Undergraduate Catalogue 2017

Faculty of

SCIENCE

Faculty Administration

Dean	Prof. Ramadan Awad
Assistant Dean	Prof. Ghassan Younes
Director, Tripoli Branch	Prof. Sherif El-Gayar
Executive Administrator	Ms. Najwa Hajjar

History

The Faculty of Science offers unique opportunities for innovative research & education. Founded in 1976 with the department of Physics, the faculty underwent a rapid expansion to include the Departments of Mathematics & Computer Science, Chemistry, Biological & Environmental sciences. The postgraduate program was initiated in 1999. In line with its growth policy, & 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, & a new branch was established in 2011 in the northern Lebanon, Tripoli.

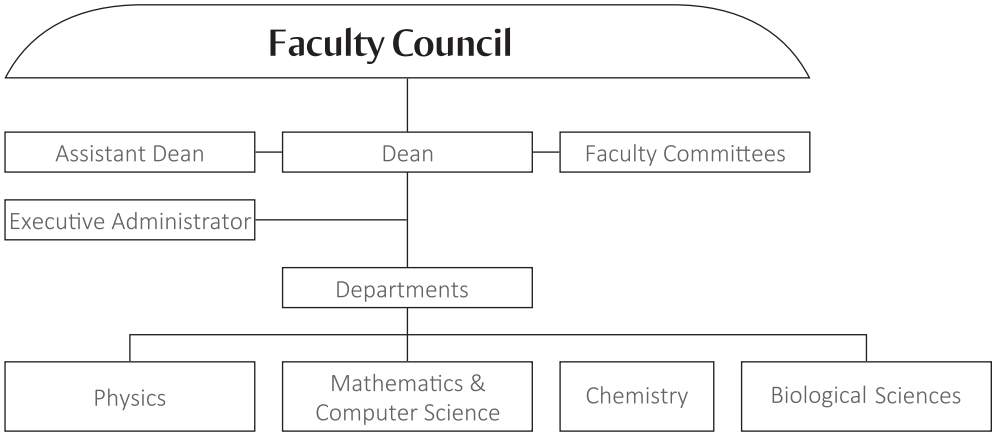
The Faculty in Debbieh now has 37 academic staff (full & part timers). The alumni body includes over 3700 BSc. graduates as well as 300 MSc. & PhD alumni.

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

Organizational Structure

The following four departments constitutes the Faculty of Science: Mathematics & Computer Science, Physics, Chemistry, Biological Sciences. The Mathematics & Computer Science Department offers two programs: Mathematics & Computer Science. The Biological Sciences Department offers three programs: Biology, Biochemistry & 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 & scientific research.

Mission

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

Admission Requirements

To be enrolled 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 & 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 & 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 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 & Computer Science

Academic Staff

Chairperson	Prof. Mohammad N. Abdulrahim
Professors	Prof. Ali El-Zaart
Associate Professors	Dr. Imad Al Ashmawy, Dr. Toufic El Arwadi
Assistant Professors	Dr. Islam Elkabani, Dr. Ahmed Sherif, 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
Part-time Lecturers	Dr. Hassan Tarraf, Dr. Ahmad Kheir, Dr. Joseph Farah Dr. Abdulrahman El Falou, Dr. Nazek Al-Khoja, Dr. Haydi Shreiteh

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, & make positive contributions to society. This will lead to achieve the national development goals through fostering an academic environment ideal for knowledge development, research, & 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 & mathematics to design innovative computer-related solutions for real world problems.
- Have demonstrated effective teamwork, oral & written communication skills as well as collaborative skills & have contributed to society by behaving ethically & responsibly.
- Be successfully employed or accepted into a graduate program, & demonstrate professional development & 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 & mathematics appropriate to the discipline.
- An ability to analyze a problem, & identify & define the computing requirements appropriate to its solution.
- An ability to design, implement & 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 & social issues & responsibilities.
- An ability to communicate effectively with a range of audiences.
- An ability to analyze the local & global impact of computing on individuals, organizations & society.
- Recognition of the need for & an ability to engage in continuing professional development.
- An ability to use the current techniques, skills & tools necessary for computing practice.

- An ability to apply mathematical foundations, algorithmic principles, & computer science theory in the modeling & design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
- An ability to apply design & 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

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 & 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
I. University 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 & 3 credits from other lists of the university elective courses + ICDL.

Faculty & Major Core Courses

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

Description of Faculty Core Courses

CHEM 241 PRINCIPLES OF CHEMISTRY (3Crs.:3Lec)

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

CHEM 241L PRINCIPLES OF CHEMISTRY LABORATORY (1Cr.:3 Lab)

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.:3 Lab)

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 & spherical coordinates, indefinite & definite integrals, methods of integration, multiple integrals, sequences & series, power series, vector field integration.

CMPS 241 INTRODUCTION TO PROGRAMMING (3Crs.: 2Lec.,2Lab)

Introduction to computer hardware & software. Binary system & data representation. The software life-cycle. Flow charts & IPO-charts. Introduction to computer programming & problem solving. Structured high level language programming with an emphasis on procedural abstraction & good programming style. The basic looping & selection constructs arrays, functions, parameter passing & scope of variables.

MATH 242 PROBABILITY & STATISTICS (3Crs.:2Lec.,2 Lab)

Basic concepts in statistics (mean, variance & frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete & continuous distributions, central limit theorem, regression & correlation, confidence intervals.

Description of Major Core Courses

CMPS 242 OBJECT ORIENTED PROGRAMMING (3Crs.:2Lec,3Lab)
Object oriented concepts & techniques for analysis, design, & implementation. Topics include methods & parameters passing, recursive methods, objects & 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.:2 Lec,3Lab)
An introduction to digital electronics, integrated circuits, numbering systems, Boolean algebra, gates, flip-flops, multiplexers, sequential circuits, combinational circuits, & computer architecture. Introduction to hardware description language & programmable logic devices.

CMPS 246 WEB PROGRAMMING (3Crs.:2 Lec,3Lab)
The course covers different techniques & 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 & AJAX for enriching web services, & page layout with HTML & 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 & conceptual reasoning, matrices, determinants, system of linear equations, vector spaces, linear transformations & their matrix representation, linear independence, bases & dimension, rank-nullity, brief discussion on inner product, projections, orthonormal bases, eigenvalues, eigenvectors, diagonalization.

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

CMPS 343 COMPUTER ORGANIZATION & ARCHITECTURE (3Crs.:2Lec,3Lab)
This course introduces the principles of computer organization & 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, & documentation. Topics include: introduction to software engineering, ethics in software engineering, development processes, requirements developments, object oriented analysis & design using UML, architectural design, testing, & 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 & topics from Number Theory including computer arithmetic with large integers & 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 & 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 & topics related to time complexity, P, NP & NP-Completeness. Pre-req.: CMPS 248.

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

MATH 348 NUMERICAL METHODS (3Crs.:2Lec.,2 Lab)
Solutions of nonlinear equations in one variable: Bisection, Newton, Fixed point & Secant methods, interpolation & approximation: Lagrange Polynomial, divided differences, Hermite interpolating polynomial, numerical differentiation & 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.:2 Lec,3Lab)
A systematic study of algorithms & their complexity. Topics include techniques for designing efficient computer algorithms, proving their correctness, analyzing their run-time complexity; as well as Divide & Conquer algorithms, Greedy algorithms, Dynamic Programming algorithms, Sorting & Searching algorithms (Binary search, Radix sort, Bucket sort, Count Sort, Insertion sort, Merge sort, Quick sort & Heap sort), Order statistics, Graph algorithms (Graph traversal, Minimum spanning trees & Shortest path problems). Prerequisites: CMPS 347 & CMPS 345

CMPS 442 OPERATING SYSTEMS (3Crs.:2 Lec,3Lab)

Operating systems concepts & functions. Operating systems structures & system Calls. Processes & threads scheduling. Inter-process communication. CPU scheduling algorithms. Process synchronization. Deadlocks. Main memory management. Virtual memory management. File management. I/O subsystem & device management. Selected topics in networking, protection & 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 & system requirements, make feasibility study, define design & time table schedule. In this course, students must deliver a preliminary report & 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 & final senior project report, which passes through the requirements, analysis, design, implementation, testing, & 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 & evaluate important concepts found in current programming languages. Its goals are to build an ability to evaluate & compare programming languages, both from the user's & implementor's view. Topics include: syntax, operational semantics, scope of objects & 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 & object-oriented programming languages. This course includes a team project to learn a novel programming language & 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 & skills necessary for designing & implementing computer networks, protocols, & network applications. Various network design techniques, simulation techniques, & UNIX network programming are covered. Pre-req.: CMPS 347

Departmental Elective Courses

Course			Credits	Prerequisite
CMPS	325	Computer & 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 & 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 & 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 & SOCIETY (3Crs.:2Lec,3Lab)
Technology & Humanity, Social & Political impacts of computers. Privacy & Information: wiretapping & encryption, internet security, communication in cyberspace, censorship. Protecting software & 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.:2 Lec,3Lab)
The goal of the course is to introduce the student to theoretical foundations &

modern applications in Digital Image Processing. Topics include image digitization & representation, image enhancement in spatial & frequency domain, image segmentation, edge detection, features extraction & 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 & tree structured files (B-Trees), Hashed files. Pre-req.: CMPS 347.

