Faculty of

Science

Faculty of Science

Departments

Mathematics and Computer Science
Physics
Chemistry
Biological and Environmental Science

History

The Faculty of Science was established in 1976 with the department of Physics. It underwent a rapid expansion to include the departments of Mathematics, Chemistry and Biology and Environmental Science in 1978, 1988 and 1998 respectively. The postgraduate program was initiated in 1999 to respond to the marketplace growing demand for higher education, and grew from an initial number of 40 students to over 100 Master Degrees awarded up to date. Today, more than 200 students are registered in the Masters and PhD programs, conducting research projects in molecular biology, genetics, medicinal chemistry and bioremediation, group representation, solving optimal control problems using numerical optimization techniques, analytical chemistry, physical chemistry, organic and inorganic chemistry, in addition to molecular physics, radiation physics and semiconductor physics.

In 2005, the Science faculty joined international institutions of higher education by adopting the Credit Hour System to simplify and advance its education scheme. Today, the Faculty continues to reinvent itself, modernizing its undergraduate and graduate programs to keep pace with the evolving technologies and emerging scientific disciplines, preparing its students for the challenges of the 21st Century.

Vision

To be recognized in the national and international scientific communities for science education, innovation and technology. To foster an environment of intellectual freedom as well as excellence in educational programs and scientific research.

Mission

The Faculty of Science is committed to sustain excellence in the creation and dissemination of knowledge by teaching, research, and scholarly publication in both basic and applied sciences. The centrality of the Faculty within the University will be strengthened by excellence of our academic programs, as well as by our strategic collaborations with all faculties across the University.

Undergraduate Programs

The Faculty of Science offers a Bachelor of Science Degree in the following 9 specializations:

General Sciences Group

- Mathematics
- Computer Science
- Information Technology
- Physics
- Chemistry

Biological & Environmental Science Group

- Biology
- Biotechnology
- Biochemistry
- Environmental Science

First year students enlist in either the General Science group or the Biological & Environmental Science group.

Program Description

The Bachelor Degree requirements consist of a total of 120 credit hours taken, in accordance to the field of specialization, as follows:

- Mandatory Courses - The number of credit hours of mandatory courses varies according to the academic department.
- Departmental Elective Courses - The number of credit hours varies according to the academic department and courses are selected according to the field of specialization as offered by the department.
- General University Requirements - 16 Cr. divided according to the field of specialization into either:
  University Mandatory Courses - 7 Cr.
  University Elective Courses - 9 Cr.

OR

  University Mandatory Courses - 5 Cr.
  University Elective Courses - 11 Cr.

The standard duration of study for a Bachelor Degree in Science in the 9 specializations is 8 semesters. There are two general semesters of study for the students of the General Science group, and four semesters of general study for the students of the Biological and Environmental Science group.

Department of Mathematics & Computer Science

Bachelor of Science in Mathematics (120 Cr. Hr.)

Curricula

First Semester			Cr.
MATH	101	Calculus & Analytical Geometry I	2
MATH	103	Applied Mathematics I	2
PHYS	111	Principles of Physics I	4
CHEM	111	Principles of Chemistry I	4
		Elective (General)[1]	4
			16

Second Semester			Cr.
MATH	102	Calculus & Analytical Geometry II	2
MATH	104	Applied Mathematics II	2
PHYS	112	Principles of Physics II	4
CHEM	112	Principles of Chemistry II	4
CMPS	114	Introduction to Programming	2
			14

Third Semester			Cr.
MATH	201	Set Theory	2
MATH	203	Differential Equations	2
MATH	205	Dynamics of Particles	3
		Elective [2]	3
		Elective (General)[1]	5
			15

Fourth Semester			Cr.
MATH	202	Mathematical Analysis I	3
MATH	204	Linear Algebra	3
MATH	206	Dynamics of Rigid Bodies	2
		Elective [2]	5
		Elective (General)[1]	2
			15

Fifth Semester			Cr.
MATH	301	Abstract Algebra	3
MATH	303	Mathematical Analysis II	3
MATH	304	Functions of Complex Variables	2
MATH	309	Fluid Dynamics	2
		Elective [2]	3
		Elective (General)[1]	2
			15

Sixth Semester			Cr.
MATH	302	Topology	3
MATH	308	Analytical Dynamics	3
MATH	310	Quantum Mechanics	2
		Elective [2]	4
		Elective (General)[1]	3
			15

Seventh Semester			Cr.
MATH	401	Research Topics	1
MATH	403	Partial Differential Equations	3
MATH	405	Topics in Fluid Dynamics	2
MATH	408	Functional Analysis	2
		Elective [2]	8
			16

Eighth Semester			Cr.
MATH	499	Senior Research in Mathematics	2
MATH	412	Topics in Abstract Algebra	3
MATH	414	Theory of Elasticity	2
		Elective [2]	7
			14

[1] A total of 16 credits is required as General University Requirement; 5 credits are selected from the university Mandatory courses list including-ARAB 001(2Cr.); ENG 001(2Cr.); BLAW 001(1Cr.) & another 11 credits are selected from the university Elective courses list.

[2] Selected from departmental and faculty elective courses. To qualify for a minor in computer science, information technology or physics a minimum of 18 credits must be earned in that field.

Mandatory Courses

MATH 101 - Calculus & Analytical Geometry I (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Calculus of transcendental functions. Integration techniques, improper integrals. Infinite sequences and series, Taylor's and Maclaurin series. Parameterized curves in the plane. Polar coordinates and polar equations. Conic sections and its general equation.

MATH 102 - Calculus & Analytical Geometry II (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Functions in two or more variables, partial derivatives, gradient vectors, maxima, minima and saddle points, Taylor's series for functions in two or more variables. Double integrals, double integrals in polar coordinates. Triple integrals, triple integral in spherical and cylindrical coordinates. Substitution in multiple integrals. Coordinates in space, vector products. Lines and planes in space, surfaces in space, quadratic surfaces. Vector - valued functions and space curves.

MATH 103 - Applied Mathematics I (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Differentiation of vectors, grad of a scalar function, divergence and curl of a vector function, applications. Moments and couples. System of concurrent forces, system of parallel forces. Equilibrium of a system of forces. Motion of a particle in a straight line with variable acceleration, circular motion, Newton's law of motion, work, power, momentum, energy, Impulse, Impact of elastic bodies.

MATH 104 - Applied Mathematics II (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Bending moments and Shearing forces, center of gravity using integration, problems involving rigid bodies: Equilibrium of bodies in contact, friction, frameworks, virtual work. Equilibrium of Catenary. Dynamics of a particle moving in a circle, simple pendulum, conical pendulum, simple harmonic motion, Constrained motion of a particle on a smooth curve.

MATH 115 - Calculus & Analytical Geometry for Biology (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

(Core course for Biology). Calculus: Functions, continuity, differentiability, application of derivatives, integration techniques, improper integrals, applications of integration (calculations of areas, lengths of curves, surface of revolutions), first order differential equations, sequences, infinite series. Algebra and geometry: System of equations, matrices, solution of linear systems, partial fractions, complex numbers. Vectors in the plane, dot and cross products, lines and planes in space, parametrized curves in the plane, polar coordinates and graphs, conics.

