec):
Elementary logic, propositional and predicate calculus, operations on sets and families of sets, ordered sets, countable and uncountable sets, transfinite induction, axiom of choice and equivalent forms, ordinal and cardinal numbers.

MATH 354 INTRODUCTION TO DYNAMICS (3Crs.:3Lec):
Vector algebra, motion of particle in a straight line with variable acceleration, vector motion of a particle, simple harmonic motion with applications, simple pendulum and conical pendulum, motion projectiles, impulse, momentum and impact of elastic bodies, center of mass of rigid bodies, motion of a particle in two dimensions using polar coordinates and intrinsic coordinates, motion of a particle on a rough curve in a vertical plane. Pre-req.: MATH 241.

MATH 355 CALCULUS OF VARIATIONS (3Crs.:3Lec):
Topics will include: variation of a functional, the Euler-Lagrange equations, parametric forms, canonical transformations, conservation laws, the Hamilton-Jacobi equation, second variation. Pre-req.: MATH 244.

MATH 451 DIFFERENTIAL CALCULUS (3Crs.:3Lec):
Normed vector spaces, differentiation, diffeomorphisms, Jacobian matrix (finite dimension case), high order differentiation, Schwarz theorem, critical points and extrema, generalized inverse and implicit function theorems. Pre-req.: MATH 246.

MATH 452 PARTIAL DIFFERENTIAL EQUATIONS (3Crs.:3Lec):
Classifications and characteristics of second order partial differential equations, qualitative behavior of solutions to elliptic equations and evolution equations. First order partial differential equations, eigen function expansion and integral transform, Green's functions, finite difference method. Pre-req.: MATH 244.

MATH 454 MATHEMATICAL COMPUTATION (3Crs.:2Lec.,2Lab):
Modeling linear programming and deriving methods for solving them using algorithms such as: geometrical method, simplex method, dual simplex method, transportation algorithms. Problems without constraint will be also discussed, where various numerical methods apply. Pre-req.: MATH 348.

MATH 455 TOPICS IN LINEAR ALGEBRA (3Crs.:3Lec.,1Lab):
Hamilton-Cayley theorem, Jordan normal form, adjoints and spectral theory in finite dimensional spaces, primary decomposition, triangularizations, direct sums, canonical forms, orthogonal and unitary transformations. Pre-req.: MATH 341.

MATH 456 TOPICS IN MATHEMATICS (3Crs.:3Lec):
This course covers selected topics in mathematics.

Study Plan

B.Sc. Degree in Mathematics (97 Credits)

First Semester (17 Credits)			Crs.	Pre-/co-requisites
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-Req: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-Req: PHYS 241
MATH	241	Calculus and Analytical Geometry	3	
CMPS	241	Introduction to Programming	3	
		University Requirements	3	

Second Semester (16 Credits)			Crs.	Pre-/co-requisites
MATH	244	Ordinary Differential Equations	3	Pre-Req: MATH 241
MATH	246	Real Analysis I	3	Pre-Req: MATH 241
MATH	242	Probability and Statistics	3	
		University Requirements	7	

Third Semester (17 Credits)			Crs.	Pre-/co-requisites
MATH	341	Linear Algebra	3	
MATH	343	Special Functions	3	Pre-Req: MATH 244
MATH	345	Discrete Mathematics	3	
		University Requirements	2	
		Departmental Elective	3	
		Free Elective	3	

Fourth Semester (17 Credits)			Crs.	Pre-/co-requisites
MATH	342	Vector Calculus	3	Pre-Req: MATH 241
MATH	344	Real Analysis II	3	Pre-Req: MATH 246
MATH	346	Abstract Algebra I	3	Pre-Req: MATH 345
MATH	348	Numerical Methods	3	Pre-Req: MATH 241
		University Requirements	5	

Fifth Semester (16 Credits)			Crs.	Pre-/co-requisites
MATH	441	Introduction to Complex Analysis	3	Pre-Req: MATH 241
MATH	443	Topology	3	Pre-Req: MATH 246
		University Requirements	4	
		Departmental Elective	3	
		Free Elective	3	

Sixth Semester (14 Credits)			Crs.	Pre-/co-requisites
MATH	442	Abstract Algebra II	3	Pre-Req: MATH 346
MATH	446	Fourier Series and Applications	3	Pre-Req: MATH 246
MATH	444	Senior Project	2	
		Departmental Elective	6	

DEPARTMENT OF PHYSICS

Academic Staff

Chairperson	Dr. Ramadan Awad
Professors	Dr. Mahmoud El Korek
Associate Professors	Dr. Mohamed Sakr
Assistant Professors	Dr. Salem Marhaba
Part-time Lecturers	Dr. Alaa Hamdan, Dr. Ali Kaafarani, Dr. Omar Deeb, , Dr. Rami Nabulsi, Dr. Alaa El-Din Allouch, Dr. Ola Kerhani, Dr. Houssam El Sheikh, Mr. Adnan Tayyara

Mission

The Department of Physics at the Faculty of Science, BAU, aims to provide students with a rigorous and lively program of instruction in physics within the liberal arts context of the Faculty.

Objectives

The program strives to enable students to:

- Demonstrate applied competence in applying basic knowledge of physics to analyze problems of nature.
- Improve the analytical and problem-solving skills related to physics.
- Develop research on, teaching of, and design of components, devices, and systems.

Learning Outcomes

a- Knowledge and understanding of:

- The physical sciences and mathematics (Physics, Mathematics, Mechanics, Chemistry,…).
- The fundamentals to study physics problems.
- The quantitative comparison of theory and experiments for physics.

b- Intellectual abilities:

- Ability to understand what physics is.
- Ability to be familiar with acute physics (electronics, microwaves, radiation, nuclear, solid, quantum mechanics, acoustics….)
- Ability to identify, formulate, and solve problems in physics.

c- Professional and Practical competencies:

- Efficient use of and familiarity with physic laboratory measuring instruments.
- Understanding of professional and ethical responsibilities.
- Efficient use of the techniques, skills and tools of modern physics in practical life.

d- General and Transferable Skills:

- Function in multi-disciplinary teams
- Communicate ideas effectively in graphical, oral and written media
- Recognize and respond to the need for lifelong and self-learning for a successful career

Degree Requirements

To obtain the Bachelor Degree in Physics, students must successfully complete a total of 97 credit hours + ICDL, where the standard duration of study is 6 semesters. There is one general semester of study for the students of the Physics Program.

Career Opportunities

Students graduating with a degree in Physics from the Faculty of Science will be well prepared for graduate study and careers in many fields, including physics and related sciences. They will be competitive with their peers both in application to top graduate schools and in seeking employment.

Program Overview

The physics curriculum consists of the following components:

Physics Program	
I. University Requirements	**Credits**
* University Mandatory Courses	5
* University Elective Courses	16
II. Program Requirements	**Credits**
Faculty Core Courses	17
Major Core Courses	44
Departmental Elective Courses	9
**Free Electives	6
Total	**97**

* A total of 21 credits is required as University Requirements: 5 credits are selected from the University Mandatory courses list, 6 credits from social sciences list, 6 credits from humanities list and 4 credits from other lists of the university elective courses.

** A total of 6 credits is required as free electives, student can enroll in any course offered by BAU faculties, with at least one course outside the department offering the program.

Faculty and Major Core Courses

Courses			Crs.	Pre-/Co-requisites
MATH	241	Calculus and Analytical Geometry	3	
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-req.: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-req.: PHYS 241
CMPS	241	Introduction to Programming	3	
MATH	242	Probability and Statistics	3	
PHYS	242	Thermal Physics	2	
PHYS	242L	Thermal Physics Laboratory	1	Co-req.: PHYS 242
PHYS	244	Physical Optics	2	
PHYS	244L	Physical Optics laboratory	1	Co-req.: PHYS 244
MATH	244	Ordinary Differential Equations	3	Pre-req.: MATH 241
PHYS	341	Classical Mechanics and Waves	3	
PHYS	341L	Classical Mechanics and Waves Laboratory	1	Co-req.: PHYS 341
PHYS	342	Quantum Mechanics I	3	Pre-req.: PHYS 341
PHYS	343	Electromagnetism	3	Pre-req.: PHYS 241
PHYS	343L	Electromagnetism Laboratory	1	Co-req.: PHYS 343
PHYS	344	Relativity	3	Pre-req.: PHYS 341
PHYS	345	Mathematical Methods for Physics	3	Pre-req.: MATH 241
PHYS	441	Electrodynamics	3	Pre-req.: PHYS 343
PHYS	442	Solid State Physics	3	Pre-req.: PHYS 342
PHYS	442L	Solid State Physics Laboratory	1	Co-req.: PHYS 442
PHYS	443	Quantum Mechanics II	3	Pre-req.: PHYS 342
PHYS	444	Senior Project	2	
PHYS	446	Statistical Physics	3	Pre-req.: PHYS 242
PHYS	448	Computational Physics	3	Pre-req.: CMPS 241

Description of Faculty Core Courses

CHEM 241 PRINCIPLES OF CHEMISTRY (3Crs.:3 Lec):
A study of the fundamental concepts of chemistry including matter and measurement, atoms, molecules, ions, moles, nomenclature, atomic and molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, and solid states of matter. Properties of solutions, aqueous reactions and solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases and ionic equilibria, electrochemistry, nuclear chemistry and coordination chemistry.

CHEM 241L PRINCIPLES OF CHEMISTRY LABORATORY (1Cr.:3Lab):
Selected experiments illustrate the topics discussed in CHEM 241. Co-req.: CHEM 241.

PHYS 241 PRINCIPLES OF PHYSICS (3Crs.:3 Lec):
Mechanical properties of matter, Coulomb's law, electric field, electric potential, equipotential surfaces, Gauss's law, capacitors, energy of charged capacitors, electric current, resistivity, Kirchhoff's law, bridges, potentiometer, thermoelectricity, chemical effect of current, magnetic effect of current, magnetic force on current carrying conductors, galvanometers , Biot – Savart's law, Ampere's law, induced e.m.f., Faraday's law, Lenz's law, eddy currents.

PHYS 241L PRINCIPLES OF PHYSICS LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in PHYS 241. Co-req.: PHYS 241.

MATH 241 CALCULUS & ANALYTICAL GEOMETRY (3Crs.:3Lec):
Multivariable functions, partial derivatives, polar, cylindrical and spherical coordinates, indefinite and definite integrals, methods of integration, multiple integrals, sequences and series, power series, vector field integration.

CMPS 241 INTRODUCTION TO PROGRAMMING (3Crs.:2 Lec.,2Lab):
Introduction to computer hardware and software, Binary system and data representation. The software life-cycle. Flow charts and IPO-charts. Introduction to computer programming and problem solving. Structured high level language programming with an emphasis on procedural abstraction and good programming style. The basic looping and selection constructs arrays, functions, parameter passing and scope of variables.

MATH 242 PROBABILITY AND STATISTICS (3Crs.:2Lec.,2 Lab):
Basic concepts in statistics (mean, variance and frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete and continuous distributions, central limit theorem, regression and correlation, confidence intervals.

Description of Major Core Courses

PHYS 242 THERMAL PHYSICS (2Crs.:2 Lec):
Thermodynamic systems, isolated, closed and opened systems. Thermodynamic equilibrium, zeroth law, Temperature and Temperature scales, Pressure and Thermometry. Ideas gases. Inversion theorem and pseudo-chain rule, applications of isothermal compressibility and volume expansion coefficients. First Law, Calorimetric definition of heat, work in thermodynamic systems, Internal energy. Reversible and Irreversible processes. Work in different processes, cycles, PV systems (P-V diagrams) and magnetic systems, Heat Capacities, Adiabatic Transformations of ideal gas. Second Law, Kelvin and Clausius statements, and their equivalence. Carnot Cycle efficiency, engines, Refrigerators, Carnot Theorem and Thermodynamic Temperature scale. Clausius-Clapeyron Equation, Drinking bird and Maxwell's Demon. Entropy, Examples: of ideal gas, free expansion, Gibbs' Paradox, Clausius inequality, principle of increase of entropy, T-S diagrams, Third Law, with applications. Thermodynamic potentials and Maxwell's relations, First and second Tds equations, Joule-Thompson Effect and gas liquefaction.

PHYS 242L THERMAL PHYSICS LABORATORY (1Cr.:2 Lab):
Experimental work related to the topics discussed in PHYS 242. Co-req.: PHYS 242.

PHYS 244 PHYSICAL OPTICS (2Crs.:2Lec):
The simple fundamental facts about light- The corpuscular and wave theories of light, The velocity of light determination using different techniques, The properties and theory of waves-Young's double slit experiment, Fresnel's biprism, Fresnel's double mirror and Lloyd's single mirror, The colours of thin films and thin films theory, Newton's rings, Michelson Interferometer-Fresnel's diffraction, Fresnel's zones and his zone plate, Diffraction at a circular aperture, circular disk and straight edges,Fraunhofer case of diffraction, single slit and diffraction grating, Resolving powers of different devices, Double refraction, ordinary and extra ordinary light beams, Malu's law of polarization, Rotation of plane of polarization, Polarization by reflection, Brewester's law.

PHYS 244L PHYSICAL OPTICS LABORATORY (1Cr.:2 Lab):
Experimental work related to the topics discussed in PHYS 244. Co-req.: PHYS 244.

MATH 244 ORDINARY DIFFERENTIAL EQUATIONS (3Crs.:3Lec):
First order ordinary differential equations and applications, linear higher order differential equations, systems of linear differential equations, series solutions of differential equations, Laplace transforms. Pre-req.: MATH 241.

PHYS 341 CLASSICAL MECHANICS AND WAVES (3Crs.:3 Lec):
Vectors: coordinate systems, derivatives of vectors. Kinematics: velocity and acceleration, angular velocity, relative motion. Newton's laws, consequences. Conservative forces, solution methods. Harmonic oscillator, damped and forced oscillations. Resonance. Internal forces and torques, Center of Mass CM coordinates, two-body problem, collisions. Rigid body mechanics, equation of motion, moment of inertia. Kepler's laws, gravitational fields and forces, inverse square law orbits and energies, stability and symmetry. Constraints, generalized coordinates, Lagrangian, generalized momenta. Lagrange and Hamilton's equations, examples. Strings, equations of motion, normal frequencies and modes. Wave Equation.

PHYS 341L CLASSICAL MECHANICS AND WAVES LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in PHYS 341. Co-req.: PHYS 341.