CMPS 450 COMPUTER GRAPHICS (3Crs.:2 Lec,3Lab)
Raster & vector graphics system. Video display devices. Physical & 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 & frame buffer, color channels (a channel for opacity).Color models (RGB, HVS, CYM).Light source properties; material properties; ambient, diffuse, & specular reflections. Phong reflection model. Rendering of a polygonal surface, flat shading, Gouraud shading, & Phong shading. Texture mapping, bump texture, environment map. Ray tracing. Image synthesis, sampling techniques, & anti-aliasing. Parametric polynomial curves & surfaces. Implicit curves & surfaces. Bézier curves & surfaces, control points, de Casteljau algorithm. B-spline curves & surfaces, local editing, knots, control points. NURBS curves & surfaces. Constructive Solid Geometry (CSG) for solid modeling. Boundary Representation of solids (B-Rep). Pre-req.: CMPS 347.

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

CMPS 452 INTRODUCTION TO DATA MINING (3Crs.:2Lec,3Lab)
This course introduces & studies the concepts, issues, tasks & techniques of data mining. Topics include data preparation & feature selection, decision tables, decision trees, classification rules, association rules, clustering, statistical modeling, & 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 & heuristic repair).Representation of space & time. Predicate calculus & resolution. Logic programming & theorem proving. Design & development of knowledge-based systems. Knowledge representation mechanisms. Tools for knowledge-based system development. Pre-req.: CMPS 347 & CMPS 345.

CMPS 454 LOGIC & 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 & 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 & applied methods of computer security, especially as they relate to confidentiality, integrity, & availability of information assets. Topics include system security analysis, access control & various security models, identification & authentication, protection against external & internal threats, communication protocols & 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 (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 & Analytical Geometry	3	* Pre: MATH 111, MATH 112
CMPS	241	Introduction to Programming	3	
ARAB	001	Arabic Language	2	

Second Semester (18 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 & Statistics	3	
ENGL	001	English Language	2	
BLAW	001	Human Rights	1	

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 Elective	2	
		Elective (Departmental)	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 Elective	2	
		Departmental Elective	3	

Fifth Semester (17 Credits)			Crs.	Pre-co/requisites
CMPS	441		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 Elective	3	
		Elective (General Science)	4	
		Total	17	

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 Elective	4	
		Elective (General Science)	4	
		Departmental Elective	3	

* The courses MATH 111 (Introduction to Calculus & Analytical Geometry) & MATH 112 (Introduction to Algebra) are considered as intensive courses for socio-Economics baccalaureate holders.

- 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 & 3 credits from other lists of the university elective courses.

- The list of University Requirement courses & 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 & social science majors with the necessary mathematical tools for work in their disciplines, & introduces all students to serious & interesting mathematical ideas & their applications.

Objectives

The program strives to enable students to:

- Build a foundation of basic knowledge of mathematics.
- Improve analytical & problem-solving skills.
- Develop research skills & 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 & understanding of:

1- The basic theorems & concepts in the different areas of mathematics.
2- The implementation of theories in problem solving.
3- The different areas of research in mathematics.

b- Intellectual abilities:

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

c- Professional & Practical competencies:

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

d- General & Transferable Skills:

1- Functioning in multi-disciplinary teams.
2- Communicate ideas effectively in graphical, oral, & written media.
3- Recognize & respond to the need for lifelong & 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**

* A total of 21 credits is required as General University Requirements: 5 credits are selected from the University Mandatory courses list, 6 credits from social sciences list, 6 credits from humanities list & 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 & Major Core Courses

Course			**Credits**	**Prerequisite**
MATH	241	Calculus & Analytical Geometry	3	
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-requisite: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-requisite: PHYS 241
CMPS	241	Introduction to Programming	3	

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

Description of Faculty Core Courses

CHEM 241 PRINCIPLES OF CHEMISTRY (3Crs.:3Lec)

A study of the fundamental concepts of chemistry including matter & measurement, atoms, molecules, ions, moles, nomenclature, atomic & molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, & solid states of matter. Properties of solutions, aqueous reactions & solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases & ionic equilibria, electrochemistry, nuclear chemistry & 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 & spherical coordinates, indefinite & definite integrals, methods of integration, multiple integrals, sequences & series, power series, vector field integration.

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

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

Description of Major Core Courses

MATH 244 ORDINARY DIFFERENTIAL EQUATIONS (3Crs.:3Lec)
First order ordinary differential equations & 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 & series, continuity & 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 & conceptual reasoning, matrices, determinants, system of linear equations, vector spaces, linear transformations & their matrix representation, linear independence, bases & 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 & implicit function theorem, directional derivative, divergence, curl, differential forms, linear integrals, Stoke's theorem & Green's Theorem with applications, orthogonal curvilinear coordinate systems, cylindrical, spherical & elliptic coordinate systems. Pre-req.: MATH 241.

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

MATH 344 REAL ANALYSIS II (3Crs.:3Lec)
Riemann integral, convergence of sequences & 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.,2 Lab)
Logical reasoning & proof, sets, relations & functions, matrices, Boolean Algebra, mathematical induction, counting & simple finite probability theory, analysis of algorithms, truth table, graphs & trees, Euler's path & Euler's cycle.

MATH 346 ABSTRACT ALGEBRA I (3Crs.:3Lec)
Binary operations, groups, subgroups, normal subgroups, cyclic groups & 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.,2 Lab)
Solutions of nonlinear equations in one variable: Bisection, Newton, Fixed point & Secant methods, interpolation & approximation: Lagrange Polynomial, divided differences, Hermite interpolating polynomial, numerical differentiation & 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 & contour integration. Pre-req.: MATH 241.

MATH 442 ABSTRACT ALGEBRA II (3Crs.:3Lec)
Rings, integral domains, fields, ideals, quotient rings, prime & 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 & closure, continuous functions, separation axioms, compactness, connectedness, metrizable spaces & 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 & submit a written project at the end of the semester.

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

Departmental Elective Courses

Course			Credits	Prerequisite
MATH	351	Differential Geometry	3	Pre-requisite: MATH 241
MATH	352	Number Theory	3	
MATH	353	Set Theory	3	
MATH	354	Introduction to Dynamics	3	Pre-requisite: MATH 241
MATH	355	Calculus of Variations	3	Pre-requisite: MATH 244
MATH	451	Differential Calculus	3	Pre-requisite: MATH 246
MATH	452	Partial Differential Equations	3	Pre-requisite: MATH 244
MATH	454	Mathematical Computation	3	Pre-requisite: MATH 348
MATH	455	Topics in Linear Algebra	3	Pre-requisite: 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 & normal plane, osculating plane, principal normal, curvature, binomial, moving trihedron of a curve, torsion, formulas of Frenet, evolutes & involutes, cylindrical helices, curvature & torsion of involutes & evolutes, surfaces : curves on surfaces, tangent & normal planes, family of surfaces, envelope, edge of regression, Gaussian & mean curvatures, lines & 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 & predicate calculus, operations on sets & families of sets, ordered sets, countable & uncountable sets, transfinite induction, axiom of choice & equivalent forms, ordinal & 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 & conical pendulum, motion projectiles, impulse, momentum & impact of elastic bodies, center of mass of rigid bodies, motion of a particle in two dimensions using polar coordinates & 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 & extrema, generalized inverse & implicit function theorems. Pre-req.: MATH 246.

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

MATH 454 MATHEMATICAL COMPUTATION (3Crs.:2Lec.,2 Lab)
Modeling linear programming & 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 & spectral theory in finite dimensional spaces, primary decomposition, triangularizations, direct sums, canonical forms, orthogonal & 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 (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 & Analytical Geometry	3	* Pre: MATH 111 & MATH 112
CMPS	241	Introduction to Programming	3	
ARAB	001	Arabic Language	2	

Second Semester (17 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 & Statistics	3	
ENGL	001	English Language	2	
BLAW	001	Human Rights	1	
		University Elective	5	

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 Elective	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 Elective	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 & Applications	3	Pre-Req: MATH 246
MATH	444	Senior Project	2	
		Departmental Elective	6	

* The courses MATH 111 (Introduction to Calculus & Analytical Geometry) & MATH 112 (Introduction to Algebra) are considered as intensive courses for socio-Economics baccalaureate holders.

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

- The list of University Requirement courses & their descriptions are presented in the introductory pages of this catalogue.