MATH 201 - Set Theory (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Elementary logic, propositional and predicate calculus. Formal proofs, method of proof induction. Sets, set operations, cartesian products, indexed family of sets. Relations, properties of relations, composition. Functions, injections, surjections and bijections, inverse of functions, induced functions. Partitions, equivalence relations, equipotent sets, countable and uncountable sets, cardinal arithmetics, infinite cardinals.

MATH 202 - Mathematical Analysis I (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Sets: Countable, uncountable, compact, perfect and connected sets. Sequences and series, Cauchy's sequence, convergence and absolute convergence. Limit, continuity, compactness, connectedness, discontinuity and monotonic functions. Differentiation of vector valued functions from Rn to Rm. Sequences and Series of functions - Functions of several variables: Contraction principle - inverse and Implicit function theorems. Rieman - Stieltjes integral - Integration of differential forms. Prereq.: MATH 101 or MATH 102.

MATH 203 - Differential Equations (2 Cr. : 2 Lec : 1 Lab : 1 Tut)

Introduction. First order differential equations, linear and non - linear differential equations, second order differential equations, power series solutions of differential equations. Laplace transform. Existence - uniqueness theorem. Systems of differential equations. Applications of differential equations. Prereq.: MATH 101 or MATH 102.

MATH 204 - Linear Algebra (3 Cr. : 2 Lec : 1 Lab : 2 Tut)

(Also core course for computer science & IT). Elementary matrices, system of equations and invertible matrices. Vector spaces, subspaces, basis and dimensions, rank, nullity. Inner product spaces. Eigenvalues and eigenvectors, diagonalization. Applications to conic sections and quadratic surfaces. Complex vector spaces, unitary, normal and Hermitian matrices. Linear transformations over the complex field, linear functional and adjoint operators. Sums and direct sums. Minimal polynomial. Kinematics of a rigid body in plane motion. Dynamics of a rigid body in translation. Dynamics of a rigid body in rotation. Dynamics of a rigid body in plane motion. Work and energy of a rigid body. Impulse and momentum of a rigid body.

MATH 205 - Dynamics of Particles (3 Cr. : 2 Lec : 1 Lab : 2 Tut)

Tangential and normal acceleration, simple pendulum, conical pendulum, motion of a particle on a rough curve in a vertical plane, central forces: Equation of motion, determination of the orbit, Kepler's law, apses, planetary motion - uniplaner motion when the acceleration is central and varying as the inverse square of the distance. Moments and products of inertia, momental ellipsoid and principal axis. Prereq.: MATH 103.

MATH 206 - Dynamics of Rigid Bodies (2 Cr. : 2 Lec : 1 Lab : 1 Tut)

Hydrostatic, general equations of equilibrium of fluid, centers of pressure of an immersed plane area, thrusts on curved surface, the principal of Archimedes, conditions of equilibrium of a floating body, applications. Attraction and Potential, field intensity for a system of particles and for continuous distribution of matter, potential for a system of particles distributed in space for a continuous distribution of matter, applications, equilibruim of slightly elastic beams, bending of beams, work done in bending a rod or wire, dammep and forced oscillations, small oscillations, motion of rigid bodies in two dimensions. Prereq.: MATH 103.

MATH 215 - Differential Equations for Biology (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

(Core course for Biology). Differential equations, first order (various types), second order differential equations (homogeneous and non - homogeneous with constant coefficients), variation of parameters, normal form solution in series. Prereq.: MATH 115 or MATH 101.

MATH 216 - Discrete Structures (2 Cr. : 2 Lec : 1 Lab : 1 Tut)

(Core course for computer science & IT). This course provides a broad introduction to mathematical concepts that are important for the study of computer science such as basic mathematical concepts in logic and proof, number theory, set theory, induction and recursion, functions, combinatorics, algorithms, and discrete structures. In addition to computer assignments.

MATH 301 - Abstract Algebra (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Binary operations, algebraic systems. Groups, subgroups, normal subgroups, cyclic groups and subgroups. Cosets, Lagrange's theorem, counting theorems. Groups of permutations. Quotient groups, homomorphisms, isomorphisms, homomorphisms theorems. Direct product, fundamental theorem of finite abelian groups. Classification of groups of low order. Prereq.: MATH 201 or MATH 204 or MATH 211.

MATH 302 - Topology (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Topological space, open sets, closed sets, derived set, interior, closure. T1 spaces and Hausdorff spaces. Subspace toplogy, convergence, metric Topology. Continuous functions, basis and subbasis, homeomorphisms, open maps, closed maps. Compactness, connectedness, seperation axioms, product toplogy. Prereq.: MATH 201.

MATH 303 - Mathematical Analysis II (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Real outer measure, measurable sets, Lebesgue measure, measurable functions, Litlewood principle. Lebesgue integral, convergence in measure. Diffentiation, differentiation of monotone functions, functions of bounded variation, differentiation of an integral, absolute continuity, convex function. Prereq.: MATH 202.

MATH 304 - Functions of Complex Variables (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Complex numbers, elementary functions of complex variables, topology of the complex plane, limit, continuity, differentiation, analytical functions, Cauchy - Riemann equations, complex integration, Cauchy's integral formulas, Taylor and Laurent series expansion, contour integration, meromorphic functions, conformal mapping. Prereq.: MATH 101.

MATH 308 - Analytical Dynamics (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Generalized coordinates and generalized velocities, Lagrange's equations for a holonomic system, case of conservative forces, energy investigation, cyclic of ignorable coordinates, the outhian function, Routh equation, application, hamiltonian form of the equation of motion, hamiltonian methods. Prereq.: MATH 205 or MATH 206.

MATH 309 - Fluid Dynamics (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Stream lines, differentiation with respect to time, equation of continuity, irrotational motion, velocity potential, circulation, boundary conditions, uniqueness theorem, Kelvin's theorem, symmetrical motion about a point, axis symmetrical motion, the equation of motion, Bernoulli's equation, applications, introduction to two dimensional motion. Prereq.: MATH 203.

MATH 310 - Quantum Mechanics (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Failure of classical mechanics in dealing with some physical problems, the origin of the old quantum theory, Bohr's model of the hydrogen atom, Wilson, Sommerfield quantization method, special quantization, Stark effect for hydrogen, the decline of the old quantum theory, algebra of operators, commutation relation, eigenvalue problems, expectation values, Hermitian operator, elements of wave mechanics, Schrodinger's wave equation, time derivative operators, some simple one - dimensional quantum mechanical problems. Prereq.: MATH 203.

MATH 311 - Statistical Methods & Computer Applications (2 Cr. : 2 Lec : 2 Lab : 0 Tut)

(Core course for Computer Science). Basic concepts of probability and statistics, sampling techniques, estimation, hypothesis testing, regression. Introduction to computer packages, statistical computer packages, SPSS, SAS. Computer applications to algebra, arithmatics, differential equations and other branches using mathematical packages such as Mathematica, Mathcad, Matlab, etc...

MATH 312 - Operation Research (2 Cr. : 2 Lec : 2 Lab : 0 Tut)

(Core course for Computer Science & IT). Modeling linear programming problems and deriving methods for solving them using algorithms such as: The simplex method, the dual simplex method, transportation algorithms, PERT - CPM for project scheduling. Inventory models will be briefly covered.