PHYS 342 QUANTUM MECHANICS I (3Crs.:3Lec):
Schrödinger wave equation and probability interpretations, eigen functions and eigenvalues, one dimensional potentials and barriers. The general structure of wave mechanics, operator methods in quantum mechanics. N–particle systems, Schrödinger equation in three dimensions, angular momentum, solution of Schrödinger equation for the hydrogen atom. Pre-req.: PHYS 341

PHYS 343 ELECTROMAGNETISM (3Crs.:3Lec):
The electric field. Divergence and curl of electrostatic fields. Electric potential. Work and energy in electrostatics. Conductors. Laplace's Equation. The method of images. Separation of variables. Multipole expansion. Electric fields in matter. The Lorentz force law. The Biot-Savart law. The divergence and curl of the magnetic field. Magnetic vector potential. Magnetic fields in matter. Electromotive force, electromagnetic induction and Maxwell's equations. Pre-req.: PHYS 241.

PHYS 343L ELECTROMAGNETISM LABORATORY (1Cr.:2 Lab):
Experimental work related to the topics discussed in PHYS 343. Co-req.: PHYS 343.

PHYS 344 RELATIVITY (3Crs.:3Lec):
Michelson and Morley Experiment-Lorentz Transformations, Time dilation, Simultaneity, Length Contraction, Composition of velocities, Fizeu's expriment, Interval Invariance, Causality and Twin Paradox Transformation of mometum factor α, Relativistic momentum, Relativistic energy, Kinetic energy and mass energy relation, Motion of a charge in uniform Electric Field, Motion of a charge in uniform magnetic Field-The conservation of momentum and energy in Relativity, Particles decays, Tarasformations of momentum and energy, Doppler Effect and Aberration ,
Forces Transformations, Electromagnetic Fields Transformations, Fields of a moving charge and Four vector techniques. Relativistic covariance of Maxwell's equations. Pre-req.: PHYS 341.

PHYS 345 MATHEMATICAL METHODS FOR PHYSICS (3Crs.:3Lec):
Vector Analysis, Vector Spaces, Matrices, Complex variables, residues, contour integration, Dirac delta and generalized functions, Fourier transform, Laplace transform, Special functions. Pre-req.: MATH 241.

PHYS 441 ELECTRODYNAMICS (3Crs.:3Lec):
Maxwell's Equations, Maxwell's Equations in Matter, Boundary Conditions, Conservation of Charge and Energy, Continuity Equation, Poynting's Theorem, Newton's Third Law in Electrodynamics, Maxwell's Stress Tensor, Conservation of Momentum, Angular Momentum, Waves in One Dimension, Sinusoidal Waves , Reflection and Transmission, Polarization, 3 D Wave Equation for E and B, Monochromatic Plane Waves, Energy and Momentum in Electromagnetic Waves , Electromagnetic Waves in Matter, Propagation in Linear Media, Reflection and Transmission at Normal and Oblique Incidences, Absorption and Dispersion,Electromagnetic Waves in Conductors, Reflection at a Conducting Surface, The frequency Dependence of Permittivity, Guided Waves, Rectangular Wave Guide, The Coaxial Transmission Line , Potential Formulation, Gauge Transformations, Coulomb Gauge and Lorentz Gauge, Retarded Potentials, The Fields of a Moving Charge, Dipole Radiation, Power Radiated by a Point Charg, Radiation Reaction. Pre-req.: PHYS 343.

PHYS 442 SOLID STATE PHYSICS (3Crs.:3Lec):
Crystal structures. X-ray diffraction in crystals. Lattice vibrations. The free electron model of metals. Energy bands in solids. Semiconductors. Pre-req.: PHYS 342.

PHYS 442L SOLID STATE PHYSICS LABORATORY (1Cr.:2Lab):
Experimental work related to the topics discussed in PHYS 442. Co-req.: PHYS 442.

PHYS 443 QUANTUM MECHANICS II (3Crs.:3 Lec):
Operator matrices and spin, interaction of electrons with electromagnetic fields, addition of angular momentum, perturbation theories, Born approximations, theory of scattering, phase shifts. Pre-req.: PHYS 342.

PHYS 444 SENIOR PROJECT (2Crs.:2Lec):
An in-depth study of particular topics in physics. The included topics are selected by groups of students and approved by the department board.

PHYS 446 STATISTICAL PHYSICS (3Crs.:3Lec):
Some counting problems. Stirling's approximation and Lagrange multipliers. Themacrostate. The averaging postulate. Statistical entropy and microstates. Distinguishable particles. A statistical definition of temperature. The Boltzmann distribution and the partition function. Calculation of thermodynamic functions. A Spin-1/2 solid. Localized harmonic oscillators. The density of states. Fermions and bosons. Counting microstates for gases and the three distributions. Maxwell–Boltzmann gases. Diatomic gases. Fermi–Dirac gases. Bose–Einstein gases. Entropy and disorder. Phase transitions. Ensembles. Ideal gases in the grand ensemble. Pre-req.: PHYS 242

PHYS 448 COMPUTATIONAL PHYSICS (3Crs.:3Lec):
Introduction to programming. Applications to physical systems: radioactive decay, projectile motion, simple harmonic motion, chaos in the driven nonlinear pendulum, the solar system, potential and fields, waves and random systems, statistical mechanics and quantum mechanics. Pre-req.: CMPS 241.

Departmental Elective Courses

Courses			Crs.	Pre-/Co-requisites
PHYS	350	Accelerators	3	
PHYS	352	Biophysics	3	
PHYS	354	Modern Physics	3	
PHYS	356	Astrophysics	3	
PHYS	358	Circuit Analysis	3	
PHYS	360	Atomic Physics	3	
PHYS	451	Elemantary Particle Physics	3	
PHYS	452	Electronics	3	
PHYS	453	Nuclear Physics	3	
PHYS	454	Molecular Physics	3	

Description of Departmental Elective Courses

PHYS 350 ACCELERATORS (3Crs.:3Lec):
Basic electronic components, Insulation issues, electrostatic accelerators: Cockroft–Walton, Van de Graaf accelerator, sparks breakdown, linear accelerator, low energy circular accelerators, cyclotron &betatron, high energy circular accelerators, synchrotron.

PHYS 352 BIOPHYSICS (3Crs.:3Lec):
Fluids: Circulation of the blood, blood pressure, power produced by heart. Heat: trasfer of heat, transport of molecules by diffusion, respiratory system, surfactants and breathing, diffusion and contanct lenses. Thermodynamics of living systems, energy from food, regulation of body temperature, evaporation, resistance to cold, heat and soil. Sound: hearing and the ear, clinical uses of sound, ultrasonic waves. Electricity: the nervous system, electricity in plants, electricity in bone, electric fish, electrocardiograph, physiological effects of elelctricity, sensory aids. Optics: strucutre of the eye, accommodation, eye and the camera, retina, defects in vision, fiber optics. X-rays: computerized tomography CT. Lasers: lasers surgery. Nuclear Physics: magnetic resonance imaging, radiation therapy, food preservation by radiation, isotopic tracers.

PHYS 354 MODERN PHYSICS (3Crs.:3Lec) :
Hertz's experiments, Blackbody Radiation-Planck's Law derivation, Photoelectric Effect , Compton Effect, The Composition of Atoms, The Bohr Atom, Direct Confirmation of Atomic Energy Levels, De Broglie Hypothesis, Davison, Germer Experiment, Wave Groups and Dispersion, Heisenberg Principle, The Wave, Particle Duality, Born Interpretation, Wavefunctions for a Free Particle, The Particle in a Box, The square Barrier, Alpha Decay, Some Properties of Nuclei-Radioactivity.

PHYS 356 ASTROPHYSICS (3Cr.:3Lec):
The Scientific Method, Ancient Astronomy, Ptolemaic model of the solar system, Copernican model of the solar system, Birth of modern Astronomy (Copernicus, Brake, Kepler, Galileo, Newton), Optics and instrumentation, Solar system, plants, minor objects, sun, Stars Astrometry and the HR diagram, Binary stars and clusters, Variable Stars, Nebulae; Novae; Supernovae-Stellar Evolution, galaxies and cosmology. Along with these topics, virtual observational astronomy software must be used with it, as an example, we can use Starry Night software or Project Clea. Field Trip to BAU observatory should be an integrated part of the course.

PHYS 358 CIRCUIT ANALYSIS (3Crs.:3Lec) :
Dc series and parallel circuits. Dc series-parallel networks. Methods of analysis (dc). Network theorems (dc). Inductors capacitors, ac signal and phasors. Series and parallel ac circuits. Series-parallel ac networks. Methods of analysis (ac). Network theorems (ac). Power and resonance.

PHYS 360 ATOMIC PHYSICS (3Crs.:3Lec):
Mass spectroscopy, Isotopes, Basic principles of spectroscopy, Optical spectrum of elements, Spectra of Hydrogen Like atoms, Muonic atoms, Sommerfeld's extension of Bohr Model, Motion of the nucleus, Positronuium, Anti-Hydrogen atoms, Quantum Mechanics of Hydrogen atom and Spectrum of Alkali atoms, Gyromagnetic ratio determination, Stern and Gerlach experiments, Spin-orbit splitting and Fine structure, Level scheme of the Alkali atoms, Many electron atoms, LS and jj couplings, X-ray and internal shells, Auger effect, Periodic System, Basic Concepts of Laser.

PHYS 451 ELEMENTARY PARTICLE PHYSICS (3Crs.:3Lec):
Historical overview, discovery of elementary particles, Leptons, Mesons, Baryons. Resonances, Quark Model, particle interaction, Feynman diagrams of QED - QCD and Weak theory, Symmetries in physics, Parity, charge conjugation, discrete symmetries, Bound states, Feynman calculus, decay rates, cross sections, Golden rule, two-particle scatterings.

PHYS 452 ELECTRONICS (3Crs.:3Lec):
Semiconductor basics. Diode applications. Special-purpose diodes. Bipolar junction transistors. Transistor bias circuits. BJT amplifiers. Field-effect transistors. Amplifier frequency response. The operational amplifier. Basic op-amp circuits. Active filters. Oscillators.

PHYS 453 NUCLEAR PHYSICS (3Crs.: 2Lec.,2Lab):
Rutherford scattering, cross-sections, radioactive decay law, chain decays, radioactive dating, size and shape of nuclei, binding energy, liquid drop model, nuclear stability, beta decays, spontaneous fission, alpha decay, nuclear collisions, induced fission and fission reactors, shell model, magic numbers.

PHYS 454 MOLECULAR PHYSICS (3Crs.:3Lec):
Molecular structure: Molecular orbital, theory of diatomic and polyatomic molecules. Molecular rotation and vibration: spectroscopic transitions, the rotation and vibration of diatomic and polyatomic molecules. Molecular electronic transitions, Hund coupling cases, vibrational transitions, the electronic spectra of polyatomic molecules. The electronic properties of molecules: The response to electrostatic fields, bulk electrical properties. The magnetic properties of molecules. Scattering theory.

Study Plan

B.Sc. Degree in Physics (97 Credits)

First Semester (16 Credits)			Crs.	Pre-/co-requisites
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-Req: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-Req: PHYS 241
MATH	241	Calculus and Analytical Geometry	3	
CMPS	241	Introduction to Programming	3	
		University Requirement	2	

Second Semester (17 Credits)			Crs.	Pre-/co-requisites
PHYS	242	Thermal Physics	2	
PHYS	242L	Thermal Physics Laboratory	1	Co-Req: PHYS242
PHYS	244	Physical Optics	2	
PHYS	244L	Physical Optics Laboratory	1	Co-Req: PHYS 244
MATH	244	Ordinary Differential Equations	3	Pre-Req: MATH 241
MATH	242	Probability and Statistics	3	
		University Requirement	5	

Third Semester (16 Credits)			Crs.	Pre-/co-requisites
PHYS	341	Classical Mechanics and Waves	3	
PHYS	341L	Classical Mechanics and Waves Laboratory	1	Co-Req: PHYS 341
PHYS	343	Electromagnetism	3	Pre-Req: PHYS 241
PHYS	343L	Electromagnetism Laboratory	1	Co-Req: PHYS 343
PHYS	345	Mathematical Methods for Physics	3	Pre-Req: MATH 241
		University Requirement	5	

Fourth Semester (16 Credits)			Crs.	Pre-/co-requisites
PHYS	342	Quantum Mechanics I	3	Pre-Req: PHYS 341
PHYS	344	Relativity	3	Pre-Req: PHYS 341
		University Requirement	4	
		Departmental Elective	3	
		Free Elective	3	

Fifth Semester (17 Credits)			Crs.	Pre-/co-requisites
PHYS	441	Electrodynamics	3	Pre-Req: PHYS 343
PHYS	443	Quantum Mechanics II	3	Pre-Req: PHYS 342
		University Requirement	3	
		University Requirement	2	
		Departmental Elective	3	
		Free Elective	3	

Sixth Semester (15 Credits)			Crs.	Pre-/co-requisites
PHYS	442	Solid State Physics	3	Pre-Req: PHYS 342
PHYS	442L	Solid State Physics Laboratory	1	Co-Req: PHYS 442
PHYS	446	Statistical Physics	3	Pre-Req: PHYS 242
PHYS	448	Computational Physics	3	Pre-Req: CMPS 241
PHYS	444	Senior Project	2	
		Departmental Elective	3	

DEPARTMENT OF CHEMISTRY

Academic Staff

Chairperson	Dr. Ashraf Abdel Gaber
Professors	Dr. Ghassan Younes, Dr. Shawky El Shazly
Assistant Professors	Dr. Mohammad EL-Dakdouki, Dr. Rami Oweini
Part-time Lecturer	Dr. Sirine Chehaidi, Dr. Farah Ibrahim, Dr. Zalfa Nour

Mission

The mission of the Department of Chemistry is to provide high quality education which includes exposure to the core areas of chemistry. The Department offers a wide variety of courses to support other departments and faculties. It prepares chemistry professionals to meet the challenges encountered in their chosen careers, and supports research activities. The Chemistry Department also provides distinguished services to the community.

Objectives

The aim of the Bachelor of Science in Chemistry is to:

- Provide students with the basic theoretical principles and practical concepts of core and applied chemistry disciplines.
- Develop students' skills in analysis, critical thinking, problem solving, teamwork, communication and research skills.
- Prepare students for graduate study or professional careers in chemistry.
- Provide students with hands-on experiences with state-of-the art scientific instruments and equipments.