DEPARTMENT OF PHYSICS

Academic Staff

Chairperson	Prof. Ramadan Awad
Professors	Dr. Mahmoud El Korek
Associate Professors	Dr. Salem Marhaba
Assistant Professors	Dr. Walid Malaeb
Part-time Lecturers	Dr. Sally Shawa, Dr. Ali Kaafarani, Dr. Omar Deeb, Dr. Diana El Hajjar Dr. Ola Kerhani, Dr. Houssam El Sheikh, Mr. Adnan Tayyara Dr. Ali Al Zein, Dr. Samir Tohme, Dr. Maher Sweidan

Mission

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

Objectives

The program strives to enable students to:

- Establish a broad solid knowledge of both theoretical & experimental physics & mathematics, which enable them to analyze & understand real-world natural phenomena, & utilize this knowledge in practical fields related to physics.
- Demonstrate effective teamwork, oral & written communication skills as well as collaborative skills & effectively contribute to society with an ethical & responsible behavior.
- Succeed in getting employed or accepted in a graduate program, & demonstrate professional development & life-long learning throughout their careers.

Learning Outcomes

- Acquire a deep understanding of basic concepts in physical sciences & mathematics.
- Understand how to apply physics concepts to interpret both natural & artificial phenomena.
- Develop strong skills in experimental methods: collect, analyse, & explain data from physics experiments.
- Learn how to design & carry out basic physics experiments.
- Become familiar with advanced concepts & techniques related to contemporary physics (principles of physics, radiation science, solid state physics, molecular physics, quantum mechanics, etc…)
- Develop skills in identifying & solving critical problems in both applied & theoretical physics.
- Learn various computational & quantitative analysis techniques.
- Gain a broader education to physics & understand the impact of solutions in a global & societal context.
- Understand & implement professional & ethical responsibilities.
- Participate effectively in multi-disciplinary teams.
- Communicate ideas effectively in visual, oral, & written media.
- Develop key skills like personal organization & respond to the needs of life-long & 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

Physics graduates will be qualified to work in:

- Educational or research institutions like becoming a school teacher, university instructor, or research assistant.
- Governmental laboratories & industrial areas such as becoming a physics laboratory technician, laboratory materials technician, astronomer, or nanoscience technician.

Program Overview

The physics 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	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 & 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 & Major Core Courses

Course			Credits	Prerequisite
MATH	241	Calculus & Analytical Geometry	3	
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-requisite: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-requisite: PHYS 241
CMPS	241	Introduction to Programming	3	
MATH	242	Probability & Statistics	3	
PHYS	242	Thermal Physics	2	
PHYS	242L	Thermal Physics Laboratory	1	Co-requisite: PHYS 242
PHYS	244	Physical Optics	2	
PHYS	244L	Physical Optics laboratory	1	Co-requisite: PHYS 244
MATH	244	Ordinary Differential Equations	3	Pre-requisite: MATH 241
PHYS	341	Classical Mechanics & Waves	3	
PHYS	341L	Classical Mechanics & Waves Laboratory	1	Co-requisite: PHYS 341
PHYS	342	Quantum Mechanics I	3	Pre-requisite: PHYS 341
PHYS	343	Electromagnetism	3	Pre-requisite: PHYS 241
PHYS	343L	Electromagnetism Laboratory	1	Co-requisite: PHYS 343
PHYS	344	Relativity	3	Pre-requisite: PHYS 341
PHYS	345	Mathematical Methods for Physics	3	Pre-requisite: MATH 241
PHYS	441	Electrodynamics	3	Pre-requisite: PHYS 343
PHYS	442	Solid State Physics	3	Pre-requisite: PHYS 342
PHYS	442L	Solid State Physics Laboratory	1	Co-requisite: PHYS 442
PHYS	443	Quantum Mechanics II	3	Pre-requisite: PHYS 342
PHYS	444	Senior Project	2	
PHYS	446	Statistical Physics	3	Pre-requisite: PHYS 242
PHYS	448	Computational Physics	3	Pre-requisite: 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 & measurement, atoms, molecules, ions, moles, nomenclature, atomic & molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, & solid states of matter. Properties of solutions, aqueous reactions & solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases & ionic equilibria, electrochemistry, nuclear chemistry & 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 & spherical coordinates, indefinite & definite integrals, methods of integration, multiple integrals, sequences & series, power series, vector field integration.

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

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

Description of Major Core Courses

PHYS 242 THERMAL PHYSICS (2Crs.:2 Lec)

Thermodynamic systems, isolated, closed & opened systems. Thermodynamic equilibrium, zeroth law, Temperature & Temperature scales, Pressure & Thermometry. Ideas gases. Inversion theorem & pseudo-chain rule, applications of isothermal compressibility & volume expansion coefficients. First Law, Calorimetric definition of heat, work in thermodynamic systems, Internal energy. Reversible & Irreversible processes. Work in different processes, cycles, PV systems (P-V diagrams) & magnetic systems. Heat Capacities. Adiabatic Transformations of ideal gas. Second Law, Kelvin & Clausius statements, & their equivalence. Carnot Cycle efficiency, engines, Refrigerators, Carnot Theorem & Thermodynamic Temperature scale. Clausius-Clapeyron Equation, Drinking bird & 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 & Maxwell's relations. First & second Tds equations. Joule-Thompson Effect & 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 & wave theories of light-The velocity of light determination using different techniques-The properties & theory of waves-Young's double slit experiment-Fresnel's biprism, Fresnel's double mirror & Lloyd's single mirror-The colours of thin films & thin films theory, Newton's rings, Michelson Interferometer-Fresnel's diffraction, Fresnel's zones & his zone plate-Diffraction at a circular aperture, circular disk & straight edges-Fraunhofer case of diffraction, single slit & diffraction grating-Resolving powers of different devices-Double refraction, ordinary & 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 & 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 & WAVES (3Crs.:3 Lec)

Vectors: coordinate systems, derivatives of vectors. Kinematics: velocity & acceleration, angular velocity, relative motion. Newton's laws, consequences. Conservative forces, solution methods. Harmonic oscillator, damped & forced oscillations. Resonance. Internal forces & torques, Center of Mass CM coordinates, two-body problem, collisions. Rigid body mechanics, equation of motion, moment of inertia. Kepler's laws, gravitational fields & forces, inverse square law orbits & energies, stability & symmetry. Constraints, generalized coordinates, Lagrangian, generalized momenta. Lagrange &

Hamilton's equations, examples. Strings, equations of motion, normal frequencies & modes. Wave Equation.

PHYS 341L CLASSICAL MECHANICS & 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 & probability interpretations, eigen functions & eigenvalues, one dimensional potentials & 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 & curl of electrostatic fields. Electric potential. Work & 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 & curl of the magnetic field. Magnetic vector potential. Magnetic fields in matter. Electromotive force, electromagnetic induction & 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 & Morley Experiment-Lorentz Transformations,Time dilation, Simultaneity, Length Contraction-Composition of velocities, Fizeu's expriment-Interval Invariance, Causality & Twin Paradox, Transformation of mometum factor α, Relativistic momentum-Relativistic energy, Kinetic energy & mass energy relation-Motion of a charge in uniform Electric Field-Motion of a charge in uniform magnetic Field-The conservation of momentum & energy in Relativity-Particles decays, Tarasformations of momentum & energy-Doppler Effect & Aberration, Forces Transformations-Electromagnetic Fields Transformations-Fields of a moving charge & 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 & 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 & 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 & Transmission – Polarization – 3 D Wave Equation for E & B – Monochromatic Plane Waves – Energy & Momentum in Electromagnetic Waves – Electromagnetic Waves in Matter – Propagation in Linear Media – Reflection & Transmission at Normal & Oblique Incidences – Absorption & 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 & Lorentz Gauge – Retarded Potentials – The Fields of a Moving Charge – Dipole Radiation – Power Radiated by a Point Charge – 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 & 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 & approved by the department board.

PHYS 446 STATISTICAL PHYSICS (3Crs.:3Lec)
Some counting problems. Stirling's approximation & Lagrange multipliers. Themacrostate. The averaging postulate. Statistical entropy & microstates. Distinguishable particles. A statistical definition of temperature. The Boltzmann distribution & the partition function. Calculation of thermodynamic functions. A Spin-1/2 solid. Localized harmonic oscillators. The density of states. Fermions & bosons. Counting microstates for gases & the three distributions. Maxwell–Boltzmann gases. Diatomic gases. Fermi–Dirac gases. Bose–Einstein gases. Entropy & 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 & fields, waves & random systems, statistical mechanics & quantum mechanics. Pre-req.: CMPS 241.