MATH 401 - Research Topics (1 Cr. : 1 Lec : 0 Lab : 0 Tut)

MATH 403 - Partial Differential Equations (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Introduction, classification and characteristics of second order partial differential equations. Qualitative behavior of solutions to elliptic equations, qualitative behavior of solutions to evolution equations. First order partial differential equations, eigenfunction expansion and integral transforms. Green's functions, variational formulation of boundary value problems, variational approximation methods. Introduction to the fnite element method. Prereq.: MATH 203.

MATH 405 - Topics in Fluid Dynamics (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Two dimensional motion, stream function, complex potential, complex velocity, source, doublet, circulation, streaming and circulation for a circular and elliptical cylinder, method of images source in front a wall, source outside a circular cylinder, Joukowski's transformation, blassius theorem, circle theorem, elliptic coordinates, wave in liquids, simple harmonic progressive waves, stationary waves, group velocity, sound wave, plane waves, vortices, single infinite row, Karman vortex street. Prereq.: MATH 205.

MATH 408 - Functional Analysis (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Normed space, Banach spaces, Hilbrert spaces, fundamental theory of normed and Banach spaces, Hann - Banach extention theorem, open mapping theorem, closed graph theorem, and Riez representation theorem, Banach fixed points theorem. Applications, spectral theory of linear operation in normed spaces, compact linear operators on normed spaces, adjoint linear operators, unbounded linear operators in Hilbert space. Prereq.: MATH 303.

MATH 412 - Topics in Abstract Algebra (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Rings, integral domains, fields, ideals, quotient rings, prime and maximal ideals. Divisibility theory, unique factorization domains, Euclidean domains. Polynomial rings, finite fields. Prereq.: MATH 301.

MATH 414 - Theory of Elasticity (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

State of stress in a body, differential equations of equilibrium, stresses on areas inclined to the coordinate planes, surface conditions, analysis of state of stress at a given point in a body, principle areas and principle stresses, stress distribution at a given point, Cauchy's stress surface, invariant of the stress tensor, Lame's ellipsoid, maximum shearing stresses, compatibility equations, dilatations strain, generalized Hook's law, stress strain relations, work done by elastic forces in a solid, potential of elastic forces, longitudinal and transverse vibrations in an unbounded elastic medium, longitudinal vibrations of a bar, Fourier's method, torsion of circular bar, the problem of torsion of a circular bar, pure bending of a prismatical bar, stretching of beams by its own weight. Prereq.: MATH 203.

MATH 499 - Senior Research in Mathematics (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Elective Courses

MATH 106 - Mathematics (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Calculus: Functions, continuity, differentiability, application of derivatives, integration techniques, improper integrals, applications of integration. (Calculations of areas, lengths of curves, surface of revolutions), first order differential equations, sequences, infinite series. Algebra and geometry: System of equations, matrices, solution of linear systems using matrices, eigen values and eigen vectors, partial fractions, complex numbers. Vectors in the plane, dot and cross products, lines and planes in space, parametrized curves in the plane, polar coordinates and graphs, conics.

MATH 153 - Elementary Calculus & Analytical Geometry (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Differentiation and integration: Functions and limits, differentiation and its applications, integration and its applications, differential equations, introduction to statics and applications in the architectural engineering field. Analytical geometry: Determinates and solution of simultaneous equations, lengths and areas, the straight line, the circle, the parabola, the ellipse, the hyperbola, polar coordinates, applications.

MATH 207 - Vector Analysis (2 Cr. : 2 Lec : 1 Lab : 1 Tut)

Vector analysis, divergence and curl, physical meaning of the divergence vector, Stoke's, Gauss, and divergence theorems and applications, Green's theorem, orthogonal curvilinear coordinates, forces in three dimensions. Prereq.: MATH 101 or MATH 102.

MATH 208 - Numerical Analysis (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Solutions of nonlinear equations in one variable: Bisection, Newton and secant methods. Interpolation and approximation: Lagrange polynomial, divided Differences, Hermite interpolating polynomial, cubic splines interpolation, trigonometric polynomial approximation and least - squares approximation. Numerical differentiation and integration. Direct methods for solving linear systems: Gaussian elimination with backward substitution, LU factorization. Numerical methods for solving nonlinear systems of equations. Numerical solution of ODE's. Prereq.: MATH 101 or MATH 102.

MATH 209 - Mathematical Statistics & Probability (3 Cr. : 2 Lec : 1 Lab : 2 Tut)

Probability set function, conditional probability and independence, discrete random variables, continuos random variables, distribution function, expectation, moment generating function, multivariate distribution, independent random variables, correlation, some special distributions, distributions of functions of random variables, limiting distributions and central limit theorem. Prereq.: MATH 101 or MATH 102.

MATH 210 - Discrete Mathematics (2 Cr. : 2 Lec : 2 Lab : 1 Tut)

Sequences, recursive definitions, recursion relations. Counting techniques. Divisibility, division algorithm, Euclidean algorithm, modular arithmatics. Partially ordered stes, the lattice of partition. Graphs, directed graphs, isomorphism, graph algorithm, Euler's path and Euler's cycle. Trees, properties of trees, rooted trees, search algorithms. Order of growth of functions, big - oh and little - oh notation, time estimate and complexity of algorithms. Prereq.: MATH 101 or MATH 102.

MATH 212 - Pure Mathematics & Statistics (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Statistical Methods applied to biological problems. Probability Theory - Statistical estimates and hypothesis testing - Regression - Correlation. Linear Algebra: (Matrices - elementary operations and matrices - Eigenvalues and Eigen vectors - Cayley-Hamilton theorem - Linear systems of equations). Numerical analysis (solution of equations - Newton Raphson formula - Interpolation - Aitken's formula - Newton's formulas - Iteration). Prereq.: MATH 115 or MATH 101.

MATH 213 - Applied Dfferential Equations (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Differential equations - first order (various types) - second order differential equations (homogeneous and non - homogeneous with constant coefficients) - variation of parameters - normal form solution in series. Prereq.: MATH 115 or MATH 101. Equivalent to MATH 203.

MATH 214 - Statistics & Computing (2 Cr. : 2 Lec : 2 Lab : 1 Tut)

Data organization and frequency distributions, measures of central tendency and dispersion, probability and random variables, bionomial and normal distributions, regression, estimation and hypothesis testing. Computer packages may be used to illustrate methods.

MATH 217 - Methods of Theoretical Physics (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Vector calculus with applications. Fourier series and Fourier integral with applications, Gamma, Beta and error functions; Legendre polynomial; Bessel functions; Hermite functions, Laguerre functions, set of orthogonal functions, Green's function methods, theory of linear vector spaces. Prereq.: MATH 101 or MATH 102.

MATH 218 - Classical Mechanics (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Mechanics of a system of particles in vector form, conservation of linear momentum, energy and angular momentum, degrees of freedom, generalised coordinates and velocities. Lagrangian, action principle, external action, Euler - Lagrange equations. Constraints, applications of the lagrangian formalism. Generalised momenta, Hamiltonian, Hamilton's equations of motion. Legendre transform, relation to Lagrangian formalism. Phase space, phase trajectories.