Learning Outcomes

The Chemistry program enables students, by the time of graduation, to achieve the following outcomes:

a- Knowledge and Understanding:

- The basic science including chemical principles and theories, terminology, nomenclatures, units and basic mathematics and physics.
- The detailed knowledge of the subfields of chemistry, including analytical and physical chemistry, as well as inorganic and organic chemistry.
- The fundamental facts, principles and theories of selected topics in applied chemistry including petrochemical industry, chemistry of polymers, catalysis, heterocyclic chemistry, physical photochemistry, medicinal chemistry, industrial organic chemistry, and industrial inorganic chemistry.

b- Intellectual Skills:

- Demonstrate essential facts, concepts, principles and theories relating to the main fields in chemistry.
- Analyze and solve qualitative and quantitative synthetic chemical problems.
- Analyze experimental data for meaningful interpretations, critically assess data in the literature and extract useful data from it.

c- Practical Skills:
- Follow practical instructions safely and accurately.
- Conduct experiments and use appropriate experimental apparatus effectively.
- Operate chemical instrumentation. Read, evaluate and interpret data.

d- Transferable Skills:
- Communicate effectively, both orally and in writing.
- Use information technology skills, especially in the areas of information retrieval, literature searching and use of library databases.
- Work independently and collaborate effectively.
- Manage time by the ability to plan and implement efficient and effective modes of working.
- Acquire the knowledge and skills needed to succeed in the workplace or in professiona field after graduation.

Degree Requirements

To obtain the Bachelor Degree in Chemistry, students must successfully complete a total of 97 credit hours + ICDL, where the standard duration of study is 6 semesters. There is one general semester of study for the students of the Chemistry Program.

Career Opportunities

Chemistry graduates are qualified to either continue their postgraduate studies, or work in educational or research institutions, laboratories, industries, pharmaceutical or health companies. The available options include the following: School Teacher, University Teacher, Lab Assistant, Research Assistant, Petroleum and Petrochemicals, Corrosion Control and Electroplating, Paints, Polymers and Materials Development, Food and Water industries, Drug, Pharmaceutical, Health, Environmental Monitoring, Quality Control, Forensic and many others.

Program Overview

The Chemistry curriculum consists of the following components:

Chemistry Requirements	
I. University Requirements	**Credits**
* University Mandatory Courses	5
* University Elective Courses	16
II. Program Requirements	**Credits**
Faculty Core Courses	17
Major Core Courses	41
Departmental Elective Courses	12
**Free Electives	6
Total	**97**

* A total of 21 credits is required as University Requirements: 5 credits are selected from the University Mandatory courses list, 6 credits from social sciences list, 6 credits from humanities list and 4 credits from other lists of the university elective courses.

** A total of 6 credits is required as free electives, student can enroll in any course offered by BAU faculties, with at least one course outside the department offering the program.

Faculty and Major Core Courses

Courses			Crs.	Pre-/Co-requisites
MATH	241	Calculus and Analytical Geometry	3	
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-req.: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-req.: PHYS 241
CMPS	241	Introduction to Programming	3	
MATH	242	Probability and Statistics	3	
CHEM	242	Analytical Chemistry	3	Pre-req.: CHEM 241
CHEM	242L	Analytical Chemistry Laboratory	1	Co-req.: CHEM 242
CHEM	244	Organic Chemistry I	3	
CHEM	246	Physical Chemistry I	3	Pre-req.: CHEM 241
CHEM	341	Organic Chemistry II	3	Pre-req.: CHEM 244
CHEM	341L	Organic Chemistry Laboratory	1	Co-req.: CHEM 341
CHEM	342	Instrumental Analysis	3	Pre-req.: CHEM 242
CHEM	342L	Instrumental Analysis Laboratory	1	Co-req.: CHEM 342
CHEM	345	Inorganic Chemistry I	3	Pre-req.: CHEM 241
CHEM	346	Bioorganic Chemistry	3	Pre-req.: CHEM 341
CHEM	348	Inorganic Chemistry II	3	Pre-req.: CHEM 345
CHEM	348L	Inorganic Chemistry Laboratory	1	Co-req.: CHEM 348
CHEM	349	Physical Chemistry II	3	Pre-req.: CHEM 246
CHEM	349L	Physical Chemistry Laboratory	1	Co-req.: CHEM 349
CHEM	441	Electrochemistry and Applications	2	
CHEM	441L	Electrochemistry and Applications Laboratory	1	Co-req.: CHEM 441
CHEM	442	Spectroscopic Identification of Chemical Compounds	3	Pre-req.: CHEM 341
CHEM	442L	Spectroscopic Identification of Chemical Compounds Laboratory	1	Co-req.: CHEM 442
CHEM	444	Senior Project	2	

Description of Faculty Core Courses

CHEM 241 PRINCIPLES OF CHEMISTRY (3Cr.:3 Lec):
A study of the fundamental concepts of chemistry including matter and measurement, atoms, molecules, ions, moles, nomenclature, atomic and molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, and solid states of matter. Properties of solutions, aqueous reactions and solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases and ionic equilibria, electrochemistry, nuclear chemistry and coordination chemistry.

CHEM 241L PRINCIPLES OF CHEMISTRY LABORATORY (1Cr.:3Lab):
Selected experiments illustrate the topics discussed in CHEM 241. Co-req.: CHEM 241.

PHYS 241 PRINCIPLES OF PHYSICS (3Crs.:3Lec):
Mechanical properties of matter, Coulomb's law, electric field, electric potential, equipotential surfaces, Gauss' law, capacitors, energy of charged capacitors, electric current, resistivity, Kirchhoff's law, bridges, potentiometer, thermoelectricity, chemical effect of current, magnetic effect of current, magnetic force on current carrying conductors, galvanometers , Biot – Savart's law, Ampere's law, induced e.m.f., Faraday's law, Lenz's law, eddy currents.

PHYS 241L PRINCIPLES OF PHYSICS LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in PHYS 241. Co-req.: PHYS 241.

MATH 241 CALCULUS & ANALYTICAL GEOMETRY (3Crs.:3Lec):
Multivariable functions, partial derivatives, polar, cylindrical and spherical coordinates, indefinite and definite integrals, methods of integration, multiple integrals, sequences and series, power series, vector field integration.

CMPS 241 INTRODUCTION TO PROGRAMMING (3Crs.:2Lec.,2Lab):
Introduction to computer hardware and software. Binary system and data representation. The software life-cycle. Flow charts and IPO-charts. Introduction to computer programming and problem solving. Structured high level language programming with an emphasis on procedural abstraction and good programming style. The basic looping and selection constructs arrays, functions, parameter passing and scope of variables.

MATH 242 PROBABILITY AND STATISTICS (3Crs.:2Lec.,2 Lab):
Basic concepts in statistics (mean, variance and frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete and continuous distributions, central limit theorem, regression and correlation, confidence intervals.

Description of Major Core Courses

CHEM 242 ANALYTICAL CHEMISTRY (3Crs.:3Lec):
This course presents the basic concepts of classical methods of quantitative chemical analysis and their applications. The topics covered include gravimetric and volumetric methods based on solution equilibria such as acid-base, complexometric, redox and precipitation reactions, introduction to separation and spectroscopic methods of analysis. The course also introduces students to statistical data treatment, errors, precision and accuracy in chemical analysis. Pre-req.: CHEM 241.

CHEM 242L ANALYTICAL CHEMISTRY LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in CHEM 242. Co-req.: CHEM 242.

CHEM 244 ORGANIC CHEMISTRY I (3Crs.:3 Lec):
The course offers comprehensive understanding of the basic principles of organic chemistry. The course describes chemical bonding, structure properties, nomenclature, synthesis, and reactions of alkanes, cycloalkanes, alkenes, alkynes, alcohols, ethers, alkyl halides, and stereochemistry. Addition, elimination and nucleophilic substitution reactions. Emphasis on the mechanistic, kinetic and thermodynamic aspects governing these reactions.

CHEM 246 PHYSICAL CHEMISTRY I (3Crs.:3Lec):
The course covers laws of thermodynamics, entropy and free energy changes in chemical reactions, thermodynamic of solutions. Phase equilibria and phase diagrams. Chemical kinetics including rate of chemical reactions, mechanisms of elementary and complex reactions, chain reactions and explosion, fast reactions, catalysis and their applications. Pre-req.: CHEM 241.

CHEM 341 ORGANIC CHEMISTRY II (3Crs.:3Lec):
This course is a continuation of organic chemistry I and describes the nomenclature, preparation, and reactions of aromatic compounds, carbonyl compounds, enols and enolates, carboxylic acids and its derivatives, amines and phenols. Pre-req.: CHEM 244.

CHEM 341L ORGANIC CHEMISTRY LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in Organic Chemistry I and Organic Chemistry II. Co-req.: CHEM 341.

CHEM 342 INSTRUMENTAL ANALYSIS (3Crs.:3 Lec):
Theory and application of modern instrumental methods to qualitative and quantitative chemical analysis. Ultra-violet, visible absorption and fluorescence spectroscopy, flame atomic absorption, electrothermal and plasma atomic emission. Principles of chromatographic analysis, gas chromatography, high performance liquid chromatography. Pre-req.: CHEM 242.

CHEM 342L INSTRUMENTAL ANALYSIS LABORATORY (1Cr.:3 Lab):
Experimental work related to the topics discussed in Instrumental Analysis. Co-req.: CHEM 342.

CHEM 345 INORGANIC CHEMISTRY I (3Crs.:3Lec):
Brönsted and Lewis acid and base. Chemistry of main group elements. Basic concepts of coordination compounds: nomenclature, bonding, structure, stability, magnetic properties, stereochemistry. Crystal and ligand field theories. Pre-req.: CHEM 241.

CHEM 346 BIOORGANIC CHEMISTRY (3Crs.:2Lec,2Lab):
This course introduces the identification, classifications, synthesis and reactions of biomolecules such as carbohydrates, peptides, proteins, lipids and nucleic acids. It also emphasizes on the three-dimensional structures and fundamental concepts of stereochemistry. Practical: Selected experiments to illustrate the topics discussed. Pre-req.: CHEM 341.

CHEM 348 INORGANIC CHEMISTRY II (3Crs.:3Lec):
Organometallic compounds of transition metals: Alkyls, hydrides, carbonyls, olefinic, allylic, butadiene, η5 and η6 complexes. Group theory. Pre-req.: CHEM 345.

CHEM 348L INORGANIC CHEMISTRY LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in Inorganic Chemistry I and Inorganic Chemistry II. Co-req.: CHEM 348.

CHEM 349 PHYSICAL CHEMISTRY II (3Cr.:3Lec):
This course covers quantum mechanics including classical mechanical treatment of the simple harmonic oscillator, black body radiation, photoelectric effect, Compton's effect, de Broglie relation, the Heisenberg uncertainty principal, derivation and solutions of Schrödinger equation for several simple systems with some chemical applications. Basic principles and concepts of photochemistry; Jablonski diagram; photochemical reaction kinetics and mechanisms. Pre-req.: CHEM 246.

CHEM 349L PHYSICAL CHEMISTRY LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in Physical Chemistry I and Physical Chemistry II. Co-req.: CHEM 349.

CHEM 441 ELECTROCHEMISTRY & APPLICATIONS (2Crs.:2Lec):
Electrodes and Electrochemical cells, the chloro-alkali industry, extraction, refining and production of metal, metal finishing, corrosion and its control.

CHEM 441L ELECTROCHEMISTRY AND APPLICATIONS LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in CHEM 441. Co-req.: CHEM 441.

CHEM 442 SPECTROSCOPIC IDENTIFICATION OF CHEMICAL COMPOUNDS (3Cr.:3Lec):
The course covers structure analysis and identification of chemical compounds by chemical analysis methods (elemental analysis, functional groups classification, identification and derivatization reactions) and spectroscopic techniques including Fourier Transform InfraRed, Nuclear Magnetic Resonance, Ultraviolet-Visible, and mass spectrometry. Pre-Req.: CHEM 341.

CHEM 442L SPECTROSCOPIC IDENTIFICATION OF CHEMICAL COMPOUNDS LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in CHEM 442. Co-Req.: CHEM 442.

CHEM 444 SENIOR PROJECT (2Crs.:2Lec):
Experimental or theoretical research project carried on by the student under the supervision of staff member. Includes literature search, laboratory and/or theoretical work and conferences with the staff members. Written report and a final oral examination on that report are required.

Departmental Elective Courses

Courses			Crs.	Pre-/Co-requisites
CHEM	355	Petrochemistry	3	
CHEM	356	Environmental Chemistry	3	
CHEM	357	Water Analysis	3	
CHEM	358	Surface and Colloid Chemistry	3	
CHEM	359	Regulatory Aspects of Industrial Chemicals	3	
CHEM	450	Introduction to Medicinal Chemistry	3	
CHEM	451	Physical Organic Chemistry	3	Pre-req.: CHEM 341
CHEM	452	Nuclear and Radiochemistry	3	
CHEM	453	Materials Science	3	
CHEM	454	Topics in Chemistry	3	

Description of Departmental Elective Courses

CHEM 355 PETROCHEMISTRY (3Crs.:3Lec):
A study of the chemicals obtained directly and indirectly from petroleum, including their chemistry and their industrial production and applications.

CHEM 356 ENVIRONMENTAL CHEMISTRY (3Crs.:3Lec):
Chemistry of the ozone layer, and particulate matter. Climate change. Mass and energy transfer and balance. Risk, dose-response, and human exposure assessment. Hazard identification. Water resources and pollutants. BOD and waste water.

CHEM 357 WATER ANALYSIS (3Crs.:2Lec,3Lab):
Physico-chemical aspects of water. Inorganic and organic substances in water: occurrence, significance and methods of determination. Biochemical process consuming oxygen. Soil analysis. Practical: Selected experiments to illustrate the topicsdiscussed.

CHEM 358 SURFACE AND COLLOID CHEMISTRY (3Crs.:3Lec):
Basic terms in surface and colloid chemistry, the kinetic properties of disperse systems, interfacial phenomena, the optical and electrical properties of colloids, the preparation and stability of colloids, properties of gels, emulsion, foams and aerosol.

CHEM 359 REGULATORY ASPECTS OF INDUSTRIAL CHEMICALS (3Crs.:3Lec):
Survey of regulations, handling, use, transportation and disposal of hazardous substances.