Departmental Elective Courses

Course			Credits	Prerequisite
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	Elementary 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 & breathing, diffusion & contanct lenses. Thermodynamics of living systems, energy from food, regulation of body temperature, evaporation, resistance to cold, heat & soil. Sound: hearing & 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 & 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 & 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 & instrumentation-Solar system – plants, minor objects, sun-Stars Astrometry & the HR diagram - Binary stars & clusters-Variable Stars - Nebulae; Novae; Supernovae-Stellar Evolution – galaxies & 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 & parallel circuits. Dc series-parallel networks. Methods of analysis (dc). Network theorems (dc). Inductors capacitors, ac signal & phasors. Series & parallel ac circuits. Series-parallel ac networks. Methods of analysis (ac). Network theorems (ac). Power & 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 & Spectrum of Alkali atoms, Gyromagnetic ratio determination, Stern & Gerlach experiments, Spin-orbit splitting & Fine structure, Level scheme of the Alkali atoms, Many electron atoms, LS & jj couplings, X-ray & 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 & 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 & shape of nuclei, binding energy, liquid drop model, nuclear stability, beta decays, spontaneous fission, alpha decay, nuclear collisions, induced fission & fission reactors, shell model, magic numbers.

PHYS 454 MOLECULAR PHYSICS (3Crs.:3Lec)

Molecular structure: Molecular orbital, theory of diatomic & polyatomic molecules. Molecular rotation & vibration: spectroscopic transitions, the rotation & vibration of diatomic & 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	* Pre: PHYS 120
PHYS	241L	Principles of Physics Laboratory	1	Co-Req: PHYS 241
MATH	241	Calculus & Analytical Geometry	3	* Pre: MATH 111
CMPS	241	Introduction to Programming	3	
ARAB	001	Arabic Language	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 & Statistics	3	
ENGL	001	English Language	2	
BLAW	001	Human Rights	1	
		University Requirements	2	

Third Semester (16 Credits)			Crs.	Pre-co/requisites
PHYS	341	Classical Mechanics & Waves	3	
PHYS	341L	Classical Mechanics & 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 Requirements	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 Requirements	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 Requirements	5	
		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	Prof. Ashraf Abdel-Gaber
Professors	Dr. Ghassan Younes, Dr. Sherif El-Gayar
Associate Professors	Dr. Mohammad El-Dakdouki
Assistant Professors	Dr. Rami Oweini
Part-time Lecturer	Dr. Hiba Abdullah, Dr. Farah Zaytouni, Dr. Nada Youssef Dr. Khadija Hijazi, Dr. Mohamad El-Eter, Dr. Zalfa Nour Dr. Berna Hamad, Miss Hanan Rahal

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 & faculties. It prepares chemistry professionals to meet the challenges encountered in their chosen careers, & supports research activities. The Chemistry Department also provides distinguished services to the community.

Objectives

The educational objectives of the Chemistry program at Beirut Arab University are to prepare graduates who, after few years of graduation, will have:

- Mastered the fundamentals of chemistry to design innovative & effective solutions to address real world problems.
- Establish themselves as successful, ethical, & responsible professionals & leaders in their chosen career path with commitment to continuous professional development through life-long learning.
- Demonstrated effective teamwork, the ability to communicate ideas & findings both orally & in writing, as well as contributed to the development & advancement of their communities by participating in community activities.

Learning Outcomes

Upon the successful completion of this program, chemistry graduates will be able to:

- Demonstrate knowledge of chemistry, physics, & mathematics necessary for the discipline.
- Demonstrate a broad knowledge of all the sub-disciplines of chemistry, including analytical, physical, organic, & inorganic chemistry.
- Solve chemical problems qualitatively & quantitatively.
- Demonstrate an ability to design procedures to systematically assess target needs.
- Observe safe practices in the laboratory.
- Competently conduct experiments, operate modern & classic instrumentation, analyse & assess data through rational thinking & critical interpretation.
- Communicate effectively, both orally & in writing, with a diverse range of audiences.
- Demonstrate familiarity with cutting-edge technology.
- Work independently, collaborate effectively, & manage time efficiently.

- Utilize the acquired knowledge to address science-related societal & environmental issues.
- Demonstrate the level of content mastery necessary to succeed in the workplace.
- Demonstrate an ability to pursue self-education to address novel issues.

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:

- Work in educational or research institutions:

School Teacher, University Instructor, Lab Assistant, Research Assistant.

- Work in many governmental laboratories & industrial areas:

Petroleum, Petrochemicals, Corrosion control, Electroplating & Paints, Materials Development, Food Analysis, Water Analysis & treatment, Pharmaceutical, Cosmetic, Quality Control, Forensic Science, & many others…

Program Overview

The Chemistry curriculum consists of the following components:

Chemistry 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**

* 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 & 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 & Major Core Courses

Course			Credits	Prerequisite
MATH	241	Calculus & Analytical Geometry	3	
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-requisite: CHEM 241
PHYS	241	Principles of Physics	3	
PHYS	241L	Principles of Physics Laboratory	1	Co-requisite: PHYS 241
CMPS	241	Introduction to Programming	3	
MATH	242	Probability & Statistics	3	
CHEM	242	Analytical Chemistry	3	Pre-requisite: CHEM 241
CHEM	242L	Analytical Chemistry Laboratory	1	Co-requisite: CHEM 242
CHEM	244	Organic Chemistry I	3	
CHEM	246	Physical Chemistry I	3	Pre-requisite: CHEM 241
CHEM	341	Organic Chemistry II	3	Pre-requisite: CHEM 244
CHEM	341L	Organic Chemistry Laboratory	1	Co-requisite: CHEM 341
CHEM	342	Instrumental Analysis	3	Pre-requisite: CHEM 242
CHEM	342L	Instrumental Analysis Laboratory	1	Co-requisite: CHEM 342
CHEM	345	Inorganic Chemistry I	3	Pre-requisite: CHEM 241
CHEM	346	Bioorganic Chemistry	3	Pre-requisite: CHEM 341
CHEM	348	Inorganic Chemistry II	3	Pre-requisite: CHEM 345
CHEM	348L	Inorganic Chemistry Laboratory	1	Co-requisite: CHEM 348
CHEM	349	Physical Chemistry II	3	Pre-requisite: CHEM 246
CHEM	349L	Physical Chemistry Laboratory	1	Co-requisite: CHEM 349
CHEM	441	Electrochemistry & Applications	2	
CHEM	441L	Electrochemistry & Applications Laboratory	1	Co-requisite: CHEM 441
CHEM	442	Spectroscopic Identification of Chemical Compounds	3	Pre-requisite: CHEM 341
CHEM	442L	Spectroscopic Identification of Chemical Compounds Laboratory	1	Co-requisite: 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 & measurement, atoms, molecules, ions, moles, nomenclature, atomic & molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, & solid states of matter. Properties of solutions, aqueous reactions & solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases & ionic equilibria, electrochemistry, nuclear chemistry & coordination chemistry.

CHEM 241L PRINCIPLES OF CHEMISTRY LABORATORY (1Cr.:3Lab)

Co-req.: CHEM 241.
Selected experiments illustrate the topics discussed in 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 & spherical coordinates, indefinite & definite integrals, methods of integration, multiple integrals, sequences & series, power series, vector field integration.

CMPS 241 INTRODUCTION TO PROGRAMMING (3Crs.:2Lec.,2Lab)

Introduction to computer hardware & software. Binary system & data representation. The software life-cycle. Flow charts & IPO-charts. Introduction to computer programming & problem solving. Structured high level language programming with an emphasis on procedural abstraction & good programming style. The basic looping & selection constructs arrays, functions, parameter passing & scope of variables.

MATH 242 PROBABILITY & STATISTICS (3Crs.:2Lec.,2 Lab)

Basic concepts in statistics (mean, variance & frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete & continuous distributions, central limit theorem, regression & 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 & their applications. The topics covered include gravimetric & volumetric methods based on solution equilibria such as acid-base, complexometric, redox & precipitation reactions, introduction to separation & spectroscopic methods of analysis. The course also introduces students to statistical data treatment, errors, precision & accuracy in chemical analysis. Pre-req.: CHEM 241.

CHEM 242L ANALYTICAL CHEMISTRY LABORATORY (1Cr.:3 Lab)
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, & reactions of alkanes, cycloalkanes, alkenes, alkynes, alcohols, ethers, alkyl halides, & stereochemistry. Addition, elimination & nucleophilic substitution reactions. Emphasis on the mechanistic, kinetic & thermodynamic aspects governing these reactions.

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

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

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

CHEM 342 INSTRUMENTAL ANALYSIS (3Crs.:3 Lec)
Theory & application of modern instrumental methods to qualitative & quantitative chemical analysis. Ultra-violet, visible absorption & fluorescence spectroscopy, flame atomic absorption, electrothermal & 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 & Lewis acid & base. Chemistry of main group elements. Basic concepts of coordination compounds: nomenclature, bonding, structure, stability, magnetic properties, stereochemistry. Crystal & ligand field theories. Pre-req.: CHEM 241.

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

CHEM 348 INORGANIC CHEMISTRY II (3Crs.:3 Lec)
Organometallic compounds of transition metals: Alkyls, hydrides, carbonyls, olefinic, allylic, butadiene, h5 & h6 complexes. Group theory. Pre-req.: CHEM 345.