Applications to systems with one and two degrees of freedom. Central force problem, kepler problem, bound and scattering motions. Scattering in a central potential, Rutherford formula, scattering cross section. Non inertial frames of reference and pseudoforces: Centrifugal coriolis and euler forces. Elements of rigid - body dynamics. Euler angles. The symmetric top. Small oscillations normal mode analysis. Normal modes of a harmonic chain. Elementary ideas on general dynamical systems: Conservative versus dissipative systems. Hamiltonian systems and Liouville's theorem. Canonical transformations, poisson brackets. Action - angle variables. Non - integrable systems and elements of chaotic motion. Prereq.: MATH 103 or MATH 104.

MATH 219 - Mathematical Physics (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Introduction to complex variables and residue calculus, asymptotic methods, and conformal mapping; Integral transforms; Partial differential equations; Non - linear equations; Integral equations. Prereq.: MATH 101 or MATH 102.

MATH 305 - Differential Geometry (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Vectors in Euclidean space, basic rules of vector calculus in Euclidean space. Theory of curves: Arclength, tangent and normal plane, osculating plane, principal normal, curvature, binormal, moving trihedron of a curve, torsion, formulae of Frenet, evolutes and involutes, cylindrical helices, curvature and torsion of the involutes and Evolutes. Surfaces: Concept and class of a surface, curves on a surface, tangent plane and normal, family of surfaces, envelope, edge of regression, ruled surface, first fundamental form (metric), measurements of lengths and angles in a surface, area, second fundamental form, family of curves and orthogonal trajectories, normal sections and normal curvature, principal directions, Gaussian and mean curvatures, lines of curvature, geodesics. Prereq.: MATH 102.

MATH 306 - Special Functions (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Legendere and Bessel functions, Hermite and Laguerre polynomials, hypergeometric functions, Gamma, Beta and error functions. Properties of special functions. Prereq.: MATH 203 or MATH 215.

MATH 307 - Dynamics in 3D (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Velocity and acceleration, of a particle moving in three dimensions in terms of cylindrical polar and spherical polar coordinates, motion of heavy particle on smooth surfaces of revolution, motion of particle on a twisted curve, motion of a particle in a smooth tub rotating about a fixed axis. Dynamics of system of particles, general motion of a rigid body, rotation of rigid bodies about a fixed point under its own weight and the motion first integrals, classical special cases, the dynamical system, constraints and their classification, virtual and real displacements. Prereq.: MATH 205.

MATH 313 - Special Theory of Relativity (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Contravariant and covariant vectors. Contravariant, covariant and mixed tensors, fundemental operations with tensors, length of a vector, angle between vectors, Christoffel's symbols, geodesics breaking up the newtonian mechanics, the ingredients of relativity, galilean frames of references, the synchronization of clocks, the principle of equivalence, the Lorentz transformation, contraction of a moving rod, retardation of moving clock, transformation of trajectories, kinematics of moving frames, kinematics of moving particle, transformation formulae for velociy and acceleration, the propagation of light, the relativistic doppler effect, relativistic dynamics (Minkowski force) collision, the dynamics of photo.

MATH 314 - Potential Theory (2 Cr. : 2 Lec : 0 Lab :1 Tut)

Electrostatics: The electric field, boundary conditions, uniqueness of solution, equipotential surfaces, energy and stresses in the field, system of conductors, solution of potential problems using electrical images and harmonic functions, magnetostatics. The magnetic field, magnetic dipoles and magnetic shells, scalar and vector magnetic potentials, induced magnetism, boundary conditions, energy and stresses in magnetic fields, steady electric currents in continuous media, Ohm's law, equation satisfied by the electric potential of a steady current, boundary conditions, uniqueness of solutions. Prereq.: MATH 203.

MATH 315 - Advanced Numerical Analysis (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Numerical Methods for boundary value problems: Shooting, parallel shooting and finite difference methods for linear and nonlinear problems. Finite difference methods for partial differential equations, derivation and error analysis, consistency, stability and convergence. Numerical methods for the matrix eigenvalue problems: Power method and its variants, Householder method, the QR algorithm. Iterative methods for solving linear systems: Jacobi, Gauss - Seidel and SOR methods, derivation and error analysis. Numerical Methods for initial value problems: Euler, Taylor, Runge - Kutta, multistep, predictor - corrector methods. Prereq.: MATH 208.

MATH 317 - Computational Methods (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Fundamental methods of computational methods and applications; Numerical algorithms, linear algebra, differential equations; Computer simulation; Vectorization, parallelism, optimization and examples on scientific applications.

MATH 404 - Mathematical Logic (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Propositional algebra: Logical operations, equivalence of formulae, duality law, decision problem, principal normal forms. Propositional calculus: Concept of a formula, postulates of propositional calculus, the deduction theorem, the derived rules and some theorems of the propositional calculus, monotonicity, consistency and completeness of the Propositional calculus. Predicate calculus: Predicates, quantifiers, formulae of predicate calculus, axioms and rules of the predicate calculus, consistency and completeness of the predicate calculus, deduction and some theorems of the calculus. Prereq.: MATH 201.

MATH 406 - Number Theory (3 Cr. : 2 Lec : 1 Lab : 2 Tut)

Divisibility of Integers, congruences, arithmetic functions, diophantine equations, primitive roots, second order congruences, quadratic residues, Legendre's symbol, Jacobi's symbol, Higher order polynomial congruences, continued fractions. Prereq.: MATH 201.

MATH 407 - Measure Theory (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Abstract measure spaces, measurable functions, integration, general convergence theorems. Outer measure and measurability, extension theorem, Legesgue - Stieltjes integral, product measure, integral operaors. Mappings of measure spaces, Boolean s - algebras, Borel measures. Daniell integral, the extension theorem, uniqueness, measurability and measure. Prereq.: MATH 303.

MATH 409 - Boundary Value Problems (3 Cr. : 2 Lec : 1 Lab : 2 Tut)

Modelling problems, integral transforms, green functions, integral equations, applications to continuum media.

MATH 410 - Statistical Mechanics (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Classical statistical mechanics. Canonical ensemble and grand canonical ensemble. Quantum statistical mechanics. Fermi system. Bose system. Special topics in statistical mechanics (super fluid). Prereq.: MATH 310, MATH 311.

MATH 411 - Advanced Quantum Mechanics (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

The simple harmonic oscillator. The 3 - dimensional anisotropic oscillator. The 3 - dimensional isotropic oscillator. Angular momentum. Hydrogen atom. The particle in a sphere. The particle in a cylinder. Matrix mechanics and the spin - angular momentum. Approximation methods for the bound state: The stationary perturbation theory, time dependent perturbation theory, and the variation method. Scattering theory: Collision in three dimensions, partial wave analysis, born approximation, and slow collision. Prereq.: MATH 310.

MATH 413 - Electrodynamics (2 Cr. : 2 Lec : 0 Lab : 1 Tut)

Steady electric currents in continuous media. The field equations. Maxwell's equations. Equation of continuity of charge. The electromagnetic potentials. The magnetic field produced by steady electric currents. Electromagnetic waves. Electromagnetic waves in an isotropic dielectric. Plane polarized waves. Refletion and refraction of electromagnetic waves. Electromagnetic waves in a homogeneous conducting medium. Prereq.: MATH 314.

University Requirement Elective Course

MATH 005 - Introduction to Statistics (2 Cr. : 2 Lec)

Describing data & relationships - elementary probability - discrete and continuous random variables - probability distributions - sampling distributions and elements of statistical inference - confidence intervals; 1 and 2 - sample significance tests - comparisons - count data - Estimation and Hypothesis.