CHEM 450 INTRODUCTION TO MEDICINAL CHEMISTRY (3Crs.:3Lec):
This course offers an introduction to the basics of medicinal chemistry, and focuses on the principles of pharmacodynamics and pharmacokinetics. It discusses the process of drug design and development, and analyzes the chemical interactions between drugs and its targets in the body, including carbohydrates, proteins, lipids, and nucleic acids. It describes protein structure, catalytic role and kinetics of enzymes, and the design and mode of action of enzyme inhibitors. The course highlights the role of receptors, the concepts of agonism and anatagonism, and the principles of affinity, efficacy, and potency. The course also details ADMET properties, and introduces various formulation and drug delivery approaches.

CHEM 451 PHYSICAL ORGANIC CHEMISTRY (3Crs.:3Lec):
Determination of reaction mechanism: Kinetic and non-kinetic methods for the elucidation of reaction mechanism: Product analysis, detection or/and isolation of intermediates, isotopic labeling and kinetic isotope effect (KIE), stereochemical evidence, effect of structure and kinetic evidence. Molecular Rearrangement: Neighboring group participation, carbanionic and cationic rearrangement. Structure-activity relationships. Free energy relationships. Quantitative estimation of electronic effects (Hammett and Taft's equation equations). Frontier Molecular Orbital (Woodward Hoffmann Rule). Electrocyclic reactions. Pre-req.: CHEM 341.

CHEM 452 NUCLEAR AND RADIOCHEMISTRY (3Crs.:3Lec):
The course introduces students with the fundamentals aspects of nuclear and radiochemistry including nuclear stability and structure, production and decay of radioactive nuclides, nuclear reactions, interactions of radiation with matter, detection and measurement of radiation, radiation protection and applications of nuclear and radiochemical methods to current scientific problems.

CHEM 453 MATERIALS SCIENCE (3Crs.:3Lec):
An introduction to materials science with emphasis on general properties of materials. Topics will include crystal structure, extended and point defects, mechanical, electrical, thermal and magnetic properties of metals, ceramics, electronic materials, composites and semiconductors materials.

CHEM 454 TOPICS IN CHEMISTRY (3Crs.:3Lec):
This course covers selected topics in organic, inorganic, physical, analytical chemistry or biochemistry not commonly included in other courses.

Study Plan

B.Sc. Degree in Chemistry (97 Credits)

First Semester (17 Credits)			Crs.	Pre-/co-requisites
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-Req.: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-Req.: PHYS 241
MATH	241	Calculus and Analytical Geometry	3	
CMPS	241	Introduction to Programming	3	
		University Requirements	3	

Second Semester (16 Credits)			Crs.	Pre-/co-requisites
CHEM	242	Analytical Chemistry	3	Pre-Req.:CHEM 241
CHEM	242L	Analytical Chemistry Laboratory	1	Co-Req.: CHEM242
CHEM	246	Physical Chemistry I	3	Pre-Req.: CHEM 241
CHEM	244	Organic Chemistry I	3	
MATH	242	Probability and Statistics	3	
		University Requirements	3	

Third Semester (17 Credits)			Crs.	Pre-/co-requisites
CHEM	341	Organic Chemistry II	3	Pre-Req: CHEM 244
CHEM	341L	Organic Chemistry Laboratory	1	Co-Req: CHEM 341
CHEM	349	Physical Chemistry II	3	Pre-Req: CHEM 246
CHEM	349L	Physical Chemistry Laboratory	1	Co-Req: CHEM 349
CHEM	345	Inorganic Chemistry I	3	Pre-Req: CHEM 241
		University Requirements	6	

Fourth Semester (17 Credits)			Crs.	Pre-/co-requisites
CHEM	342	Instrumental Analysis	3	Pre-Req: CHEM 242
CHEM	342L	Instrumental Analysis Laboratory	1	Co-Req: CHEM 342
CHEM	346	Bioorganic Chemistry	3	Pre-Req: CHEM 341
CHEM	348	Inorganic Chemistry II	3	Pre-Req: CHEM 345
CHEM	348L	Inorganic Chemistry Laboratory	1	Co-Req: CHEM 348
		University Requirements	3	
		Departmental Elective	3	

Fifth Semester (15 Credits)			Crs.	Pre-/co-requisites
CHEM	441	Electrochemistry and Applications	2	
CHEM	441L	Electrochemistry and Applications Laboratory	1	Co-Req: CHEM 441
		University Requirements	6	
		Departmental Elective	3	
		Free Elective	3	

Sixth Semester (15 Credits)			Crs.	Pre-/co-requisites
CHEM	442	Spectroscopic Identification of Chemical Compounds	3	Pre-Req: CHEM 341
CHEM	442L	Spectroscopic Identification of Chemical Compounds Laboratory	1	Co-Req: CHEM 442
CHEM	444	Senior Project	2	
		Departmental Elective	6	
		Free Elective	3	

DEPARTMENT OF BIOLOGICAL and ENVIRONMENTAL SCIENCES

Academic Staff

Chairperson	Dr. Mohamed El Sayed Moustafa
Professors	Dr. Ahmed Abdul Karim, Dr. Hoda Youssef
Assistant Professors	Dr. Essam Mousaad, Dr. Salwa AbdulRahman, Dr. Ghada Khawaja, Dr. Jamila Borjac, Dr. Tarek Houri, Dr. Nisrine Bissar
Part-time Lecturers	Dr. Zeina Saefan, Dr. Rania Zarour, Dr. Bashar Ismail, Dr. Sirine Chehaidi, Dr. Ola Kerhani, Ms. Nazek El-Jesser, Ms. Fatima Mched

A- Biology Program

Mission

The mission of the biology major is to provide undergraduate students with the concepts, principles and methodologies of various disciplines of biology, and to develop a broad base of knowledge across the sub-disciplines that comprise biological sciences. Students will be prepared for many career opportunities in biological sciences.

Objectives

The biology major curriculum:

- Provides students with knowledge and understanding of the major areas of biology sub-disciplines.
- Includes laboratory work to help students to carry out and interpret laboratory and field work in biological sciences.
- Promotes the capacity for life-long learning.
- Prepares the students for many career options in biological sciences.
- Requires that the student conduct a research project in biological sciences followed by oral and written presentation of this project.

Learning Outcomes

a- Knowledge and Understanding:

- Broad knowledge and understanding in various biological sciences (such as genetics, physiology, microbiology, ecology, biochemistry, molecular biology, cell biology and endocrinology).
- Illustrate the scientific methods and techniques for laboratory and field work in different biological sciences.
- Master aspects of the modern disciplines of biology.
- Identify and use of biological databases and literature sources.

b- Intellectual Abilities:

- Demonstrate broad knowledge and understanding of various biological processes.
- Demonstrate the ability to apply concepts and methodologies of biological science to carry out experiments, analyze the obtained data and draw reasonable conclusions or interpretations.
- Demonstrate the ability to critically evaluate and utilize scientific literature in biological

sciences.
- Use critical thinking and principles of logic to solve problems in biology disciplines.
- The ability to pursue further education as an independent life-long professional learning.
- Demonstrate skills and expertise in biology disciplines for various career opportunities.

c- Professional and Practical Competencies:
- Design plans and conduct experiments to solve problems in biological sciences.
- Analyze and evaluate experimental results and observations clearly and draw scientific conclusions.
- Operate and practice basics laboratory instrumentations efficiently.
- Conduct excellent critical thinking and formulation of scientific hypotheses.

d- General and Transferable Skills:
- Effective scientific communication skills, both in written and orally.
- Work effectively either independently or in multi-disciplinary teams.
- Recognize and respond to the need for lifelong self-learning for a successful career.

Degree Requirements

To obtain the Bachelor Degree in Biology, students must successfully complete a total of 97 credit hours + ICDL, where the standard duration of study is 6 semesters. There is one general semester of study for the students of the Biology Program.

Career Opportunities

- Graduate studies in various biological sciences.
- Admission to biomedical schools.
- Teaching biology courses.
- Biologists for employment in research laboratories and facilities, industry and government.

Program Overview

The Biology curriculum consists of the following components:

Biology Requirements	
I. University Requirements	**Credits**
* University Mandatory Courses	5
* University Elective Courses	16
II. Program Requirements	**Credits**
Faculty Core Courses	15
Major Core Courses	46
Departmental Elective Courses	9
**Free Electives	6
Total	**97**

* A total of 21 credits is required as University Requirements: 5 credits are selected from the University Mandatory courses list, 6 credits from social sciences list, 6 credits from humanities list and 4 credits from other lists of the university elective courses.

** A total of 6 credits is required as free electives, student can enroll in any course offered by BAU faculties, with at least one course outside the department offering the program.

Faculty and Major Core Courses

Courses			Crs.	Pre-/Co-requisites
BIOL	231	Biology I	3	
BIOL	231L	Biology I Laboratory	1	Co-req.: BIOL 231
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-req.: CHEM 241
PHYS	231	Physics for Life Sciences	3	
PHYS	231L	Physics for Life Sciences Laboratory	1	Co-req.: PHYS 231
MATH	242	Probability and Statistics	3	
CHEM	234	Organic Chemistry	3	
CHEM	234L	Organic Chemistry Laboratory	1	Co-req.: CHEM 234
BIOL	232	Biology II	3	Pre-req.: BIOL 231
BIOL	232L	Biology II Laboratory	1	Co-req.: BIOL 232
BIOL	236	Immunology	2	Pre-req.: BIOL 231
BCHM	331	Biochemistry	3	Pre-req.: CHEM 234
BCHM	331L	Biochemistry Laboratory	1	Co-req.: BCHM 331
BIOL	333	Microbiology	3	Pre-req.: BIOL 231
BIOL	333L	Microbiology Laboratory	1	Co-req.: BIOL 333
BIOL	334	Cell and Molecular Biology	3	Pre-req.: BIOL 231
BIOL	334L	Cell and Molecular Biology Laboratory	1	Co-req.: BIOL 334
BIOL	336	Plant Physiology	3	Pre-req.: BIOL 232
BIOL	336L	Plant Physiology Laboratory	1	Co-req.: BIOL 336
BIOL	337	Human Physiology	3	Pre-req.: BIOL 231
BIOL	338	Genetics	3	Pre-req.: BIOL 231
BIOL	432	Ecology	3	Pre-req.: BIOL 232
BIOL	432L	Ecology Laboratory	1	Co-req.: BIOL 432
BIOL	433	Developmental Biology	3	Pre-req.: BIOL 232
BIOL	433L	Developmental Biology Laboratory	1	Co-req.: BIOL 433
BIOL	435	Seminar in Biology	1	
BCHM	437	Endocrinology	3	Pre-req.: BCHM 331
BIOL	444	Senior Project	2	

Description of Faculty Core Courses

PHYS 231 PHYSICS FOR LIFE SCIENCES (3Crs.:3Lec):
Units and dimensions- Force, work, energy and power in biological systems- Elastic properties of bones and tissues- Nonviscous and viscous fluids- Heat, temperature and thermal properties of materials- electricity and magnetism- Nerve conduction- Sound wave- X-rays (production, and uses in life science).

PHYS 231L PHYSICS FOR LIFE SCIENCES LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in PHYS 231. Co-req.: PHYS 231.

BIOL 231 BIOLOGY I (3Crs.:3Lec):
This course introduces the students to fundamental concepts in biology. Topics to be covered include the cellular and chemical basis of life, organization of life, energy transfer through living organisms, evolution, diversity of life with emphasis on the animal and plant kingdoms and their interaction with the environment.

BIOL 231L BIOLOGY I LABORATORY (1Cr.:2Lab):
Laboratory includes applications and experiments related to the topics discussed in Biology I course. Co-req.: BIOL 231.

BIOL 232 BIOLOGY II (3Cr.:3Lec):
The course presents an introduction to the anatomy and physiology of plants and animals covering their structure, growth, nutrition, transport, reproduction, development, and control systems, cell division, histology, invertebrates, entomology and vertebrate physiology and embryology. Pre-req.: BIOL 231.

BIOL 232L BIOLOGY II LABORATORY (1Cr.:2Lab):
Laboratory includes applications and experiments related to the topics discussed in Biology II course. Co-req.: BIOL 232.

CHEM 241 PRINCIPLES OF CHEMISTRY (3Cr.:3Lec):
A study of the fundamental concepts of chemistry including matter and measurement, atoms, molecules, ions, moles, nomenclature, atomic and molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, and solid states of matter. Properties of solutions, aqueous reactions and solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases and ionic equilibria, electrochemistry, nuclear chemistry and coordination chemistry.

CHEM 241L PRINCIPLES OF CHEMISTRY LABORATORY (1Cr.:3Lab):
Selected experiments illustrate the topics discussed in CHEM 241. Co-req.: CHEM 241.

MATH 242 PROBABILITY AND STATISTICS (3Crs.:2Lec,2Lab):
Basic concepts in statistics (mean, variance and frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete and continuous distributions, central limit theorem, regression and correlation, confidence intervals.

Description of Major Core Courses

CHEM 234 ORGANIC CHEMISTRY (3Crs.:3Lec):
The course provides the necessary background in organic chemistry in the context of living cells. Nomenclature of chemical compounds, chemical bonding and structure, conformations and stereochemistry, organic reactivity and catalysis, organic acids and bases. Nucleophilic substitution, phosphoryl transfer, nucleophilic carbonyl addition, acyl substitution, electrophilic, oxidation, reduction and radical reactions.

CHEM 234L ORGANIC CHEMISTRY LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in CHEM 234. Co-req.: CHEM 234.

BIOL 236 IMMUNOLOGY (2Cr.:2Lec):
A course that covers the fundamental concepts of modern immunology emphasizing on the molecular and cellular elements of the immune system, and their basic function. Topics covered include description of the immune system, antibody and T-cell receptor structure and functions, genes of the immunoglobulin superfamily, cells and molecular mediators that regulate the immune response, allergy, autoimmunity, immunodeficiency, transplantation and tumor immunity. Pre-req.: BIOL 231.

BCHM 331 BIOCHEMISTRY (3Crs.:3Lec):
An Introduction to basic principle of biochemistry emphasizing on the broad understanding of the structure and function of biomolecules. Pre-req.: CHEM 234.