CHEM 348L INORGANIC CHEMISTRY LABORATORY (1Cr.:3 Lab)
Experimental work related to the topics discussed in Inorganic Chemistry I & 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 & solutions of Schrödinger equation for several simple systems with some chemical applications. Basic principles & concepts of photochemistry; Jablonski diagram; photochemical reaction kinetics & mechanisms. Pre-req.: CHEM 246.

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

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

CHEM 441L ELECTROCHEMISTRY & 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 & identification of chemical compounds by chemical analysis methods (elemental analysis, functional groups classification, identification & derivatization reactions) & spectroscopic techniques including Fourier Transform InfraRed, Nuclear Magnetic Resonance, Ultraviolet-Visible, & 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 & conferences with the staff members. Written report & a final oral examination on that report are required.

Departmental Elective Courses

Course			Credits	Prerequisite
CHEM	355	Petrochemistry	3	
CHEM	356	Environmental Chemistry	3	
CHEM	357	Water Analysis	3	
CHEM	358	Surface & Colloid Chemistry	3	
CHEM	359	Regulatory Aspects of Industrial Chemicals	3	
CHEM	405	Solid State Chemistry	2	
CHEM	450	Introduction to Medicinal Chemistry	3	
CHEM	451	Physical Organic Chemistry	3	Pre-requisite: CHEM 341
CHEM	452	Nuclear & Radiochemistry	3	
CHEM	453	Materials Science	3	
CHEM	454	Topics in Chemistry	3	

Description of Departmental Elective Courses

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

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

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

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

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

CHEM 405 SOLID STATE CHEMISTRY FOR ENGINEER (2Cr.: 2Lec)
Bonding in solids, crystal structures, x-ray diffraction, electron models, band theory, & crystal defects. Electrical, thermal, optical & magnetic properties of solid-state materials from a chemical perspective. Fabrication techniques & modern applications.

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

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

CHEM 452 NUCLEAR & RADIOCHEMISTRY (3Crs.:3 Lec)
The course introduces students to the fundamentals aspects of nuclear & radiochemistry including nuclear stability & structure, production & decay of radioactive nuclides, nuclear reactions, interactions of radiation with matter, detection & measurement of radiation, radiation protection & applications of nuclear & 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 & point defects, mechanical, electrical, thermal & magnetic properties of metals, ceramics, electronic materials, composites & 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	*Pre-Req: CHEM 110
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 & Analytical Geometry	3	*Pre-Req: MATH 111
CMPS	241	Introduction to Programming	3	
ARAB	001	Arabic Language	2	
		University Requirements	1	

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 & Statistics	3	
ENGL	001	English Language	2	
BLAW	001	Human Rights	1	

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	3	

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 & Applications	2	
CHEM	441L	Electrochemistry & 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 SCIENCES

Academic Staff

Chairperson	Prof. Mohamed El Sayed Moustafa
Professors	Dr. Hoda Youssef
Associate Professors	Dr. Nisrine Bissar-Tadmouri
Assistant Professors	Dr. Salwa AbdulRahman, Dr. Ghada Khawaja, Dr. Jamila Borjac Dr. Tarek Houri, Dr. Bilal Osta
Part-time Lecturers	Dr. Rasha Kerek

A- Biology Program

Mission

The mission of the biology major is to provide undergraduate students with the concepts, principles & methodologies of various disciplines of biology, & 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

Few years after graduation, graduates of the biology program will:

a. have established extensive knowledge & understanding of various biological disciplines that help him/her plan innovative solutions to real world problems.
b. be successfully employed in different biology-related careers & disciplines or accepted in graduate programs.
c. have demonstrated effective, ethical & responsible team-work with oral & written communication skills.
d. have shown professional development & the capacity for life-long learning.

Learning Outcomes

a- Knowledge & Understanding:

1. Broad knowledge & understanding in various biological sciences (such as genetics, physiology, microbiology, ecology, biochemistry, molecular biology, cell biology & endocrinology).
2. Illustrate the scientific methods & techniques for laboratory & field work in different biological sciences.
3. Master aspects of the modern disciplines of biology.

b- Intellectual Abilities:

1. Demonstrate broad knowledge & understanding of various biological processes.
2. Demonstrate the ability to apply concepts & methodologies of biological science to carry out experiments, analyze the obtained data & draw reasonable conclusions or interpretations.
3. Demonstrate the ability to critically evaluate & utilize scientific literature in biological sciences.
4. Use critical thinking & principles of logic to solve problems in biology disciplines.
5. Demonstrate the ability to pursue further education as an independent life-long professional learning.
6. Demonstrate skills & expertise in biology disciplines for various career opportunities.

7. Merging knowledge of biology & related disciplines such as molecular biology & biochemistry.

c- Professional & Practical Competencies:

1. Design plans & conduct experiments to solve problems in biological sciences.
2. Operate & practice basics laboratory instrumentations efficiently.
3. Conduct excellent critical thinking & formulation of scientific hypotheses.

d- General & Transferable Skills:

1. Effective scientific communication skills, both in written & orally.
2. Work effectively either independently or in multi-disciplinary teams.

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

- Admission to biomedical sciences.
- Graduate studies in various biological sciences.
- Work in educational or research institutions in Biology & Molecular Biology.
- School Teachers for courses in Biology & Molecular Biology.
- University Teacher.
- Lab or Research Assistant in various fields such as Food Science, Pharmaceutical & Health industries, Environmental Monitoring, Quality Control, & Forensic Science

Program Overview

The Biology curriculum consists of the following components:

Biology 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 & 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 & Major Core Courses

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

Description of Faculty Core Courses

PHYS 231 PHYSICS FOR LIFE SCIENCES (3Crs.:3Lec)
Units & dimensions- Force, work, energy & power in biological systems- Elastic properties of bones & tissues- Nonviscous & viscous fluids- Heat, temperature & thermal properties of materials- electricity & magnetism- Nerve conduction- Sound wave- X-rays (production, & 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 & chemical basis of life, organization of life, energy transfer through living organisms, evolution, diversity of life with emphasis on the animal & plant kingdoms & their interaction with the environment.

BIOL 231L BIOLOGY I LABORATORY (1Cr.:3Lab)
Laboratory includes applications & experiments related to the topics discussed in Biology I course. Co-req.: BIOL 231.

CHEM 241 PRINCIPLES OF CHEMISTRY (3Cr.:3Lec)
A study of the fundamental concepts of chemistry including matter & measurement, atoms, molecules, ions, moles, nomenclature, atomic & molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, & solid states of matter. Properties of solutions, aqueous reactions & solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases & ionic equilibria, electrochemistry, nuclear chemistry & 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 & STATISTICS (3Crs.:2Lec,2 Lab)
Basic concepts in statistics (mean, variance & frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete & continuous distributions, central limit theorem, regression & correlation, confidence intervals.

Description of Major Core Courses

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

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

CHEM 234 ORGANIC CHEMISTRY (3Crs.:3 Lec)
The course provides the necessary background in organic chemistry in the context of living cells. Nomenclature of chemical compounds, chemical bonding & structure, conformations & stereochemistry, organic reactivity & catalysis, organic acids & bases. Nucleophilic substitution, phosphoryl transfer, nucleophilic carbonyl addition, acyl substitution, electrophilic, oxidation, reduction & 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 & cellular elements of the immune system, & their basic function. Topics covered include description of the immune system, antibody & T-cell receptor structure & functions, genes of the immunoglobulin superfamily, cells & molecular mediators that regulate the immune response, allergy, autoimmunity, immunodeficiency, transplantation & 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 & 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 & quantification of biomolecules. Co-req.: BCHM 331.

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

BIOL 333L MICROBIOLOGY LABORATORY (1Cr.:2 Lab)
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 & MOLECULAR BIOLOGY (3Crs.:3 Lec)
This course provides an introduction to cell biology emphasizing on cell division, cell cycle, structure & function of cellular organelles & the functional interaction of the cells with their microenvironment, an overview on DNA replication, transcription & translation, regulation of gene expression in prokaryotes & eukaryotes & protein synthesis. This course also covers molecular biology techniques including isolation & purification of nucleic acids, enzymes used in molecular biology such as restriction endonucleases & ligases, genomic library, PCR, Southern, northern & western blotting, sequencing, & cloning. Pre-req.: BIOL 231.

BIOL 334L CELL & MOLECULAR BIOLOGY LABORATORY (1Cr.:2 Lab)
This laboratory introduces students to the tools of cell biology & 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 & development & plant response to environmental stress. Pre-req.: BIOL 232.

BIOL 336L PLANT PHYSIOLOGY LABORATORY (1Cr.:2 Lab)
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 & 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 & modern genetics. Topics include Mendelian inheritance & deviations from classical Mendelian ratios, pedigree analysis, gene interactions, gene mutation, linkage, gene mapping & 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, & interactions with other species, energy flow & recycling of nutrients. Principles of growth, regulation, diversity, stability of populations & the interactions among populations at the community & ecosystems levels are discussed. Pre-req.: BIOL 232.