Bachelor of Science in Computer Science (120 Cr. Hr.)

Curricula

First Semester			Cr.
MATH	101	Calculus & Analytical Geometry I	2
MATH	103	Applied Mathematics I	2
PHYS	111	Principles of Physics I	4
CHEM	111	Principles of Chemistry I	4
		Elective (General)[1]	3
			15

Second Semester			Cr.
MATH	102	Calculus & Analytical Geometry II	2
MATH	104	Applied Mathematics II	2
PHYS	112	Principles of Physics II	4
CMPS	114	Introduction to Programming	2
CHEM	112	Principles of Chemistry II	4
		Elective (General)[1]	1
			15

Third Semester			Cr.
CMPS	201	Advanced Programming	3
CMPS	203	Fundamental Electric & Electronic Circuits	3
MATH	204	Linear Algebra	3
		Elective [2]	3
		Elective (General)[1]	4
			16

Fourth Semester			Cr.
CMPS	202	Data Structures I	3
CMPS	204	Computer Organization & Assembly	3
MATH	216	Discrete Structures	2
		Elective [2]	3
		Elective (General)[1]	4
			15

Fifth Semester			Cr.
CMPS	301	Data Structures II	3
CMPS	303	Software Engineering	3
CMPS	305	Theory of Computation	3
MATH	311	Statistical Methods & Computer Applications	2
		Elective (General)[1]	4
			15

Sixth Semester			Cr.
CMPS	302	Data Base Systems	3
CMPS	304	Computer Architecture	3
CMPS	306	Computer Networks	3
MATH	312	Operation Research	2
		Elective [2]	3
			14

Seventh Semester			Cr.
CMPS	401	Research Topics	1
CMPS	403	Programming Languages	3
CMPS	405	Operating Systems	3
		Elective [2]	9
			16

Eighth Semester			Cr.
CMPS	499	Senior Research in Computer Science	2
CMPS	404	Compiler Construction	3
CMPS	406	Artificial Intelligence	3
ITEC	404	Internet Programming	3
		Elective [2]	3
			14

[1] A total of 16 credits is required as General University Requirements; 5 credits are selected from the university Mandatory courses list including - ARAB 001 (2 Cr.); ENG 001(2 Cr.); BLAW 001(1 Cr.) & another 11 credits are selected from the university Elective courses list.

[2] Selected from departmental and faculty elective courses. To qualify for a minor in any field in the Faculty, a minimum of 18 credits must be earned in that field.

Mandatory Courses

CMPS 114 - Introductory to Programming (2 Cr. : 2 Lec : 2 Lab : 0 Tut)

An introduction to computer programming and problem solving, utilizing a block - structured high level language, with an emphasis on procedural abstraction and good programming style. This course covers the basic looping and selection constructs, procedures and functions, parameter passing, and scope of variables.

CMPS 201 - Advanced Programming (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Functions and parameter passing. Simple I / O. Exception handling. Primitive types. Arrays. Records. Strings and string processing. Data representation in memory. Pointers (or the notion of a reference in an object - oriented language). The concept of recursion. Recursive mathematical functions. Simple recursive procedures (towers of Hanoi, generating permutations). Divide - and - conquer strategies recursive backtracking. Prereq.: CMPS 114.

CMPS 202 - Data Structures I (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Introduction to algorithm analysis, and programs verification; Searching and sorting techniques. Specification and representation of the elementary data types (integers, real, character, logical). Specification, representation and implementation of basic data structure: Linear data structures (arrays, lists, queues, stacks, double ended queues, files). Implementation of linked and dynamic data structures. Prereq.: CMPS 201.

CMPS 203 - Fundamentals of Electric & Electronic Circuits (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Network analysis for AC and DC circuits, network theory, circuit laws, RLC sinusoidal transients, resonance, transformer, two - port network, semiconductors, diodes and applications, bipolar transistor operation and biasing, field - effect transistor operation and biasing, amplifier circuit and feedback amplifiers.

CMPS 204 - Computer Organization & Assembly (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Structures of microcomputers and workstations: Architecture, design, and assembly language programming. Instruction set, addressing modes, indexing, subroutines, parameters passing, and stack operations. Number representation and arithmetic. Conditional assembly and macros. System software and cross - assemblers. Assembler interface to a high - level language in some appropriate format. Prereq.: CMPS 201 and CMPS 203.

CMPS 301 - Data Structures II (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Specification, representation and implementation of non - linear data structures (trees, binary trees, AVL trees, B - trees, graphs). Implementation of linked and dynamic data structures. Prereq.: CMPS 202.

CMPS 302 - Data Base Systems (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Entity - relationship (E / R) models. E / R model designs and constraints. Object definition language (ODL). The relational model. Converting E / R models to relational designs. Converting ODL models to relational designs. Design of relational database schemas. 3NF, 4NF, BCNF. SQL and relational algebra. Data definition using SQL. Constraints in relational algebra and SQL. Bags vs. sets, extended operators. Extended operators and views.

CMPS 303 - Software Engineering (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Different phases of large - scale software development with emphasis on analysis, design, and documentation. Topics include: Preliminary investigation, analysis methods, and modeling tools. Design of files and databases, user interface, program design, testing, and project management. Students work in groups on realistic projects to apply covered techniques. Prereq.: CMPS 201.

CMPS 304 - Computer Architecture (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Instruction set architectures, RISC processors, introduction to the MIPS instruction set, performance, designing a simple processor, a single cycle datapath implementation, a multi - cycle implementation, control unit design, pipelining. Prereq.: CMPS 204.

CMPS 305 - Theory of Computation (3 Cr. : 2 Lec : 0 Lab : 2 Tut)

Deterministic Finite Automata (DFA) and regular languages Non - Deterministic Finite Automata (NFA). Equivalence of NFAs and DFAs. Closure properties. Regular expressions. The pumping lemma. Pushdown automata. Pushdown automata. Context free languages. Ambiguity and Chomsky normal form. Turing machines. Turing machines variants. enumerators. Decidability. Diagonalization. The halting problem. Reducibility. Time complexity. P and NP. Polytime reductions. NP - completeness. Prereq.: MATH 216, CMPS 201.

CMPS 306 - Computer Networks (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Fundamental principles in computer networks are applied to obtain practical experience and skills necessary for designing and implementing computer networks, protocols, and network applications. Various network design techniques, simulation techniques, and UNIX network programming are covered.

CMPS 401 - Research Topics (1 Cr. : 1 Lec : 0 Lab : 0 Tut)

CMPS 403 - Programming Languages (3 Cr. : 2 Lec ; 3 Lab : 0 Tut)

Scheme. Expression evaluation and a simple model of evaluation. Data procedures. Local variables, logical operators. Data driven programming. Inductive definitions, BNF, recursion. Mutual recursion. Properties of variables. Data abstraction. Abstract syntax. Environments. Mutable data and sequencing. An new evaluation model. Transformational languages. Environment passing interpreters. Conditional evaluation and local binding. User - defined procedures and closures. Variable assignment. Parameter passing. Lazy evaluation. Aggregate data implementations. Statements. Type checking. Type inference and type abstractions. Polymorphism. Object oriented language. Inheritance. Implementing object - oriented features. Control context and continuations. A continuation passing interpreter. Procedural representation of continuations. Exceptions and control flow. Logic programming. Prereq.: CMPS 201.