BCHM 331L BIOCHEMISTRY LABORATORY (1Cr.:2Lab):
Introduction to basic biochemistry experiments. Acquaints students with basic biochemical laboratory techniques including the identification and quantification of biomolecules. Co-req.: BCHM 331.

BIOL 333 MICROBIOLOGY (3Cr.:3Lec):
An introduction to the microbial world, with emphasis given to bacteria and viruses, and the impact of these organisms on the environment and human health. Topics include: diversity of microorganisms, structure of prokaryotic cells, bacterial nutrition, reproduction and growth, factors affecting microbial growth, control of microorganisms, physiology, properties of viruses, taxonomy of plant and animal viruses, and bacteriophages. Pre-req.: BIOL 231.

BIOL 333L MICROBIOLOGY LABORATORY (1Cr.:2Lab):
Microbiological laboratory procedures including sterilization methods, microscopy, preparation of culture media, isolation of bacteria from different sources, preservation, staining of bacteria, bacterial count, pure culture techniques. Co-req.: BIOL 333.

BIOL 334 CELL AND MOLECULAR BIOLOGY (3Crs.:3Lec):
This course provides an introduction to cell biology emphasizing on cell division, cell cycle, structure and function of cellular organelles and the functional interaction of the cells with their microenvironment, an overview on DNA replication, transcription and translation, regulation of gene expression in prokaryotes and eukaryotes and protein synthesis. This course also covers molecular biology techniques including isolation and purification of nucleic acids, enzymes used in molecular biology such as restriction endonucleases and ligases, genomic library, PCR, Southern, northern and western blotting, sequencing, and cloning. Pre-req.: BIOL 231.

BIOL 334L CELL AND MOLECULAR BIOLOGY LABORATORY (1Cr.:2Lab):
This laboratory introduces students to the tools of cell biology and experiments in molecular biology. Co-req.: BIOL 334.

BIOL 336 PLANT PHYSIOLOGY (3Cr.:3Lec):
An introduction to basic principles of plant function, primarily covering selected physical processes in plants. Topics include: cell physiology, water relations, solute transport, mineral nutrition, photosynthesis, respiration, plant metabolism, plant growth and development and plant response to environmental stress. Pre-req.: BIOL 232.

BIOL 336L PLANT PHYSIOLOGY LABORATORY (1Cr.:2Lab):
Introduction to experimental techniques used to study plant physiology. Co-req.: BIOL 336.

BIOL 337 HUMAN PHYSIOLOGY (3Crs.:3Lec):
The course focuses on the major physiological systems of the human body (e.g., circulatory, respiratory, gastrointestinal, urogenital and the nervous system) with emphasis on understanding human diseases. Pre-req.: BIOL 231.

BIOL 338 GENETICS (3Cr.:3Lec):
A study of the basic principles of classical and modern genetics. Topics include Mendelian inheritance and deviations from classical Mendelian ratios, pedigree analysis, gene interactions, gene mutation, linkage, gene mapping and population genetics. Pre-req.: BIOL 231.

BIOL 432 ECOLOGY (3Crs.:3Lec):
This course presents the basic concepts of ecology emphasizing on the interactions among individuals of a population, interactions in their abiotic environment, and interactions with other species, energy flow and recycling of nutrients. Principles of growth, regulation, diversity, stability of populations and the interactions among populations at the community and ecosystems levels are discussed. Pre-req.: BIOL 232.

BIOL 432L ECOLOGY LABORATORY (1Cr.:2Lab):
Laboratory illustrates principles of ecology through field trips and experiments. Co-req.: BIOL 432.

BIOL 433 DEVELOPMENTAL BIOLOGY (3Crs.:3Lec):
A study of the basic principles of embryonic and post-embryonic development of animals with an emphasis on the underlying cellular and molecular mechanisms. Specific topics include fertilization, determination of cell fate and differentiation, cell migration, establishment of the body plan, formation of selected organs and organ systems, stem cells, and limb regeneration. Pre-req.: BIOL 232.

BIOL 433L DEVELOPMENTAL BIOLOGY LABORATORY (1Cr.:2Lab):
Examination of different developmental stages in animal embryos belonging to different classes, along with the examination of microscopic slides. Co-req.: BIOL 433.

BIOL 435 SEMINAR IN BIOLOGY (1Cr.:1Lec):
A special course that discusses recent advances in topics of high interest related to biology disciplines.

BCHM 437 ENDOCRINOLOGY (3Crs.:3Lec):
This course deals with the endocrine system and its hormonal products, including the hormone producing cells, synthesis, modification, release and transport of hormones, hormone receptors and the mechanisms of hormone action, their effects on target cells, their effects on physiological processes, the diseases caused by inappropriate hormone functions and bioenergetics and metabolic regulation. Pre-req.:: BCHM 331.

BIOL 444 SENIOR PROJECT (2Crs.:2Lec):
Using the scientific literature and under the direct supervision of a faculty mentor, this course provides a training for senior students to pursue and present an independent study or research on a biology topic.

Departmental Elective Courses

Courses			Crs.	Pre-/Co-requisites
BIOL	342	Histology	3	Co-req.: BIOL 231
BIOL	344	Virology	3	Co-req.: BIOL 333
PHYS	352	Biophysics	3	
BCHM	434	Biotechnology	3	Pre-req.: BIOL 334
BIOL	441	Cell and Tissue Culture	3	Pre-req.: BIOL 231
BIOL	442	Biology of Invertebrates	3	Pre-req.: BIOL 231
BIOL	443	Food Microbiology	3	Pre-req.: BIOL 333
BCHM	445	Biochemical Principles of Nutrition	3	Pre-req.: BCHM 331
BCHM	446	Gene Therapy	3	Pre-req.: BIOL 334
BCHM	447	Biochemical and Molecular Toxicology	3	Pre-req.: BCHM 331
BCHM	448	Molecular Biology of Cancer	3	Pre-req.: BIOL 334
BIOL	449	Comparative Vertebrate Anatomy	3	Pre-req.: BIOL 231

Description of Departmental Elective Courses

BIOL 342 HISTOLOGY (3Cr.:2Lec,2 Lab):
The fundamental basic knowledge of the structure of mammalian cells and their organization into tissues. Topics include histological techniques, the use of virtual microscopy and the morphological examination of epithelium, connective tissue, muscle and nervous tissues. An emphasis is placed on the recognition of cell types and the correlation of structure and function. Practical: applications of the lecture topics. Pre-req.: BIOL 231.

BIOL 344 VIROLOGY (3Crs.:3Lec):
This course introduces the students to the classification, structure of viruses and their replication at the molecular level, emphasizing on the major viruses causing important diseases in humans and animals. The course focuses also on the mechanisms of viral pathogenesis, determinants of viral virulence and the host response to infections. Diagnosis of viral infections, vaccines and control of viral infections are also discussed. Pre-req.: BIOL 333.

PHYS 352 BIOPHYSICS (3Crs.:3Lec):
Fluids: Circulation of the blood, blood pressure, power produced by heart. Heat: trasfer of heat, transport of molecules by diffusion, respiratory system, surfactants and breathing, diffusion and contanct lenses. Thermodynamics of living systems, energy from food, regulation of body temperature, evaporation, resistance to cold, heat and soil. Sound: hearing and the ear, clinical uses of sound, ultrasonic waves. Electricity: the nervous system, electricity in plants, electricity in bone, electric fish, electrocardiograph, physiological effects of elelctricity, sensory aids. Optics: strucutre of the eye, accommodation, eye and the camera, retina, defects in vision, fiber optics. X-rays: computerized tomography CT. Lasers: lasers surgery. Nuclear Physics: magnetic resonance imaging, radiation therapy, food preservation by radiation, isotopic tracers.

BCHM 434 BIOTECHNOLOGY (3Crs.:3 Lec):
The basic principles of recombinant DNA technology and genetic engineering used in the field of biotechnology to produce transgenic plants, animals and microorganisms. Topics include applications of molecular biotechnology in medicine, agriculture and environment. Pre-req.: BIOL 334.

BIOL 441 CELL AND TISSUE CULTURE (3Crs.:3 Lec):
The course provides theoretical knowledge on how to culture cells outside the body emphasizing on the equipment and sterile techniques of the cell culture laboratory, the composition of cell culture media, establishment of primary cultures and cell lines from normal tissue and cancer tissue, routine cultivation of cells, long-term storage and contamination. Various methods for characterization of cells and transfection are also discussed. Pre-req.: BIOL 231.

BIOL 442 BIOLOGY OF INVERTEBRATES (3Crs.:3 Lec):
This course surveys the diversity of invertebrates and their functional systems, emphasizing the basic themes that define each phylum and those that are common to all animals. The course focuses on evolution, life histories, physiology, and anatomy of the major phyla and the diversity of the minor phyla. Pre-req.: BIOL 231.

BIOL 443 FOOD MICROBIOLOGY (3Crs.:3Lec):
This course is designed to extend the student's knowledge and understanding of the attributes of microorganisms and the applications of modern techniques in food microbiology. Topics covered include: the microbiology of food, common food-borne pathogens, food preservation, food spoilage, food fermentation, rapid and culture-based microbe detection. Pre-req.: BIOL 333.

BCHM 445 BIOCHEMICAL PRINCIPLES OF NUTRITION (3Crs.:3Lec):
This course emphasizes on the body's handling of carbohydrate, protein and fats and the functions of vitamins and minerals, the use of supplements. It also describes the factors associated with weight control, including causes of obesity, methods of assessing body weight and composition. Pre-req.: BCHM 331.

BCHM 446 GENE THERAPY (3Crs.:3Lec):
This course introduces the molecular basis of gene therapy emphasizing on the types of human diseases that could benefit the most, and the safety and ethical issues. Some of the major gene transfer vector systems, the viral delivery methods will be covered in detail. Gene therapy strategies are contrasted with various diseases, including cancer and AIDS. Pre-req.: BIOL 334.

BCHM 447 BIOCHEMICAL AND MOLECULAR TOXICOLOGY (3Crs.:3Lec):
This course presents an overview of the basic principles of toxicology and examines factors that affect the toxicity of foreign substances. Topics include the absorption, distribution, excretion, metabolism of various toxins. Signaling pathways at the molecular level that regulate cellular responses to toxicant exposure are also discussed. Pre-req.: BCHM 331.

BCHM 448 MOLECULAR BIOLOGY OF CANCER (3Crs.:3 Lec):
This course is focused on the molecular and cellular mechanisms of carcinogenesis. The topics of oncogene activation and tumor suppressor gene inactivation induced by carcinogens will be emphasized. DNA repair genes, cell cycle regulation, programmed cell death, cytochrome P450 and tumor markers will be examined. Pre-req.: BIOL 334.

BIOL 449 COMPARATIVE VERTEBRATE ANATOMY (3Crs.:3Lec):
A comparative study of the functional adaptations, which caused structural changes in different chordate animals based on specific examples. Pre-req.: BIOL 231.

Study Plan

B.Sc. Degree in Biology (97 Credits)

First Semester (16 Credits)			Crs.	Pre-/co-requisites
BIOL	231	Biology I	3	
BIOL	231L	Biology I Laboratory	1	Co-Req.: BIOL 231
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-Req.: CHEM 241
PHYS	231	Physics for Life Sciences	3	
PHYS	231L	Physics for Life Sciences Laboratory	1	Co-Req.: PHYS 231
		University Requirement	4	

Second Semester (17 Credits)			Crs.	Pre-/co-requisites
MATH	242	Probability and Statistics	3	
CHEM	234	Organic Chemistry	3	
CHEM	234L	Organic Chemistry Laboratory	1	Co-Req.: CHEM 234
BIOL	232	Biology II	3	Pre-Req: BIOL 231
BIOL	232L	Biology II Laboratory	1	Co-Req.: BIOL 232
BIOL	236	Immunology	2	Pre-Req: BIOL 231
		University Requirement	4	

Third Semester (17 Credits)			Crs.	Pre-/co-requisites
BCHM	331	Biochemistry	3	Pre-Req: CHEM 234
BCHM	331L	Biochemistry Laboratory	1	Co-Req.: BCHM 331
BIOL	333	Microbiology	3	Pre-Req: BIOL 231
BIOL	333L	Microbiology Laboratory	1	Co-Req.: BIOL 333
BIOL	337	Human Physiology	3	Pre-Req: BIOL 231
		University Requirement	6	

Fourth Semester (16 Credits)			Crs.	Pre-/co-requisites
BIOL	334	Cell and Molecular Biology	3	Pre-Req: BIOL 231
BIOL	334L	Cell and Molecular Biology Laboratory	1	Co-Req.: BIOL 334
BIOL	336	Plant Physiology	3	Pre-Req: BIOL 232
BIOL	336L	Plant Physiology Laboratory	1	Co-Req.: BIOL 336
BIOL	338	Genetics	3	Pre-Req: BIOL 231
		University Requirement	3	
		Free Elective	2	

Fifth Semester (17 Credits)			Crs.	Pre-/co-requisites
BCHM	437	Endocrinology	3	Pre-Req: BCHM 331
BIOL	433	Developmental Biology	3	Pre-Req: BIOL 232
BIOL	433L	Developmental Biology Laboratory	1	Co-Req.: BIOL 433
BIOL	435	Seminar in Biology	1	
		University Requirement	4	
		Departmental Elective	3	
		Free Elective	2	

Sixth Semester (14 Credits)			Crs.	Pre-/co-requisites
BIOL	432	Ecology	3	Pre-Req: BIOL 232
BIOL	432L	Ecology Laboratory	1	Co-Req.: BIOL 432
BIOL	444	Senior Project	2	
		Departmental Elective	6	
		Free Elective	2	

B. Biochemistry Program

Mission

The mission of the biochemistry major is to provide a high quality, rigorous biochemistry curriculum that prepares undergraduate students for various aspects of biochemistry disciplines where knowledge and critical and analytical thinking skills are essential. The biochemistry curriculum also ensures that the students possess scientific skills to be successful in alternative career options in biochemistry and related disciplines.

Objectives

The biochemistry major curriculum:

- Provides undergraduate students with knowledge and understanding of biochemical concepts and principles.
- Prepares students to understand the biochemistry pathways and processes in health, nutrition and agriculture.
- Includes laboratory work to help students to carry out and interpret laboratory work in biochemistry.
- Provides students with the latest biochemical techniques used in both basic and applied areas of biochemistry and related disciplines such as molecular biology.
- Promotes the capacity for life-long learning.
- Prepares the students for many career options in biochemistry and related disciplines.
- Requires that the student conduct a research project in biochemistry followed by oral and written presentation of this project.