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

BIOL 433 DEVELOPMENTAL BIOLOGY (3Crs.:3Lec)
A study of the basic principles of embryonic & post-embryonic development of animals with an emphasis on the underlying cellular & molecular mechanisms. Specific topics include fertilization, determination of cell fate & differentiation, cell migration, establishment of the body plan, formation of selected organs & organ systems, stem cells, & 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 & its hormonal products, including the hormone producing cells, synthesis, modification, release & transport of hormones, hormone receptors & the mechanisms of hormone action, their effects on target cells, their effects on physiological processes, the diseases caused by inappropriate hormone functions & bioenergetics & metabolic regulation. Pre-req.:: BCHM 331.

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

Departmental Elective Courses

Course			Credits	Prerequisite
BIOL	342	Histology	3	Pre-requisite: BIOL 231
BIOL	344	Virology	3	Pre-requisite: BIOL 333
PHYS	352	Biophysics	3	
BCHM	434	Biotechnology	3	Pre-requisite: BIOL 334
BIOL	441	Cell & Tissue Culture	3	Pre-requisite: BIOL 231
BIOL	442	Biology of Invertebrates	3	Pre-requisite: BIOL 231
BIOL	443	Food Microbiology	3	Pre-requisite: BIOL 333
BCHM	445	Biochemical Principles of Nutrition	3	Pre-requisite: BCHM 331
BCHM	446	Gene Therapy	3	Pre-requisite: BIOL 334
BCHM	447	Biochemical & Molecular Toxicology	3	Pre-requisite: BCHM 331

BCHM	448	Molecular Biology of Cancer	3	Pre-requisite: BIOL 334
BIOL	449	Comparative Vertebrate Anatomy	3	Pre-requisite: BIOL 231

Description of Departmental Elective Courses

BIOL 342 HISTOLOGY (3Cr.:2Lec,2 Lab)

The fundamental basic knowledge of the structure of mammalian cells & their organization into tissues. Topics include histological techniques, the use of virtual microscopy & the morphological examination of epithelium, connective tissue, muscle & nervous tissues. An emphasis is placed on the recognition of cell types & the correlation of structure & 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 & their replication at the molecular level, emphasizing on the major viruses causing important diseases in humans & animals. The course focuses also on the mechanisms of viral pathogenesis, determinants of viral virulence & the host response to infections. Diagnosis of viral infections, vaccines & 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 & breathing, diffusion & contanct lenses. Thermodynamics of living systems, energy from food, regulation of body temperature, evaporation, resistance to cold, heat & soil. Sound: hearing & 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 & 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 & genetic engineering used in the field of biotechnology to produce transgenic plants, animals & microorganisms. Topics include applications of molecular biotechnology in medicine, agriculture & environment. Pre-req.: BIOL 334.

BIOL 441 CELL & TISSUE CULTURE (3Crs.:3 Lec)

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

BIOL 442 BIOLOGY OF INVERTEBRATES (3Crs.:3 Lec)
This course surveys the diversity of invertebrates & their functional systems, emphasizing the basic themes that define each phylum & those that are common to all animals. The course focuses on evolution, life histories, physiology, & anatomy of the major phyla & 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 & understanding of the attributes of microorganisms & 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 & 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 & fats & the functions of vitamins & minerals, the use of supplements. It also describes the factors associated with weight control, including causes of obesity, methods of assessing body weight & 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, & the safety & 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 & AIDS. Pre-req.: BIOL 334.

BCHM 447 BIOCHEMICAL & MOLECULAR TOXICOLOGY (3Crs.:3Lec)
This course presents an overview of the basic principles of toxicology & 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 & cellular mechanisms of carcinogenesis. The topics of oncogene activation & tumor suppressor gene inactivation induced by carcinogens will be emphasized. DNA repair genes, cell cycle regulation, programmed cell death, cytochrome P450 & 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	*Pre-Req: BIOL 121
BIOL	231L	Biology I Laboratory	1	Co-Req.: BIOL 231
CHEM	241	Principles of Chemistry	3	*Pre-Req: CHEM 110
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
ARAB	001	Arabic Language	2	
		University Requirements	2	

Second Semester (17 Credits)			Crs.	Pre-co/requisites
MATH	242	Probability & 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
ENGL	001	English Language	2	
BLAW	001	Human Rights	1	
		University Requirements	1	

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 Requirements	6	

Fourth Semester (16 Credits)			Crs.	Pre-co/requisites
BIOL	334	Cell & Molecular Biology	3	Pre-Req: BIOL 231
BIOL	334L	Cell & 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 Requirements	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 Requirements	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 & critical & 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 & related disciplines.

Objectives

Few years after graduation, graduates of the biochemistry program will:

a. have established extensive knowledge of different disciplines in biochemistry that help him/her plan innovative solutions to real world problems.
b. be successfully employed in different biochemistry related-careers & disciplines or accepted in graduate programs.
c. have demonstrated effective, ethical, & responsible team-work with oral & written communication skills.
d. have shown professional development & the capacity for life-long learning.

Learning Outcomes

a- Knowledge & Understanding:

1. Comprehensive knowledge & understanding of fundamental biochemical reactions & processes in living organisms.
2. Understand the mechanisms of diseases incidence & the strategies to treat human diseases at the molecular & cellular levels.
3. Master aspects of the modern disciplines of biochemistry at the molecular, cellular & organism levels.
4. Merging knowledge of biochemistry & related disciplines such as molecular biology, biotechnology & biomedical science.

b- Intellectual Abilities:

1. Demonstrate the ability to carry out experiments, analyze the obtained data & draw reasonable conclusions or interpretations.
2. Demonstrate the ability to critically evaluate & utilize scientific literature.
3. Demonstrate skills & expertise in biochemistry for various career opportunities.
4. Use critical thinking & principles of logic to evaluate problems in biochemistry disciplines.
5. Demonstrate the ability to pursue further education as an independent life-long professional learning.

c- Professional & Practical Competencies:

1. Obtain the ability to design experimental biochemical & molecular approaches & strategies to solve biochemical problems.
2. Operate & practice basics laboratory instrumentations efficiently.

d- General & Transferable Skills:

1.Communicate scientific information clearly & precisely, both orally & in writing.
2.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

- Admission to biomedical sciences.
- Graduate studies in various biological sciences.
- Work in educational or research institutions in Biochemistry & Molecular Biology.
- School Teachers for courses in biochemistry, Molecular Biology & related fields.
- University Teacher.
- Lab or Research Assistant in Food Science, Clinical Laboratories, Pharmaceutical or Health industries, Forensic science, Agricultural Research, Biotechnology.

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**

* 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 & 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 & Major Core Courses

Course			Credits	Prerequisite
BIOL	231	Biology I	3	
BIOL	231L	Biology I Laboratory	1	Co-requisite: BIOL 231
CHEM	241	Principles of Chemistry	3	
CHEM	241L	Principles of Chemistry Laboratory	1	Co-requisite: CHEM 241
PHYS	231	Physics for Life Sciences	3	
PHYS	231L	Physics for Life Sciences Laboratory	1	Co-requisite: PHYS 231
MATH	242	Probability & Statistics	3	
CHEM	234	Organic Chemistry	3	
CHEM	234L	Organic Chemistry Laboratory	1	Co-requisite: CHEM 234
CHEM	242	Analytical Chemistry	3	Pre-requisite: CHEM 241
CHEM	242L	Analytical Chemistry Laboratory	1	Co-requisite: CHEM 242
BIOL	236	Immunology	2	Pre-requisite: BIOL 231
BCHM	331	Biochemistry	3	Pre-requisite: CHEM 234
BCHM	331L	Biochemistry Laboratory	1	Co-requisite: BCHM 331
BIOL	333	Microbiology	3	Pre-requisite: BIOL 231
BIOL	333L	Microbiology Laboratory	1	Co-requisite: BIOL 333
CHEM	333	Physical Chemistry	3	Pre-requisite: CHEM 241
CHEM	333L	Physical Chemistry Laboratory	1	Co-requisite: CHEM 333
BIOL	334	Cell & Molecular Biology	3	Pre-requisite: BIOL 231
BIOL	334L	Cell & Molecular Biology Laboratory	1	Co-requisite:-BIOL 334
BCHM	336	Metabolic Biochemistry	3	Pre-requisite: BCHM 331
BCHM	433	Enzymology	3	Pre-requisite: BCHM 336
BCHM	433L	Enzymology Laboratory	1	Co-requisite: BCHM 433
BCHM	432	Clinical Biochemistry	3	Pre-requisite: BCHM 336
BCHM	432L	Clinical Biochemistry Laboratory	1	Co-requisite: BCHM 432
BCHM	434	Biotechnology	3	Pre-requisite: BIOL 334
BCHM	444	Senior Project	2	
BCHM	435	Seminar in Biochemistry	1	
BCHM	437	Endocrinology	3	Pre-requisite: BCHM 331

Description of Faculty Core Courses

PHYS 231 PHYSICS FOR LIFE SCIENCES (3Crs.:3Lec)
Units & dimensions- Force, work, energy & power in biological systems- Elastic properties of bones & tissues- Nonviscous & viscous fluids- Heat, temperature & thermal properties of materials- electricity & magnetism- Nerve conduction- Sound wave- X-rays (production, & 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.:3 Lec)
This course introduces the students to fundamental concepts in biology. Topics to be covered include the cellular & chemical basis of life, organization of life, energy transfer through living organisms, evolution, diversity of life with emphasis on the animal & plant kingdoms & their interaction with the environment.