CMPS 404 - Compiler Construction (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Compiler functions. Language elements. BNF grammars, regular expressions. Finite state machines. Lexical analyzers. Context free grammars. Grammar ambiguity. Parse trees. Push down automata. Parsing methods (top - down, recursive descent, LL, LR). Symbol table construction. Type checking. Code generation. Handling recursion and arrays. Code optimization techniques. Prereq.: CMPS 301.

CMPS 405 - Operating Systems (3 Cr. : 2 Lec : 3 Lab)

Structuring methods and the layered model. Evolution of hardware / software techniques. Device organization. Interrupts. User / system state and protection. State diagrams. Structures (ready list, process control blocks, and so forth). Dispatching and context switching. Concurrent execution. Mutual exclusion deadlock and starvation. Models and mechanisms (semaphores, monitors, rendezvous). Producer - consumer problems. Preemptive and non - preemptive scheduling. Schedulers and policies. Processes and threads. Deadlines and real - time issues. Overlays, swapping, and partitions. Paging and segmentation. Memory mapped files. Placement and replacement policies. Serial or parallel device. Servers and interrupts. File layout. Directories: Contents and structure. Sequential files. Non - sequential files. Process and task scheduling. Memory and disk management. Real - time systems. Prereq.: CMPS 202.

CMPS 406 - Artificial Intelligence (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Definitions of intelligent systems. Optimality vs. speed tradeoff. Problem spaces. Brute - force search (DFS, BFS, uniform cost search).Heuristic search (best - first, A*, IDA*). Local search (hill - climbing, simulated annealing, genetic search). Game - playing methods (minimax search, alpha - beta pruning). Constraint satisfaction (backtracking and heuristic repair). Representation of space and time. Representations of events and actions probabilistic reasoning. Bayes theorem. Predicate calculus and resolution. Logic programming and theorem proving. AI planning systems. Unsupervised vs. supervised learning. Inductive vs. deductive. Classification vs. clustering vs. prediction. Decision tree learning and neural network learning as examples. Design and development of knowledge - based systems. Knowledge representation mechanisms. Reasoning with uncertainty (non - monotonic logics, certainty factors, fuzzy logic). Knowledge acquisition techniques. Knowledge engineering. Tools for knowledge - based system development. Prereq.: CMPS 305 and CMPS 301.

CMPS 499 - Senior Research in Computer Science (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Elective Courses

CMPS 205 - Computer Programming (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

An intermediate course in programming for non computer science majors. Topics include: Simple data types, arrays, records, files, user - defined types, control structures, procedures, functions, recursion, program design and top - down stepwise refinements; Algorithms for searching, simple sorting algorithms. Programming will be done in an appropriately chosen high level. Prereq.: CMPS 114 or equivalent.

CMPS 206 - Introduction to Computer (3 Cr. : 2 Lec : 2 Lab : 0 Tut)

Includes an overview of computers, structure, components, hardware, software, and applications. Laboratory experience with applications software and scientific packages. Prereq.: CMPS 114 or equivalent.

CMPS 208 - Computing for the Natural Sciences (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Computing techniques emphasizing solutions to problems encountered in the mathematical and natural sciences. This course is not offered to computer science majors. Prereq.: CMPS 114 or equivalent.

CMPS 209 - Computer & Society (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Technology and humanity, social and political impacts of computers. Privacy and information: Wire tapping and encryption, internet security, communication in cyberspace, censorship. Protecting software and their intellectual property: Patent, cyberspace copyright. Computer crimes.

CMPS 210 - Logic Design of Digital Systems (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Boolean algebra. Basic combinational circuits: Analysis and synthesis. Elements of sequential circuits: Latches, flip - flops, counters, and memory circuits. Synchronous and asynchronous sequential circuits. Logic minimization. Finite state machines design and synthesis. Use of hardware description language such as VHDL in the design process. Prereq.: CMPS 203.

CMPS 307 - Object Oriented Programming (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Object oriented concepts and techniques for analysis, design, and implementation. Topics include encapsulation, abstract data types, polymorphism, reusability, object: Static, dynamics and interaction; Classes, relationships, and instances; Object oriented languages and implementation. Prereq.: CMPS 201.

CMPS 310 - File Structure (3 Cr. : 2 Lec : 3 Lab : 1 Tut)

Language essentials for file processing. Access methods, processing algorithms; I / O devices; Sequential files, indexed and tree structured files (B - Trees), hashed files. Prereq.: CMPS 301.

CMPS 311 - Discrete Structures (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Algorithms, programs and correctness proofs, propositional logic, predicate logic, sets, binary relations and functions (a review), countability of sets, partially ordered sets, basic graph theory, formal languages & machines (automata & regular expressions), the halting problem and computability + algorithmic analysis, complexity theory. Prereq.: MATH 216 or MATH 210.

CMPS 314 - Data Compression (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Document databases. Compression models: Static and adaptive. Arithmetic coding. Context modeling, PPM. Dictionary techniques (Ziv - lempel variants). Synchronization, performance. Indexing and compression, signature files, bitmaps. Lexicon structures, perfect hashing. Querying: Access structures, string matching, ranking, cosine measures. Index construction. Bilevel image compression, JBIG, JPEG - LS. Lossy image compression, JPEG. Q - Coder and vector quantization. Prereq.: CMPS 301.

CMPS 410 - Logic & Automated Reasoning (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Elementary set theory. Propositional logic. Propositional logic reasoning using resolution. Normal forms, clauses, resolution. First - order / predicate logic introduction. Quantifiers, first order models, validity and satisfiability. First - order reasoning using unrestricted resolution. Normal forms, clauses, Skolemization. Elimination of quantifiers, unification, resolution, simplification techniques. Orderings. Well - founded orderings, lexicographic combinations of orderings, multi - sets, multi - set orderings, reduction orderings, lexicographic path orderings. Refutational completeness of propositional resolution. Herbrand interpretations, soundness, clause orderings, construction of candidate models,

reduction of counter - examples, model existence theorem, refutational completeness, compactness of propositional logic. Refutational completeness of first - order resolution. Lifting principle, saturation, refutational completeness, Herbrand's theorem, Löwenheim - Skolem theorem, compactness of first - order logic. Saturation - based framework of resolution calculi. Ordered resolution with selection, lifting, refutational completeness, Craig interpolation, redundancy concept, saturation up to redundancy, practical model of a resolution prover, fairness, refinements of resolution, hyperresolution. Neuman - Stubblebine key exchange protocol. Semantic tableaux Semantic tableau for propositional logic, decidability, refutational completeness, free - variable tableau, AMGU substitution rule, treatment of - formulae, refutational completeness. Logic Programming. Horn clauses, SLD resolution, Prolog. Prereq.: CMPS 403.

CMPS 411 - Software Project Management (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Emphasis is placed on the organization of projects, teams and activities pertaining to software projects.