Learning Outcomes

a- Knowledge and Understanding:

- Comprehensive knowledge and understanding of fundamental biochemical reactions and processes in living organisms (such as human, animals, plants and microorganisms).
- Understand the mechanisms of diseases incidence and the strategies to treat human diseases at the molecular and cellular levels.
- Master aspects of the modern disciplines of biochemistry at the molecular, cellular and organism levels.
- Understand and practice various experimental techniques of biochemistry.
- Merging knowledge of biochemistry and related disciplines such as molecular biology, biotechnology and biomedical science.
- Identify and use of biochemical databases and literature sources.

b- Intellectual Abilities:

- Demonstrate broad knowledge and understanding of various biochemical aspects and pathways.
- Demonstrate the ability to carry out experiments, analyze the obtained data and draw reasonable conclusions or interpretations.
- Demonstrate the ability to critically evaluate and utilize scientific literature.
- Demonstrate skills and expertise in biochemistry for various career opportunities.
- Use critical thinking and principles of logic to evaluate problems in biochemistry disciplines.

- The ability to pursue further education as an independent life-long professional learning.

c- Professional and Practical Competencies:

- Obtain the ability to design experimental biochemical and molecular approaches and strategies to solve biochemical problems.
- Analyze and evaluate experimental results and observations clearly and draw scientific conclusions.
- Operate and practice basics laboratory instrumentations efficiently.

d- General and Transferable Skills:

- Communicate scientific information clearly and precisely, both orally and in writing.
- Work effectively in a professional or laboratory setting.
- Recognize and respond to the need of life-long learning.
- Can function effectively independently or as member of a team.

Degree Requirements

To obtain the Bachelor Degree in Biochemistry, students must successfully complete a total of 97 credit hours + ICDL, where the standard duration of study is 6 semesters. There is one general semester of study for the students of the Biochemistry Program.

Career Opportunities

The biochemistry major is an interdisciplinary science that provides students with a solid scientific background to open the door to many career opportunities.

- Graduate education in biochemistry, molecular biology, biotechnology and related life science programs.
- Employment in the area of forensic science, food science, agricultural research, biotechnology and pharmaceutical industries.
- Technical research positions.
- Clinical laboratory technicians.
- Teaching biochemistry and molecular biology courses.
- Admission to biomedical schools.

Program Overview

The Biochemistry curriculum consists of the following components:

Biochemistry Program	
I. University Requirements	**Credits**
* University Mandatory Courses	5
* University Elective Courses	16
II. Program Requirements	**Credits**
Faculty Core Courses	15
Major Core Courses	46
Departmental Elective Courses	9
**Free Electives	6
Total	**97**

Faculty and Major Core Courses

Courses			Crs.	Pre-/Co-requisites
BIOL	231	Biology I	3	
BIOL	231L	Biology I Laboratory	1	Co-req.-BIOL 231
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-req.-CHEM 241
PHYS	231	Physics for Life Sciences	3	
PHYS	231L	Physics for Life Sciences Laboratory	1	Co-req.-PHYS 231
MATH	242	Probability and Statistics	3	
CHEM	234	Organic Chemistry	3	
CHEM	234L	Organic Chemistry Laboratory	1	Co-req.-CHEM 234
CHEM	242	Analytical Chemistry	3	Pre-req.-CHEM 241
CHEM	242L	Analytical Chemistry Laboratory	1	Co-req.-CHEM 242
BIOL	236	Immunology	2	Pre-req.-BIOL 231
BCHM	331	Biochemistry	3	Pre-req.-CHEM 234
BCHM	331L	Biochemistry Laboratory	1	Co-req.-BCHM 331
BIOL	333	Microbiology	3	Pre-req.-BIOL 231
BIOL	333L	Microbiology Laboratory	1	Co-req.-BIOL 333
CHEM	333	Physical Chemistry	3	Pre-req.-CHEM 241

* A total of 21 credits is required as University Requirements: 5 credits are selected from the University Mandatory courses list, 6 credits from social sciences list, 6 credits from humanities list and 4 credits from other lists of the university elective courses.

** A total of 6 credits is required as free electives, student can enroll in any course offered by BAU faculties, with at least one course outside the department offering the program.

CHEM	333L	Physical Chemistry Laboratory	1	Co-req.-CHEM 333
BIOL	334	Cell and Molecular Biology	3	Pre-req.-BIOL 231
BIOL	334L	Cell and Molecular Biology Laboratory	1	Co-req.-BIOL 334
BCHM	336	Metabolic Biochemistry	3	Pre-req.-BCHM 331
BCHM	433	Enzymology	3	Pre-req.-BCHM 336
BCHM	433L	Enzymology Laboratory	1	Co-req.-BCHM 433
BCHM	432	Clinical Biochemistry	3	Pre-req.-BCHM 336
BCHM	432L	Clinical Biochemistry Laboratory	1	Co-req.-BCHM 432
BCHM	434	Biotechnology	3	Pre-req.-BIOL 334
BCHM	444	Senior Project	2	
BCHM	435	Seminar in Biochemistry	1	
BCHM	437	Endocrinology	3	Pre-req.-BCHM 331

Description of Faculty and Major Core Courses

PHYS 231L PHYSICS FOR LIFE SCIENCES LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in PHYS 231. Co-req.: PHYS 231.

BIOL 231 BIOLOGY I (3Crs.:3Lec):
This course introduces the students to fundamental concepts in biology. Topics to be covered include the cellular and chemical basis of life, organization of life, energy transfer through living organisms, evolution, diversity of life with emphasis on the animal and plant kingdoms and their interaction with the environment.

BIOL 231L BIOLOGY I LABORATORY (1Cr.:2Lab):
Laboratory includes applications and experiments related to the topics discussed in Biology I course. Co-req.: BIOL 231.

CHEM 241 PRINCIPLES OF CHEMISTRY (3Crs.:3Lec):
A study of the fundamental concepts of chemistry including matter and measurement, atoms, molecules, ions, moles, nomenclature, atomic and molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, and solid states of matter. Properties of solutions, aqueous reactions and solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases and ionic equilibria, electrochemistry, nuclear chemistry and coordination chemistry.

CHEM 241L PRINCIPLES OF CHEMISTRY LABORATORY (1Cr.:3Lab):
Selected experiments illustrate the topics discussed in CHEM 241. Co-req.: CHEM 241.

MATH 242 PROBABILITY AND STATISTICS (3Cr.:2Lec,2Lab):
Basic concepts in statistics (mean, variance and frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete and continuous distributions, central limit theorem, regression and correlation, confidence intervals.

Description of Major Core Courses

CHEM 242 ANALYTICAL CHEMISTRY (3Cr.:3Lec):
This course presents the basic concepts of classical methods of quantitative chemical analysis and their applications. The topics covered include gravimetric and volumetric methods based on solution equilibria such as acid-base, complexometric, redox and precipitation reactions, introduction to separation and spectroscopic methods of analysis. The course also introduces students to statistical data treatment, errors, precision and accuracy in chemical analysis. Pre-req.: CHEM 241.

CHEM 242L ANALYTICAL CHEMISTRY LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in CHEM 242. Co-req.: CHEM 242.

CHEM 234 ORGANIC CHEMISTRY (3Cr.:3Lec):
The course provides the necessary background in organic chemistry in the context of living cells. Nomenclature of chemical compounds, chemical bonding and structure, conformations and stereochemistry, organic reactivity and catalysis, organic acids and bases. Nucleophilic substitution, phosphoryl transfer, nucleophilic carbonyl addition, acyl substitution, electrophilic, oxidation, reduction and radical reactions.

CHEM 234L ORGANIC CHEMISTRY LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in CHEM 234. Co-req.: CHEM 234.

BIOL 236 IMMUNOLOGY (2Crs.:2Lec):
A course that covers the fundamental concepts of modern immunology emphasizing on the molecular and cellular elements of the immune system, and their basic function. Topics covered include description of the immune system, antibody and T-cell receptor structure and functions, genes of the immunoglobulin superfamily, cells and molecular mediators that regulate the immune response, allergy, autoimmunity, immunodeficiency, transplantation and tumor immunity. Pre-req.: BIOL 231.

BCHM 331 BIOCHEMISTRY (3Crs.:3Lec):
An Introduction to basic principle of biochemistry emphasizing on the broad understanding of the structure and function of biomolecules. Pre-req.: CHEM 234.

BCHM 331L BIOCHEMISTRY LABORATORY (1Cr.:2Lab):
Introduction to basic biochemistry experiments. Acquaints students with basic biochemical laboratory techniques including the identification and quantification of biomolecules. Co-req.: BCHM 331.

BIOL 333 MICROBIOLOGY (3Crs.:3Lec):
An introduction to the microbial world, with emphasis given to bacteria and viruses, and the impact of these organisms on the environment and human health. Topics include: diversity of microorganisms, structure of prokaryotic cells, bacterial nutrition, reproduction and growth, factors affecting microbial growth, control of microorganisms, physiology, properties of viruses, taxonomy of plant and animal viruses, and bacteriophages. Pre-req.: BIOL 231.

BIOL 333L MICROBIOLOGY LABORATORY (1Cr.:2Lab):
Microbiological laboratory procedures including sterilization methods, microscopy, preparation of culture media, isolation of bacteria from different sources, preservation, staining of bacteria, bacterial count, pure culture techniques. Co-req.: BIOL 333.

CHEM 333 PHYSICAL CHEMISTRY (3Crs.:3Lec):
Basic principles of chemical thermodynamics and kinetics. Catalysis and adsorption. Transport phenomena. States and properties of colloids. Pre-req.: CHEM 241.

CHEM 333L PHYSICAL CHEMISTRY LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in CHEM 333. Co-req.: CHEM 333.

BIOL 334 CELL AND MOLECULAR BIOLOGY (3Crs.:3Lec):
This course provides an introduction to cell biology emphasizing on cell division, cell cycle, structure and function of cellular organelles and the functional interaction of the cells with their microenvironment, an overview on DNA replication, transcription and translation, regulation of gene expression in prokaryotes and eukaryotes and protein synthesis. This course also covers molecular biology techniques including isolation and purification of nucleic acids, enzymes used in molecular biology such as restriction endonucleases and ligases, genomic library, PCR, Southern, northern and western blotting, sequencing, and cloning. Pre-req.: BIOL 231.

BIOL 334L CELL AND MOLECULAR BIOLOGY LABORATORY (1Cr.:2Lab):
This laboratory introduces students to the tools of cell biology and experiments in molecular biology. Co-req.: BIOL 334.

BCHM 336 METABOLIC BIOCHEMISTRY (3Cr.:3Lec):
Metabolism of macromolecules through energy-producing pathways such as glycolysis, the TCA cycle, oxidative phosphorylation and fatty acid oxidation; and biosynthetic pathways–gluconeogenesis, glycogen synthesis, and fatty acid biosynthesis. Nitrogen metabolism, urea cycle, amino acid metabolism, nucleotide metabolism, and. Regulation of carbohydrates, lipid and protein metabolism. Pre-req.: BCHM 331.

BCHM 432 CLINICAL BIOCHEMISTRY (3Crs.:3Lec):
A course that covers the basic principles and practice of clinical chemistry. It offers an introduction to biochemical instrumentation and a study of metabolism during normal and pathological processes of the human body. The relationship between disease states and chemical variations from normal is emphasized providing the students with useful information for the interpretation and diagnosis of the conditions. Pre-req.: BCHM 336.

BCHM 432L CLINICAL BIOCHEMISTRY LABORATORY (1Cr.:3Lab):
A laboratory that deals with the clinical parameters using various tests to identify and diagnose diseases. The students will deal with blood and urine samples for the analysis and interpretations of normal and pathological processes of the human body. The laboratory sessions also include case discussion. Co-req.: BCHM 432.

BCHM 433 ENZYMOLOGY (3Crs.:3Lec):
Classification of enzymes. Factors affecting enzyme activity, cofactors, coenzymes and enzyme inhibition. Enzyme kinetics. Allosteric control of enzymes. Mechanism of catalysis. Pre-req.: BCHM 336.

BCHM 433L ENZYMOLOGY LABORATORY (1Cr.:2lab):
A laboratory course to accompany the Enzymology lecture. Co-req.: BCHM 433.

BCHM 434 BIOTECHNOLOGY (3Crs.:3Lec):
The basic principles of recombinant DNA technology and genetic engineering used in the field of biotechnology to produce transgenic plants, animals and microorganisms. Topics include applications of molecular biotechnology in medicine, agriculture and environment. Pre-req.: BIOL 334.

BCHM 435 SEMINAR IN BIOCHEMISTRY (1Cr.:1Lec):
A seminar dealing with timely topics in the field of biochemistry that provides an in-depth examination of current topics in the mentioned field. Designed to help senior students become acquainted with latest ideas on selected topics.

BCHM 437 ENDOCRINOLOGY (3Cr.:3Lec):
This course deals with the endocrine system and its hormonal products, including the hormone producing cells, synthesis, modification, release and transport of hormones, hormone receptors and the mechanisms of hormone action, their effects on target cells, their effects on physiological processes, the diseases caused by inappropriate hormone functions and bioenergetics and metabolic regulation. Pre-req.: BCHM 331.

BCHM 444 SENIOR PROJECT (2Crs.:2Lec):
Senior students will complete a research project in the field of Biochemistry using the

scientific literature review and under supervision of a faculty member. This project is to be submitted to the department for review.

Departmental Elective Courses

Courses			Crs.	Pre-/Co-requisites
BIOL	337	Human Physiology	3	Pre-req.: BIOL 231
BIOL	338	Genetics	3	Pre-req.: BIOL 231
BIOL	342	Histology	3	Pre-req.: BIOL 231
BIOL	344	Virology	3	Pre-req.: BIOL 333
PHYS	352	Biophysics	3	
BIOL	441	Cell and Tissue Culture	3	Pre-req.: BIOL 231
BCHM	451	Membrane Biochemistry	3	Pre-req.: BCHM 331
BCHM	446	Gene Therapy	3	Pre-req.: BIOL 334
BCHM	445	Biochemical Principles of Nutrition	3	Pre-req.: BCHM 331
BCHM	447	Biochemical and Molecular Toxicology	3	Pre-req.: BCHM 331
BCHM	448	Molecular Biology of Cancer	3	Pre-req.: BIOL 334
BCHM	449	Nucleic Acid - Protein Interaction	3	Pre-req.: BIOL 334

Description of Departmental Elective Courses

BIOL 337 HUMAN PHYSIOLOGY (3Crs.:3Lec):
The course focuses on the major physiological systems of the human body (e.g., circulatory, respiratory, gastrointestinal, urogenital and the nervous system) with emphasis on understanding human diseases. Pre-req.: BIOL 231

BIOL 338 GENETICS (3Crs.:3Lec):
A study of the basic principles of classical and modern genetics. Topics include Mendelian inheritance and deviations from classical Mendelian ratios, pedigree analysis, gene interactions, gene mutation, linkage, gene mapping and population genetics. Pre-req.: BIOL 231.