BIOL 231L BIOLOGY I LABORATORY (1Cr.:2Lab)
Laboratory includes applications & 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 & measurement, atoms, molecules, ions, moles, nomenclature, atomic & molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, & solid states of matter. Properties of solutions, aqueous reactions & solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases & ionic equilibria, electrochemistry, nuclear chemistry & 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 & STATISTICS (3Cr.:2Lec,2 Lab)
Basic concepts in statistics (mean, variance & frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete & continuous distributions, central limit theorem, regression & 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 & their applications. The topics covered include gravimetric & volumetric methods based on solution equilibria such as acid-base, complexometric, redox & precipitation reactions, introduction to separation & spectroscopic methods of analysis. The course also introduces students to statistical data treatment, errors, precision & accuracy in chemical analysis. Pre-req.: CHEM 241.

CHEM 242L ANALYTICAL CHEMISTRY LABORATORY (1Cr.:3 Lab)
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 & structure, conformations & stereochemistry, organic reactivity & catalysis, organic acids & bases. Nucleophilic substitution, phosphoryl transfer, nucleophilic carbonyl addition, acyl substitution, electrophilic, oxidation, reduction & 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 & cellular elements of the immune system, & their basic function. Topics covered include description of the immune system, antibody & T-cell receptor structure & functions, genes of the immunoglobulin superfamily, cells & molecular mediators that regulate the immune response, allergy, autoimmunity, immunodeficiency, transplantation & 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 & 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 & quantification of biomolecules. Co-req.: BCHM 331.

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

BIOL 333L MICROBIOLOGY LABORATORY (1Cr.:2 Lab)
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.:3 Lec)
Basic principles of chemical thermodynamics & kinetics. Catalysis & adsorption. Transport phenomena. States & properties of colloids. Pre-req.: CHEM 241.

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

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

BIOL 334L CELL & MOLECULAR BIOLOGY LABORATORY (1Cr.:2 Lab)
This laboratory introduces students to the tools of cell biology & 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 & fatty acid oxidation; & biosynthetic pathways–gluconeogenesis, glycogen synthesis, & fatty acid biosynthesis. Nitrogen metabolism, urea cycle, amino acid metabolism, nucleotide metabolism, and. Regulation of carbohydrates, lipid & protein metabolism. Pre-req.: BCHM 331.

BCHM 432 CLINICAL BIOCHEMISTRY (3Crs.:3 Lec)
A course that covers the basic principles & practice of clinical chemistry. It offers an introduction to biochemical instrumentation & a study of metabolism during normal & pathological processes of the human body. The relationship between disease states & chemical variations from normal is emphasized providing the students with useful information for the interpretation & 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 & diagnose diseases. The students will deal with blood & urine samples for the analysis & interpretations of normal & 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 & enzyme inhibition. Enzyme kinetics. Allosteric control of enzymes. Mechanism of catalysis. Pre-req.: BCHM 336.

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

BCHM 434 BIOTECHNOLOGY (3Crs.:3Lec)
The basic principles of recombinant DNA technology & genetic engineering used in the field of biotechnology to produce transgenic plants, animals & microorganisms. Topics include applications of molecular biotechnology in medicine, agriculture & 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 & its hormonal products, including the hormone producing cells, synthesis, modification, release & transport of hormones, hormone receptors & the mechanisms of hormone action, their effects on target cells, their effects on physiological processes, the diseases caused by inappropriate hormone functions & bioenergetics & 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 & under supervision of a faculty member. This project is to be submitted to the department for review.

Departmental Elective Courses

Course			Credits	Prerequisite
BIOL	337	Human Physiology	3	Pre-requisite: BIOL 231
BIOL	338	Genetics	3	Pre-requisite: BIOL 231
BIOL	342	Histology	3	Pre-requisite: BIOL 231
BIOL	344	Virology	3	Pre-requisite: BIOL 333
PHYS	352	Biophysics	3	
BIOL	441	Cell & Tissue Culture	3	Pre-requisite: BIOL 231
BCHM	451	Membrane Biochemistry	3	Pre-requisite: BCHM 331
BCHM	446	Gene Therapy	3	Pre-requisite: BIOL 334
BCHM	445	Biochemical Principles of Nutrition	3	Pre-requisite: BCHM 331
BCHM	447	Biochemical & Molecular Toxicology	3	Pre-requisite: BCHM 331
BCHM	448	Molecular Biology of Cancer	3	Pre-requisite: BIOL 334
BCHM	449	Nucleic Acid- Protein Interaction	3	Pre-requisite: BIOL 334

Description of Departmental Elective Courses

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 & 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 & modern genetics. Topics include Mendelian inheritance & deviations from classical Mendelian ratios, pedigree analysis, gene interactions, gene mutation, linkage, gene mapping & population genetics. Pre-req.: BIOL 231.

BIOL 342 HISTOLOGY (3Crs.:2Lec,2Lab)
The fundamental basic knowledge of the structure of mammalian cells & their organization into tissues. Topics include histological techniques, the use of virtual microscopy & the morphological examination of epithelium, connective tissue, muscle & nervous tissues. An emphasis is placed on the recognition of cell types & the correlation of structure & 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 & their replication at the molecular level, emphasizing on the major viruses causing important diseases in humans & animals. The course focuses also on the mechanisms of viral pathogenesis, determinants of viral virulence & the host response to infections. Diagnosis of viral infections, vaccines & control of viral infections are also discussed. Pre-req.: BIOL 333.

PHYS 352 BIOPHYSICS (3Crs.:3 Lec)
Fluids: Circulation of the blood, blood pressure, power produced by heart. Heat: trasfer of heat, transport of molecules by diffusion, respiratory system, surfactants & breathing, diffusion & contanct lenses. Thermodynamics of living systems, energy from food, regulation of body temperature, evaporation, resistance to cold, heat & soil. Sound: hearing & 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 & 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 & TISSUE CULTURE (3Crs.:3Lec)
The course provides theoretical knowledge on how to culture cells outside the body emphasizing on the equipment & sterile techniques of the cell culture laboratory, the composition of cell culture media, establishment of primary cultures & cell lines from normal tissue & cancer tissue, routine cultivation of cells, long-term storage & contamination. Various methods for characterization of cells & transfection are also discussed. Pre-req.: BIOL 231.

BCHM 451 MEMBRANE BIOCHEMISTRY (3Crs.:3Lec)
Biochemistry of membranes & membrane proteins. Topics to be covered include membrane structure & functions with emphasis on membrane transport, membrane fusion, electrical & cell signaling & 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, & the safety & 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 & AIDS. Pre-req.: BIOL 334.

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

BCHM 447 BIOCHEMICAL & MOLECULAR TOXICOLOGY (3Crs.:3Lec)
This course presents an overview of the basic principles of toxicology & 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 & cellular mechanisms of carcinogenesis. The topics of oncogene activation & tumor suppressor gene inactivation induced by carcinogens will be emphasized. DNA repair genes, cell cycle regulation, programmed cell death, cytochrome P450 & 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 & RNA that promote molecular interactions & biological function. Topics include the physical properties of nucleic acids, the formation & biological importance of higher order structures, RNA enzymatic activities, nucleic acid-protein interactions, & 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	*Pre-Req: BIOL 121
BIOL	231L	Biology I Laboratory	1	Co-Req.: BIOL 231
CHEM	241	Principles of Chemistry	3	*Pre-Req: CHEM 110
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
ARAB	001	Arabic Language	2	
		University Requirements	2	

Second Semester (17 Credits)			Crs.	Pre-co/requisites
MATH	242	Probability & 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
ENGL	001	English Language	2	
BLAW	001	Human Rights	1	
		University Requirements	1	

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 & Molecular Biology	3	Pre-Req: BIOL 231
BIOL	334L	Cell & 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-BCHM 336
BCHM	433L	Enzymology Laboratory	1	Co-BCHM 433
BCHM	437	Endocrinology	3	Pre-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 & ecology. Laboratory courses are designed to provide students with training in various disciplines of the environmental science. The program educates & prepares students to use concepts & principles in the study of environmental science at local, regional & 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:

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

Learning Outcomes

a-Knowledge & Understanding:

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

b-Intellectual abilities:

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

c-Professional & Practical Competencies:

1. Develop analytical & critical thinking for solving problems related to environment at local, region & global scales.
2. Effectively analyze environmental data & communicate environmental science issues to stake holder.
3. Select appropriate measurement tools & collect environment data using common instruments & techniques.

d-General & Transferable Skills:

1. Communicate concisely & clearly the issues related to the environmental science, both orally & in writing.
2. Work effectively in a professional or laboratory setting.
3. Recognize & respond to the need of life-long learning.
4. 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

- Work in educational or research institutions in Environmental Sciences.
- School Teachers for courses in Environmental Sciences.
- Lab or Research Assistant in Environmental Sciences such as Environmental Monitoring, Quality Control, Forensic Science, & Agricultural Research.