CMPS 412 - Computability & Formal Languages (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Strings and languages. Regular languages. Deterministic finite automata. Nondeterministic finite automata. Regular expressions. Non - regular languages. Context - free languages. Context - free grammars. Pushdown automata. Non - context - free languages. Church - turing thesis. Turing machines. Decidability. The Halting problem. Reductions. Post correspondence problem. Computability. Advanced topics in computability. Time complexity. P and NP. NP - completeness. Space complexity. PSPACE. PSPACE - completeness. L and NL. NL - completeness. Intractability. Advanced topics in complexity theory. Approximation algorithms. Probabilistic algorithms. Alternation. Interactive proof systems. Parallel computation. Cryptography. Prereq.: CMPS 305.

CMPS 413 - Computer Graphics (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Raster and vector graphics system. Video display devices. Physical and logical input devices. Issues facing the developer of graphical systems. Hierarchy of graphics software. User interface. Half - toning. Font generation: Outline vs. bitmap. Representation of polyhedral objects. Scan conversion of 2D primitive, forward differencing. Tessellation of curved surfaces. Homogeneous coordinates. Affine transformations (scaling, rotation, translation). Viewing transformation. Clipping. Hidden surface removal methods. Z - buffer and frame buffer, color channels (a channel for opacity). Color models (RGB, HVS, CYM). Light source properties; Material properties; Ambient, diffuse, and specular reflections. Phong reflection model. Rendering of a polygonal surface, flat shading, gouraud shading, and Phong shading. Texture mapping, bump texture, environment map. Ray tracing. Image synthesis, sampling techniques, and anti - aliasing. Parametric polynomial curves and surfaces. Implicit curves and surfaces. Bézier curves and surfaces, control points, de Casteljau algorithm. B - spline curves and surfaces, local editing, knots, control points. NURBS curves and surfaces. Constructive Solid Geometry (CSG) for solid modeling. Boundary Representation of solids (B - Rep). Prereq.: CMPS 301 & (MATH 204 or MATH 211).

CMPS 414 - Data & Algorithm Analysis (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Problems, complexity, analysis; Asymptotics. Recurrences; The master method. Hashing. Dynamic programming. Greedy algorithms. Depth - 1st search; Strongly. Connected components. Minimum spanning trees. Prim's and Kruskal's algorithms. Single - source shortest paths; Bellman - Ford. Dijkstra. All - pairs shortest paths; Floyd - Warshall. Polynomial time and NP - completeness. Proving problems NP - complete. Approximation algorithms. String matching. Prereq.: CMPS 301 and CMPS 305.

CMPS 415 - Computing Algorithms (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Complexity of algorithms. Asymptotic notation. Worst case / average case bounds. Recurrence relations. Design of efficient algorithms. Polynomial evaluation. Divide and conquer. Dynamic programming. Sorting and searching. Binary search. Radix sort, insertion sort, merge sort. Quick sort, heap sort. Order statistics. Graph algorithms. Graph traversal. Minimum spanning trees. Shortest path problems. Hamiltonian tours. Geometrical algorithms. Convex hulls and related problems. Optimal placement. Intersection problems. Algebraic and numeric problems. Polynomial multiplication. Matrix multiplication and related problems. Fast Fourier transform. NP - completeness. Intractable problems. Cook's theorem. NP - completeness proofs. Coping with NP - complete problems. Parallel algorithms. Algorithms for shared - memory machines. Algorithms for interconnection networks. Prereq.: CMPS 301 and CMPS 305.

CMPS 416 - Software Engineering for Web Applications (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Principles of web - based applications. Summary HTTP as an application layer protocol. MIME types Server side programming including CGI, server - side scripts, and Java server applets. Client side programming including Javasctript and Java applets. Principles of data management. Web - based data management concurrency. Unpredictable load. Security risks. Wide - area distributed computing. Web services. Prereq.: CMPS 303.

CMPS 417 - Data Mining (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Basic concepts behind data mining. Data mining applications, techniques and models. Data mining software suite. Exploration of data mining methodologies. Decision tables, decision trees, classification rules, association rules, clustering, statistical modeling, and linear models. More extensive use of SPSS' clementine data mining suite. Prereq.: CMPS 302 and MATH 311.

University Requirement Mandatory Course

CMPG 001 - Introduction to Computer (2 Cr. : 1 Lec : 2 Lab)

This course intends to familiarize the students with computer systems, their applications and their components, and provide them with the practical experience on several popular packages.

Bachelor of Science in Information Technology (120 Cr. Hr.)

Curricula

First Semester			Cr.
MATH	101	Calculus & Analytical Geometry I	2
MATH	103	Applied Mathematics I	2
PHYS	111	Principles of Physics I	4
CHEM	111	Principles of Chemistry I	4
		Elective (General)[1]	3
			15

Second Semester			Cr.
MATH	102	Calculus & Analytical Geometry II	2
MATH	104	Applied Mathematics II	2
PHYS	112	Principles of Physics II	4
CMPS	114	Introduction to Programming	2
CHEM	112	Principles of Chemistry II	4
		Elective (General)[1]	1
			15

Third Semester			Cr.
CMPS	201	Advanced Programming	3
ITEC	201	Introduction to Information Systems	3
MATH	204	Linear Algebra	3
		Elective [2]	3
		Elective (General)[1]	4
			16

Fourth Semester			Cr.
CMPS	202	Data Structures I	3
ITEC	202	E - commerce	3
MATH	216	Discrete Structures	2
		Elective [2]	3
		Elective (General)[1]	4
			15

Fifth Semester			Cr.
ITEC	301	IS Analysis & Design	3
CMPS	303	Software Engineering	3
ITEC	303	Information Technology I	3
ITEC	305	Multimedia Systems	3
		Elective [2]	3
			15

Sixth Semester			Cr.
CMPS	302	Data Base Systems	3
ITEC	302	Software Project Management	3
CMPS	306	Computer Networks	3
MATH	312	Operation Research	2
		Elective [2]	3
			14

Seventh Semester			Cr.
ITEC	401	Research Topics	1
ITEC	403	Software Design & Quality	3
CMPS	405	Operating Systems	3
		Elective [2]	5
		Elective (General)[1]	4
			16

Eighth Semester			Cr.
ITEC	499	Senior Research in Information Technology	2
ITEC	404	Internet Programming	3
ITEC	405	Computer & Information Security	3
ITEC	406	Decision Support Systems	3
		Elective [2]	3
			14

[1] A total of 16 credits is required as General University Requirements; 5 credits are selected from the university Mandatory courses list including - ARAB 001 (2 Cr.); ENG 001 (2 Cr.); BLAW 001 (1 Cr.) & another 11credits are selected from the university Elective courses list.

[2] Selected from departmental and faculty elective courses. To qualify for a minor in any field in the Faculty, a minimum of 18 credits must be earned in that field.

Mandatory Courses

ITEC 201 - Introduction to Information Systems (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Overview of computer and information systems applications in various disciplines. Defining information systems, how they transform organizations, types of information systems, strategic information systems, information systems for decision making, introduction to e - business, e - commerce, and knowledge management.

ITEC 202 - E - Commerce (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Defining e - commerce, features of internet - based business, e - commerce new business models, infrastructure, functionalities and information requirements, internet security, on - line payment systems, introduction to supply chain integration and customer relationship management.