BIOL 342 HISTOLOGY (3Crs.:2Lec,2Lab):
The fundamental basic knowledge of the structure of mammalian cells and their organization into tissues. Topics include histological techniques, the use of virtual microscopy and the morphological examination of epithelium, connective tissue, muscle and nervous tissues. An emphasis is placed on the recognition of cell types and the correlation of structure and function. Practical: applications of the lecture topics. Pre-req.: BIOL 231.

BIOL 344 VIROLOGY (3Crs.:3Lec):
This course introduces the students to the classification, structure of viruses and their replication at the molecular level, emphasizing on the major viruses causing important diseases in humans and animals. The course focuses also on the mechanisms of viral pathogenesis, determinants of viral virulence and the host response to infections. Diagnosis of viral infections, vaccines and control of viral infections are also discussed. Pre-req.: BIOL 333.

PHYS 352 BIOPHYSICS (3Crs.:3Lec):
Fluids: Circulation of the blood, blood pressure, power produced by heart. Heat: trasfer of heat, transport of molecules by diffusion, respiratory system, surfactants and breathing, diffusion and contanct lenses. Thermodynamics of living systems, energy from food, regulation of body temperature, evaporation, resistance to cold, heat and soil. Sound: hearing and the ear, clinical uses of sound, ultrasonic waves. Electricity: the nervous system, electricity in plants, electricity in bone, electric fish, electrocardiograph, physiological effects of elelctricity, sensory aids. Optics: strucutre of the eye, accommodation, eye and the camera, retina, defects in vision, fiber optics. X-rays: computerized tomography CT. Lasers: lasers surgery. Nuclear Physics: magnetic resonance imaging, radiation therapy, food preservation by radiation, isotopic tracers.

BIOL 441 CELL AND TISSUE CULTURE (3Crs.:3Lec):
The course provides theoretical knowledge on how to culture cells outside the body emphasizing on the equipment and sterile techniques of the cell culture laboratory, the composition of cell culture media, establishment of primary cultures and cell lines from normal tissue and cancer tissue, routine cultivation of cells, long-term storage and contamination. Various methods for characterization of cells and transfection are also discussed. Pre-req.: BIOL 231.

BCHM 451 MEMBRANE BIOCHEMISTRY (3Crs.:3Lec):
Biochemistry of membranes and membrane proteins. Topics to be covered include membrane structure and functions with emphasis on membrane transport, membrane fusion, electrical and cell signaling and the involvement of membrane proteins in disease. Pre-req.: BCHM 331.

BCHM 446 GENE THERAPY (3Crs.:3Lec):
This course introduces the molecular basis of gene therapy emphasizing on the types of human diseases that could benefit the most, and the safety and ethical issues. Some of the major gene transfer vector systems, the viral delivery methods will be covered in detail. Gene therapy strategies are contrasted with various diseases, including cancer and AIDS. Pre-req.: BIOL 334.

BCHM 445 BIOCHEMICAL PRINCIPLES OF NUTRITION (3Crs.:3Lec):
This course emphasizes on the body's handling of carbohydrate, protein and fats and the functions of vitamins and minerals, the use of supplements. It also describes the factors associated with weight control, including causes of obesity, methods of assessing body weight and composition. Pre-req.: BCHM 331.

BCHM 447 BIOCHEMICAL AND MOLECULAR TOXICOLOGY (3Crs.:3Lec):
This course presents an overview of the basic principles of toxicology and examines factors that affect the toxicity of foreign substances. Topics include the absorption, distribution, excretion, metabolism of various toxins. Signaling pathways at the molecular level that regulate cellular responses to toxicant exposure are also discussed. Pre-req.: BCHM 331.

BCHM 448 MOLECULAR BIOLOGY OF CANCER (3Crs.:3Lec):
This course is focused on the molecular and cellular mechanisms of carcinogenesis. The topics of oncogene activation and tumor suppressor gene inactivation induced by carcinogens will be emphasized. DNA repair genes, cell cycle regulation, programmed cell death, cytochrome P450 and tumor markers will be examined. Pre-req.: BIOL 334.

BCHM 449 NUCLEIC ACID - PROTEIN INTERACTION (3Crs.:3Lec):
A comprehensive view of the structural properties of DNA and RNA that promote molecular interactions and biological function. Topics include the physical properties of nucleic acids, the formation and biological importance of higher order structures, RNA enzymatic activities, nucleic acid-protein interactions, and RNA metabolism. Pre-req.: BIOL 334.

Study Plan

B.Sc. Degree in Biochemistry (97 Credits)

First Semester (16 Credits)			Crs.	Pre-/co-requisites
BIOL	231	Biology I	3	
BIOL	231L	Biology I Laboratory	1	Co-Req.: BIOL 231
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-Req.: CHEM 241
PHYS	231	Physics for Life Sciences	3	
PHYS	231L	Physics for Life Sciences Laboratory	1	Co-Req.: PHYS 231
		University Requirements	4	

Second Semester (17 Credits)			Crs.	Pre-/co-requisites
MATH	242	Probability and Statistics	3	
CHEM	242	Analytical Chemistry	3	Pre-Req: CHEM 241
CHEM	242L	Analytical Chemistry Laboratory	1	Co-Req.:CHEM 242
CHEM	234	Organic Chemistry	3	
CHEM	234L	Organic Chemistry Laboratory	1	Co-Req: CHEM 234
BIOL	236	Immunology	2	Pre-Req: BIOL 231
		University Requirements	4	

Third Semester (17 Credits)			Crs.	Pre-/co-requisites
BCHM	331	Biochemistry	3	Pre-Req: CHEM 234
BCHM	331L	Biochemistry Laboratory	1	Co-Req: BCHM 331
BIOL	333	Microbiology	3	Pre-Req: BIOL 231
BIOL	333L	Microbiology Laboratory	1	Co-Req: BIOL 333
CHEM	333	Physical Chemistry	3	Pre-Req: CHEM 241
CHEM	333L	Physical Chemistry Laboratory	1	Co-Req: CHEM 333
		University Requirements	5	

Fourth Semester (16 Credits)			Crs.	Pre-/co-requisites
BIOL	334	Cell and Molecular Biology	3	Pre-Req: BIOL 231
BIOL	334L	Cell and Molecular Biology Laboratory	1	Co-Req: BIOL 334
BCHM	336	Metabolic Biochemistry	3	Pre-Req: BCHM 331
		University Requirements	4	
		Departmental Elective	3	
		Free Elective	2	

Fifth Semester (17 Credits)			Crs.	Pre-/co-requisites
BCHM	433	Enzymology	3	Pre-Req.: BCHM 336
BCHM	433L	Enzymology Laboratory	1	Co-Req.: BCHM 433
BCHM	437	Endocrinology	3	Pre-Req.: BCHM 331
BCHM	435	Seminar in Biochemistry	1	
		University Requirements	4	
		Departmental Elective	3	
		Free Elective	2	

Sixth Semester (14 Credits)			Crs.	Pre-/co-requisites
BCHM	432	Clinical Biochemistry	3	Pre-Req: BCHM 336
BCHM	432L	Clinical Biochemistry Laboratory	1	Co-Req: BCHM 432
BCHM	434	Biotechnology	3	Pre-Req: BIOL 334
BCHM	444	Senior Project	2	
		Departmental Elective	3	
		Free Elective	2	

C- Environmental Science Program

Mission

The environmental Science major is an interdisciplinary program that provides course work in environmental science and ecology. Laboratory courses are designed to provide students with training in various disciplines of the environmental science. The program educates and prepares students to use concepts and principles in the study of environmental science at local, regional and global levels. The program aims also to prepare students for many career opportunities in different disciplines of environmental science.

Objectives

The curriculum of the environmental science major is designed to:

- Enable students to understand and recognize major concepts and principles in environmental sciences.
- Learn the techniques used in solving problems and issues related to environmental science.
- Prepares students for many career opportunities in the field of environmental science.
- Promotes the capacity for life-long learning.
- Requires that the student conduct a research project in issues related to the environment, followed by oral and written presentation of this project.

Learning Outcomes

a-Knowledge and Understanding:

- Understanding major concepts and principles in environmental science that apply to air, land and water on local, region and global scales.
- Understand the ecological connections between human and environment and identify major threats to natural resources.
- Identify concepts relating to the future and advances in environmental science.
- Identify principles of environmental ethics and legal issues relating to environmental science.
- Understand how politics, management and economic factors can cause environmental problems.

b-Intellectual abilities:

- Demonstrate a working knowledge of the scientific method to identify, evaluate and recommend solutions to environmental problems.
- Demonstrate how society proposes to address threats to natural resources and waste management.
- Evaluate environmental problems in Lebanon and in the Middle East.
- Apply knowledge from other disciplines such as biology, microbiology and chemistry in the environment science.

c-Professional and Practical Competencies:

- Develop analytical and critical thinking for solving problems related to environment at local, region and global scales.
- Effectively analyze environmental data and communicate environmental science issues to

stake holder.
- Select appropriate measurement tools and collect environment data using common instruments and techniques.

d-General and Transferable Skills:
- Communicate concisely and clearly the issues related to the environmental science, both orally and in writing.
- Work effectively in a professional or laboratory setting.
- Recognize and respond to the need of life-long learning.
- Can function effectively independently or as member of a team.

Degree Requirements

To obtain the Bachelor Degree in Environmental Science, students must successfully complete a total of 97 credit hours + ICDL, where the standard duration of study is 6 semesters. There is **one general** semester of study for the students of the Environmental Science Program.

Career Opportunities

- Graduate studies in various environmental sciences.
- Employment in research laboratories and facilities, industry and government.
- Teaching environmental sciences courses.

Program Overview

The Environmental Science curriculum consists of the following components:

Environmental Science Program	
I. University Requirements	**Credits**
* University Mandatory Courses	5
* University Elective Courses	16
II. Program Requirements	**Credits**
Faculty Core Courses	15
Major Core Courses	46
Departmental Elective Courses	9
**Free Electives	6
Total	**97**

* A total of 21 credits is required as University Requirements: 5 credits are selected from the University Mandatory courses list, 6 credits from social sciences list, 6 credits from humanities list and 4 credits from other lists of the university elective courses.

** A total of 6 credits is required as free electives, student can enroll in any course offered by BAU faculties, with at least one course outside the department offering the program.

Faculty and Major Core Courses

Courses			Crs.	Pre-/Co-requisites
BIOL	231	Biology I	3	
BIOL	231L	Biology I Laboratory	1	Co-req.-BIOL 231
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-req.-CHEM 241
PHYS	231	Physics For Life Sciences	3	
PHYS	231L	Physics For Life Sciences Laboratory	1	Co-req.-PHYS 231
MATH	242	Probability and Statistics	3	
CHEM	234	Organic Chemistry	3	
CHEM	234L	Organic Chemistry Laboratory	1	Co-req.-CHEM 234
BIOL	232	Biology II	3	Pre-req.-BIOL 231
BIOL	232L	Biology II Laboratory	1	Co-req.-BIOL 232
ENVI	201	Introduction to Environmental Studies	2	
ENVI	301	Planet Earth	2	
ENVI	302	Environmental Pollution	3	
ENVI	322	Fundamentals of Ecology	2	
BCHM	331	Biochemistry	3	Pre-req.-CHEM 234
BCHM	331L	Biochemistry Laboratory	1	Co-req.-BCHM 331
BIOL	333	Microbiology	3	Pre-req.-BIOL 231
BIOL	333L	Microbiology Laboratory	1	Co-req.-BIOL 333
ENVI	303	Ecosystems And Biosphere	2	
ENVI	308	Energy Resources	2	
ENVI	417	Climate Change: Past And Future	2	
ENVI	418	Environmental Risk Assessment	3	
ENVI	420	Natural Disasters	2	
ENVI	422	Introduction To Marine Science	2	
ENVI	403	Waste Recycling	2	
ENVI	405	Gis And Arc/Info	2	
ENVI	409	Environmental Toxicology	2	
ENVI	444	Senior Project	2	

Description of Faculty Core Courses

PHYS 231 PHYSICS FOR LIFE SCIENCES (3Crs.:3Lec):
Units and dimensions- Force, work, energy and power in biological systems- Elastic properties of bones and tissues- Nonviscous and viscous fluids- Heat, temperature and thermal properties of materials- electricity and magnetism- Nerve conduction- Sound wave- X-rays (production, and uses in life science).

PHYS 231L PHYSICS FOR LIFE SCIENCES LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in PHYS 231. Co-req.: PHYS 231.

BIOL 231 BIOLOGY I (3Crs.:3Lec):
This course introduces the students to fundamental concepts in biology. Topics to be covered include the cellular and chemical basis of life, organization of life, energy transfer through living organisms, evolution, diversity of life with emphasis on the animal and plant kingdoms and their interaction with the environment.

BIOL 231L BIOLOGY I LABORATORY (1Cr.:2Lab):
Laboratory includes applications and experiments related to the topics discussed in Biology I course. Co-req.: BIOL 231.

CHEM 241 PRINCIPLES OF CHEMISTRY (3Crs.:3Lec):
A study of the fundamental concepts of chemistry including matter and measurement, atoms, molecules, ions, moles, nomenclature, atomic and molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, and solid states of matter. Properties of solutions, aqueous reactions and solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases and ionic equilibria, electrochemistry, nuclear chemistry and coordination chemistry.

CHEM 241L PRINCIPLES OF CHEMISTRY LABORATORY (1Cr.:3Lab):
Selected experiments illustrate the topics discussed in CHEM 241. Co-req.: CHEM 241.

MATH 242 PROBABILITY AND STATISTICS (3Crs.:2Lec,2 Lab):
Basic concepts in statistics (mean, variance and frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete and continuous distributions, central limit theorem, regression and correlation, confidence intervals.