Program Overview

The Environmental Science curriculum consists of the following components:

Enviromental 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 & 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 & Major Core Courses

Course			Credits	Prerequisite
BIOL	231	Biology I	3	
BIOL	231L	Biology I Laboratory	1	Co-requisite: BIOL 231
CHEM	241	Principles Of Chemistry	3	
CHEM	241L	Principles Of Chemistry Laboratory	1	Co-requisite: CHEM 241
PHYS	231	Physics For Life Sciences	3	
PHYS	231L	Physics For Life Sciences Laboratory	1	Co-requisite: PHYS 231
MATH	242	Probability & Statistics	3	
CHEM	234	Organic Chemistry	3	
CHEM	234L	Organic Chemistry Laboratory	1	Co-requisite: CHEM 234
BIOL	232	Biology II	3	Pre-requisite: BIOL 231
BIOL	232L	Biology II Laboratory	1	Co-requisite: 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-requisite: CHEM 234
BCHM	331L	Biochemistry Laboratory	1	Co-requisite: BCHM 331
BIOL	333	Microbiology	3	Pre-requisite: BIOL 231
BIOL	333L	Microbiology Laboratory	1	Co-requisite: BIOL 333
ENVI	303	Ecosystems & Biosphere	2	
ENVI	308	Energy Resources	2	
ENVI	417	Climate Change: Past & 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 & Arc/Info	2	
ENVI	409	Environmental Toxicology	2	
ENVI	444	Senior Project	2	

Description of Faculty Core Courses

PHYS 231 PHYSICS FOR LIFE SCIENCES (3Cr.:3Lec)
Units & dimensions- Force, work, energy & power in biological systems- Elastic properties of bones & tissues- Nonviscous & viscous fluids- Heat, temperature & thermal properties of materials- electricity & magnetism- Nerve conduction- Sound wave- X-rays (production, & 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 & chemical basis of life, organization of life, energy transfer through living organisms, evolution, diversity of life with emphasis on the animal & plant kingdoms & their interaction with the environment.

BIOL 231L BIOLOGY I LABORATORY (1Cr.:2 Lab)
Laboratory includes applications & 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 & measurement, atoms, molecules, ions, moles, nomenclature, atomic & molecular weights. Stoichiometry. Chemical reactions, quantitative calculations. Periodic table, atomic structure, periodic properties of the elements, chemical bonding, molecular structure. The gaseous, liquid, & solid states of matter. Properties of solutions, aqueous reactions & solution stoichiometry. Thermochemistry, chemical thermodynamics, chemical kinetics, chemical equilibrium, acids, bases & ionic equilibria, electrochemistry, nuclear chemistry & 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 & STATISTICS (3Crs.:2Lec,2 Lab)
Basic concepts in statistics (mean, variance & frequency distribution), Random variables, discrete probability, conditional probability, independence, expectation, standard discrete & continuous distributions, central limit theorem, regression & 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 & structure, conformations & stereochemistry, organic reactivity & catalysis, organic acids & bases. Nucleophilic substitution, phosphoryl transfer, nucleophilic carbonyl addition, acyl substitution, electrophilic, oxidation, reduction & radical reactions.

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

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

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

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

BIOL 333L MICROBIOLOGY LABORATORY (1Cr.:2 Lab)
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 & emissions, Biodiversity, Environmental problems (ozone depletion, acid rain, species loss, floods, droughts, climate change, urban pollution, & water contamination), Indoor pollution, waste management, nature conservation, cultural heritage & landscape protection, health, safety & chemicals

ENVI 301 PLANET EARTH (2Crs.:2Lec)
The interactions between the hydrosphere, atmosphere, biosphere, cryosphere & lithosphere that together make up the Earth System. It is now clear that the state of the Earth has dramatically & 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 & biological systems interact? What were the causes & effects of past climatic changes & what can we learn from them about the future?

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

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

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

ENVI 417 CLIMATE CHANGE: PAST & FUTURE (2Crs.:1Lec,3Lab)
History of the earth & natural cycles of changing climate. Global warming. Green house effect. Rate of climate change. Reduce carbon emissions. Difference between climate & 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 & studies conducted by the professional ecologist.

ENVI 308 ENERGY RESOURCES (2Crs.:2Lec)
Renewable natural sources of energy & clean technologies. Solar, wind, geothermal hydropower, & tidal energy. Natural resources (water, forests, fuels, etc.) Management, exploitation & 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 & waste treatment technologies. Problems associated with the conventional methods of waste treatment & disposal. Various options & modern technologies employed in waste treatment, disposal & recycling using biological systems.

ENVI 405 GIS & ARC/INFO (2Crs.:1Lec,3Lab)
Principles, characteristics & applications of environmental remote sensing. GIS as an environmental monitoring tool. Photographic systems & interpretation, thermal & multispectral scanning, satellite remote sensing, & 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 & transformation within the environment. The effects of pollutants on living organisms. At an individual level toxicants may disturb the biochemical, molecular, & physiological structure & function which will in turn have consequences on the structure & function of communities & ecosystems.

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

Departmental Elective Courses

Course			Credits	Prerequisite
ENVI	309	Bioremediation	1	
ENVI	312	Coastal & Marine Ecosystem	2	
BIOL	336	Plant Physiology	3	Pre-requisite: BIOL 232
BIOL	336L	Plant Physiology Laboratory	1	Co-requisite: BIOL 336
ENVI	406	Environmental Policy Economics & Laws	2	
ENVI	407	Metabolic Biotransformations Of Environmental Chemicals	3	
ENVI	411	Conservation Biology & Biodiversity	3	
ENVI	412	Genetic Engineering & Applications	3	
ENVI	413	Medical Microbiology	3	
ENVI	414	Aquatic & Wetland Vascular Plants	3	
BIOL	337	Human Physiology	3	Pre-requisite: 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 & biological remediation. Selection of selected case histories of existing sites.

ENVI 312 COASTAL & MARINE ECOSYSTEM (2Crs.:1Lec,3Lab)
Introduction to coastal environments & marine ecosystems & their resources. Tools for monitoring , management & development of coastal & marine ecosystems pollution sources & its impact. Conservation & protection of marine natural communities, Lebanon coastal environments & its management & 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 & development & 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 & LAWS (2Crs.:2Lec)
An introduction to the history, organization, goals & ideals of environmental protection. Legal aspects of environmental regulations. Historical perspectives & current regulations for air, land & water quality. Political implications of shifts in emphasis from nature protection to pollution control to sustainability. Economic & law approaches are combined studies in environmental policy making.

ENVI 407 METABOLIC BIOTRANSFORMATIONS OF ENVIRONMENTAL CHEMICALS (3Crs.:2Lec,3Lab)
Biochemical processes controlling transport & 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 & BIODIVERSITY (3Crs.:2Lec,2Lab)
Application of ecological & evolutionary theory to the management of rare & threatened species, communities, & ecosystems.

ENVI 412 GENETIC ENGINEERING & APPLICATIONS (3Crs.:3Lec)
Nucleic acid structure (DNA & RNA), DNA is the Genetic Material, DNA replication, transcription, translation, post translation modification, isolation & purification of nucleic acids (DNA & RNA), isolation of genes (genomic library construction & screening, DNA library construction & screening, PCR library construction & 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 & treatment of viral, bacterial & 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 & transport, biogeochemical cycling, microbes & pollutants, microbes & agriculture, indicator organisms, waste & water treatment.

ENVI 414 AQUATIC & WETLAND VASCULAR PLANTS (3Crs.:3Lec)
Identification, ecology, & adaptations of vascular aquatic & 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 & the nervous system) with emphasis on understanding human diseases. Pre-req.: BIOL 231

ENVI 408 ENVIRONMENTAL IMPACT ASSESSMENT (2Crs.:1Lec,3Lab)

Definition & objectives of environmental impact assessment (EIA), activities involved in EIA, major components & 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	*Pre-Req: BIOL 121
BIOL	231L	Biology I Laboratory	1	Co-Req.: BIOL 231
CHEM	241	Principles of Chemistry	3	*Pre-Req: CHEM 110
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
ARAB	001	Arabic Language	2	
		University Requirements	2	

Second Semester (17 Credits)			Crs.	Pre-co/requisites
MATH	242	Probability & 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	
ENGL	001	English Language	2	
BLAW	001	Human Rights	1	
		University Requirements	1	

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 & Future	2	
ENVI	405	GIS & 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	