CHEM 234 ORGANIC CHEMISTRY (3Crs.:3Lec):
The course provides the necessary background in organic chemistry in the context of living cells. Nomenclature of chemical compounds, chemical bonding and structure, conformations and stereochemistry, organic reactivity and catalysis, organic acids and bases. Nucleophilic substitution, phosphoryl transfer, nucleophilic carbonyl addition, acyl substitution, electrophilic, oxidation, reduction and radical reactions.

Description of Major Core Courses

CHEM 234L ORGANIC CHEMISTRY LABORATORY (1Cr.:3Lab):
Experimental work related to the topics discussed in CHEM 234. Co-req.: CHEM 234.

BCHM 331 BIOCHEMISTRY (3Crs.:3Lec):
An Introduction to basic principle of biochemistry emphasizing on the broad understanding of the structure and function of biomolecules. Pre-req.: CHEM 234.

BCHM 331L BIOCHEMISTRY LABORATORY (1Cr.:2Lab):
Introduction to basic biochemistry experiments. Acquaints students with basic biochemical laboratory techniques including the identification and quantification of biomolecules. Co-req.: BCHM 331.

BIOL 333 MICROBIOLOGY (3Crs.:3Lec):
An introduction to the microbial world, with emphasis given to bacteria and viruses, and the impact of these organisms on the environment and human health. Topics include: diversity of microorganisms, structure of prokaryotic cells, bacterial nutrition, reproduction and growth, factors affecting microbial growth, control of microorganisms, physiology, properties of viruses, taxonomy of plant and animal viruses, and bacteriophages. Pre-req.: BIOL 231.

BIOL 333L MICROBIOLOGY LABORATORY (1Cr.:2Lab):
Microbiological laboratory procedures including sterilization methods, microscopy, preparation of culture media, isolation of bacteria from different sources, preservation, staining of bacteria, bacterial count, pure culture techniques. Co-req.: BIOL 333.

ENVI 201 INTRODUCTION TO ENVIRONMENTAL STUDIES (2Crs.:2Lec):
Ecological systems, Biosphere, Atmosphere, Hydrosphere, Lithosphere, Carbon cycle, Nitrogen cycle, Sulfur cycle, Phosphorus cycle, water resources, air, noise and emissions, Biodiversity, Environmental problems (ozone depletion, acid rain, species loss, floods, droughts, climate change, urban pollution, and water contamination), Indoor pollution, waste management, nature conservation, cultural heritage and landscape protection, health, safety and chemicals

ENVI 301 PLANET EARTH (2Crs.:2Lec):
The interactions between the hydrosphere, atmosphere, biosphere, cryosphere and lithosphere that together make up the Earth System. It is now clear that the state of the Earth has dramatically and abruptly changed many times in the past with tremendous environmental repercussions–Why did this happen? As we humans transform the globe in many ways, we need to understand: How do the Earth's physical, chemical and biological systems interact? What were the causes and effects of past climatic changes and what can we learn from them about the future?

ENVI 302 ENVIRONMENTAL POLLUTION (3Crs.:3Lec) :
Air pollution, noise pollution, radiation and electromagnetic waves, water pollution, and soil pollution: sources, types, measurements, effects and control. Impact of environmental pollution on ecosystem degradation (land, air & water), restoration of degraded ecosystems. Improvement of rural and urban ecosystems, monitoring restoration achievements, long-term strategies for handling contaminated sites and large-scale areas, capacity controlling parameters, remediation procedures.

ENVI 303 ECOSYSTEMS AND BIOSPHERE (2Crs.:2Lec):
The ecosystem; definition and structure. Types of ecosystems. The ecosystem concept, population and the species concept, habitat and the concept of ecological factors. Analysis of biotic communities. Functions in the ecosystem; energy flow, food chains and productivity. Biosphere; definition, the web of life, Man and biosphere.

ENVI 422 INTRODUCTION TO MARINE SCIENCE (2Crs.:2Lec):
Introduction to physical, chemical, geological and biological processes in the oceans and coastal environments and their interactions; Interrelationships of man and the marine environment.

ENVI 417 CLIMATE CHANGE: PAST AND FUTURE (2Crs.:1Lec,3Lab):
History of the earth and natural cycles of changing climate. Global warming. Green house effect. Rate of climate change. Reduce carbon emissions. Difference between climate and weather. Physical impacts. Social impacts of climate change.

ENVI 418 ENVIRONMENTAL RISK ASSESSMENT (3Crs.:3Lec) :
Introduction to environmental risk assessment & management procedures. Analysis of the impact of development on various measures of environmental quality. Benefit-cost considerations in environmental impact assessment.

ENVI 322 FUNDAMENTALS OF ECOLOGY (2Crs.:1Lec,1Lab):
This course will focus on providing a basic understanding of ecological principles, concentrating on an ecosystem approach. The laboratory will provide practical experience pertaining to the study of ecology, as well as exercises intended to provide an understanding of the types of projects and studies conducted by the professional ecologist.

ENVI 308 ENERGY RESOURCES (2Crs.:2Lec) :
Renewable natural sources of energy and clean technologies. Solar, wind, geothermal hydropower, & tidal energy. Natural resources (water, forests, fuels, etc.) Management, exploitation and disposal of natural resources, non-renewable natural sources of energy. Conventional fuels (mining fuels, natural gases, etc.) Nuclear energy. Implications in the environment.

ENVI 420 NATURAL DISASTERS (2Crs.:2Lec) :
Earthquakes –Floods, Drought–Forest fires–landslides–storms–Tsunamis–Volcanic eruptions–snow avalanches–technology accidents–oil spills–Maritime disasters–Natech disasters–multirisk–Risk mapping–Learning from accidents as a basis for safety in spatial planning–Disaster reduction. Examples of recent environmental disasters.

ENVI 403 WASTE RECYCLING (2Crs.:1Lec,3Lab) :
Types of wastes and waste treatment technologies. Problems associated with the conventional methods of waste treatment & disposal. Various options and modern technologies employed in waste treatment, disposal and recycling using biological systems.

ENVI 405 GIS AND ARC/INFO (2Crs.:1Lec,3Lab):
Principles, characteristics and applications of environmental remote sensing. GIS as an environmental monitoring tool. Photographic systems and interpretation, thermal and multispectral scanning, satellite remote sensing, and digital image processing. Application of techniques to topics in the field of resource inventory, land use mapping or environmental monitoring.

ENVI 409 ENVIRONMENTAL TOXICOLOGY (2Cr.:1Lec,3Lab) :
The distribution of pollutants in the environment; their entry, movement, storage and transformation within the environment. The effects of pollutants on living organisms. At an individual level toxicants may disturb the biochemical, molecular, and physiological structure and function which will in turn have consequences on the structure and function of communities and ecosystems.

ENVI 444 SENIOR PROJECT (2Crs.):
Senior students will complete a research project in the field of Environmental Science using the scientific literature review and under supervision of a faculty member. This project is to be submitted to the department for review.

Departmental Elective Courses

Courses			Crs.	Pre-/Co-requisites
ENVI	309	Bioremediation	1	
ENVI	312	Coastal And Marine Ecosystem	2	
BIOL	336	Plant Physiology	3	Pre-req.-BIOL 232
BIOL	336L	Plant Physiology Laboratory	1	Co-req.-BIOL 336
ENVI	406	Environmental Policy Economics And Laws	2	
ENVI	407	Metabolic Biotransformations of Environmental Chemicals	3	
ENVI	411	Conservation Biology and Biodiversity	3	
ENVI	412	Genetic Engineering & Applications	3	
ENVI	413	Medical Microbiology	3	
ENVI	414	Aquatic And Wetland Vascular Plants	3	
BIOL	337	Human Physiology	3	Pre-req.-BIOL 231
ENVI	404	Environmental Microbiology	2	
ENVI	408	Environmental Impact Assessment	2	

Description of Departmental Elective Courses

ENVI 309 BIOREMEDIATION (1Cr.:1Lec):
Factors affecting the biodegradation of organic chemicals in the environment. Procedures for both physical and biological remediation. Selection of selected case histories of existing sites.

ENVI 312 COASTAL AND MARINE ECOSYSTEM (2Crs.:1Lec,3Lab):
Introduction to coastal environments & marine ecosystems and their resources. Tools for monitoring , management and development of coastal & marine ecosystems pollution sources & its impact. Conservation and protection of marine natural communities, Lebanon coastal environments and its management and development programs.

BIOL 336 PLANT PHYSIOLOGY (3Crs.:3Lec):
An introduction to basic principles of plant function, primarily covering selected physical processes in plants. Topics include: cell physiology, water relations, solute transport, mineral nutrition, photosynthesis, respiration, plant metabolism, plant growth and development and plant response to environmental stress. Pre-req.: BIOL 232.

BIOL 336L PLANT PHYSIOLOGY LABORATORY (1Cr.:2Lab):
Introduction to experimental techniques used to study plant physiology. Co-req.: BIOL 336.

ENVI 406 ENVIRONMENTAL POLICY ECONOMICS AND LAWS (2Crs.:2Lec):
An introduction to the history, organization, goals and ideals of environmental protection. Legal aspects of environmental regulations. Historical perspectives and current regulations for air, land and water quality. Political implications of shifts in emphasis from nature protection to pollution control to sustainability. Economic and law approaches are combined studies in environmental policy making.

ENVI 407 METABOLIC BIOTRANSFORMATIONS OF ENVIRONMENTAL CHEMICALS (3Crs.:2Lec,3Lab):
Biochemical processes controlling transport and metabolism of hazardous chemicals. Toxicokinetics (absorption, distribution, metabolic conversation & elimination) Molecular basis of toxic action, target organ toxicity, mutagenesis & carcinogenesis selected chemical agents that adversely affect human health.

ENVI 411 CONSERVATION BIOLOGY AND BIODIVERSITY (3Crs.:2Lec,2Lab):
Application of ecological and evolutionary theory to the management of rare and threatened species, communities, and ecosystems.

ENVI 412 GENETIC ENGINEERING & APPLICATIONS (3Crs.:3Lec):
Nucleic acid structure (DNA and RNA), DNA is the Genetic Material, DNA replication, transcription, translation, post translation modification, isolation and purification of nucleic acids (DNA and RNA), isolation of genes (genomic library construction and screening, DNA library construction and screening, PCR library construction and screening), identification of the cloned genes (southern blotting, northern blotting, Western blotting, South-western blotting-screening method), recent techniques in molecular biology (DNA-microarray, proteomics, metallomics, cellomics)

ENVI 413 MEDICAL MICROBIOLOGY (3Crs.:2Lec,2Lab):
Transmission, symptoms, diagnosis, pathogenesis and treatment of viral, bacterial and fungal diseases.

ENVI 404 ENVIRONMENTAL MICROBIOLOGY (2Crs.:1Lec,3Lab) :
The course covers the following: introduction to microbiology, metabolic diversity, terrestrial environments, aerosol environments, aquatic environments, microbial interactions and transport, biogeochemical cycling, microbes and pollutants, microbes and agriculture, indicator organisms, waste and water treatment.

ENVI 414 AQUATIC AND WETLAND VASCULAR PLANTS (3Crs.:3Lec):
Identification, ecology, and adaptations of vascular aquatic and wetland plants.

BIOL 337 HUMAN PHYSIOLOGY (3Crs.:3 Lec):
The course focuses on the major physiological systems of the human body (e.g., circulatory, respiratory, gastrointestinal, urogenital and the nervous system) with emphasis on understanding human diseases. Pre-req.: BIOL 231

ENVI 408 ENVIRONMENTAL IMPACT ASSESSMENT (2Crs.:1Lec,3Lab):
Definition and objectives of environmental impact assessment (EIA), activities involved in EIA, major components and subcomponents, characteristics of impacts, EIA methods, checklists, overlay mapping, networks, matrices, estimates of resources demand for EIA studies, recommended methodologies for rapid EIA case studies, guidelines for EIA in developing countries.

Study Plan

B.Sc. Degree in Environmental Science (97 Credits)

First Semester (16 Credits)			Crs.	Pre-/co-requisites
BIOL	231	Biology I	3	
BIOL	231L	Biology I Laboratory	1	Co-req.: BIOL 231
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-req.: CHEM 241
PHYS	231	Physics for Life Sciences	3	
PHYS	231L	Physics for Life Sciences Laboratory	1	Co-req.: PHYS 231
		University Requirements	4	

Second Semester (17 Credits)			Crs.	Pre-/co-requisites
MATH	242	Probability and Statistics	3	
CHEM	234	Organic Chemistry	3	
CHEM	234L	Organic Chemistry Laboratory	1	Co-Req: CHEM 234
BIOL	232	Biology II	3	Pre-Req: BIOL 231
BIOL	232L	Biology II Laboratory	1	Co-Req: BIOL 232
ENVI	201	Introduction to Environmental Studies	2	
		University Requirements	4	

Third Semester (17 Credits)			Crs.	Pre-/co-requisites
BCHM	331	Biochemistry	3	Pre-Req: CHEM 234
BCHM	331L	Biochemistry Laboratory	1	Co-Req: BCHM 331
BIOL	333	Microbiology	3	Pre-Req: BIOL 231
BIOL	333L	Microbiology Laboratory	1	Co-Req: BIOL 333
ENVI	301	Planet Earth	2	
ENVI	303	Ecosystems & Biosphere	2	
		University Requirements	5	

Fourth Semester (16 Credits)			Crs.	Pre-/co-requisites
ENVI	302	Environmental Pollution	3	
ENVI	322	Fundamentals of Ecology	2	
ENVI	308	Energy Resources	2	
		University Requirements	4	
		Departmental Elective	3	
		Free Elective	2	

Fifth Semester (17 Credits)			Crs.	Pre-/co-requisites
ENVI	417	Climate Change: Past and Future	2	
ENVI	405	GIS and Arc/Info	2	
ENVI	409	Environmental Toxicology	2	
ENVI	403	Waste recycling	2	
		University Requirements	4	
		Departmental Elective	3	
		Free Elective	2	

Sixth Semester (14 Credits)			Crs.	Pre-/co-requisites
ENVI	418	Environmental Risk Assessment	3	
ENVI	420	Natural Disasters	2	
ENVI	422	Introduction To Marine Science	2	
ENVI	444	Senior Project	2	
		Departmental Elective	3	
		Free Elective	2	