ITEC 301 - Information System Analysis & Design (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Types of information systems. Information systems development life cycle. Analytical skills. Managing the information systems project. Gantt and pert charts. Automated tools for systems development. Identifying and selecting systems development projects. Corporate strategic planning. Information systems planning. Project initiation and planning process. Evaluating the technical risks. Approaches to system development. Investigating system requirements. Modeling system requirements. Process modeling. Logic modeling. Conceptual data modeling. The object - oriented approach to requirements. Evaluating requirements. Designing databases. Designing the user interface.

ITEC 302 - Software Project Management (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Emphasis is placed on the organization of projects, teams and activities pertaining to software projects. Prereq.: CMPS 201.

ITEC 303 - Information Technology I (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Study of major IT related issues or fields based on current trends in the area, such as wireless technologies. Principles of managing e - commerce applications are also emphasized. Prereq.: CMPS 114.

ITEC 305 - Multimedia Systems (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Covers main aspects of hardware and software of multimedia systems.

ITEC 401 - Research Topics (1 Cr. : 1 Lec : 0 Lab : 0 Tut)

ITEC 403 - Software Design & Quality (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Critical aspects of the software lifecycle. Quality of software system. Techniques and approaches to software design, quality and reliability, domain engineering and software reuse. Prereq.: CMPS 303.

ITEC 404 - Internet Programming (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

The course emphasizes the engineering approach to internet - based applications as well the programming paradigms and languages used in the process. Students will experience HTML, DHTML, XML (and variants), CGI and others. Prereq.: CMPS 201.

ITEC 405 - Computer & Information Security (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Introduction to the protection of computer systems and networks. Authentication, access controls, malicious software, formal security methods, firewalls, intrusion detection, cryptography and information hiding, risk management, computer forensics, and ethics. Defense techniques, intrusion detection, scan techniques and detection, forensics, denial of service techniques and defenses, libpcap, libdnet and libnet programming. Public - key cryptosystems, signatures, pseudo - random sequences, hash functions, key management, and threshold schemes. Prereq.: CMPS 306.

ITEC 406 - Decision Support Systems (3 Cr. : 2 Lec : 3 Lab)

Defining decision support systems, DSS components, data acquisition, data warehousing and data mining. Quantitative models, and model management systems, user interface systems, knowledge management systems, collaborative computing and group support systems, enterprise information systems. Prereq.: CMPS 302.

ITEC 499 - Senior Research in Information Technology (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Elective Courses

ITEC 203 - Feasibility Study of Projects (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Equivalent to ISYS 203. All aspects of feasibility, including economic, technical, operational and temporal, are covered and practiced on real life cases. Prereq.: CMPS 114.

ITEC 204 - Computer & Society (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Technology and humanity, social and political impacts of computers. Privacy and Information: Wire tapping and encryption, internet security, communication in cyberspace, censorship. Protecting software and their intellectual property: Patent, cyberspace copyright. Computer crimes: Software privacy, hacking, information theft, digital forgery, internet crimes.

ITEC 205 - Introduction to Human - Computer Interaction (HCI) (2 Cr. : 2 Lec : 2 Lab : 0 Tut)

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. Prereq.: CMPS 201.

ITEC 304 - System Simulation (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Types of systems. Types of models. Discrete and Continuous systems. Stages of a typical simulation study. Concepts of system clocks, event scheduling vs time advance algorithms. Random numbers. Roles of random numbers in simulation, pseudo random number generation techniques, methods of testing PRN sequences. Random varieties.

Generation, inverse transformation techniques with exponential distributions and empirical continuous distributions. Direct isolations with normal distributions. Acceptance, rejection techniques, with poison distribution. Simulation languages. CPSS, SIMULA, SIMSCRIPT. Object oriented simulation.

ITEC 306 - System Modeling (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Input modeling. Data collection. Distribution functions such as normal, poisson, exponential distributions. Goodness of fit tests, Chi square test. Input model with out data, effect of covariance and correlation of the quality of data. Verification and validation of models. Guidelines for verification of models, their calibration and validation. Face validity. Validation of model assumptions. Validating input - output transformations, use of historical data. Evaluation of simulation experiments. Length of simulation run, static and dynamic stochastic simulations, elimination of transients. Auto correlated observations, variance reduction techniques. Prereq.: CMPS 201 and Math 311.

ITEC 307 - System Documentation (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Covers main principles of documenting system requirements and essential characteristics such that any subsequent updates can be easily incorporated.

ITEC 407 - Information Technology II (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Study of major IT related issues or fields based on current trends in the area, such as wireless technologies. Principles of development of e - commerce applications will also be covered.

ITEC 408 - Online Multimedia & Information Access (2 Cr. : 2 Lec : 2 Lab : 0 Tut)

Organizing multimedia content, physical storage and retrieval of multimedia data, content - based search and retrieval, creating and delivering networked and multimedia presentations. Different types of multimedia data, different techniques to store, manipulate, and retrieve multimedia data residing across global computer networks. Prereq.: CMPS 302.

ITEC 409 - Information Storage & Retrieval (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Basic principles and tools for analysis and retrieval of documents in bibliographic information systems. Acquisition of information, subject analysis, terminology control, coding and recording of results of analysis on a searchable medium, and question analysis and search strategy development. Prereq.: CMPS 302.

ITEC 410 - Digital Libraries (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Foundations. Search, retrieval, resource discovery. Multimedia, representations. Architectures. Interfaces. Metadata. Electronic publishing. Database issues. Agents. Commerce, economics, publishers. Intellectual property rights, security. Social issues. Prereq.: CMPS 302.

ITEC 411 - Office Automation (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

This subject provides a detailed overview of the concepts and processes used indoing business electronically. This will include information exchange processes (EDI) and inter - and intra - organizational communications; Electronic exchange and business including EET, smart cards and electronic money.

ITEC 412 - Forecasting & Time Series (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Time - critical decision modeling and analysis, causal models, smoothing techniques, averaging models, Box - Jenkins models, filtering, neural network modeling, seasonal forecasting and Delphi analysis. Measuring forecasting accuracy.

ITEC 413 - Corporate Information Technology (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Examines theories, concepts, principles and applications for managing the information technology and information systems (IT / IS) function. Topics include: Strategic planning of IT / IS activities; Project - level planning and management; Role of chief information officer; Structuring IT / IS organization to meet key customer needs; Achieving balance between in - sourcing and out - sourcing of IT / IS; Managing IT / IS human resources; Managing IT / IS data resources; Managing IT / IS acceptance by user; Managing relationships with stakeholders in IT / IS development; and use processes.

Department of Physics

Bachelor of Science in Physics (120 Cr. Hr.)

Curricula

First Semester			Cr.
MATH	101	Calculus & Analytical Geometry I	2
MATH	103	Applied Mathematics I	2
PHYS	111	Principles of Physics I	4
CHEM	111	Principles of Chemistry I	4
		Elective (General)[1]	3
			15

Second Semester			Cr.
MATH	102	Calculus & Analytical Geometry II	2
MATH	104	Applied Mathematics II	2
PHYS	112	Principles of Physics II	4
CHEM	112	Principles of Chemistry II	4
CMPS	114	Introduction to Programming	2
		Elective (General)[1]	1
			15

Third Semester			Cr.
PHYS	201	Thermal Physics	3
PHYS	203	Physical Optics	3
MATH	203	Differential Equations	2
MATH	207	Vector Analysis	2
		Elective [2]	2
		Elective (General)[1]	3
			15

Fourth Semester			Cr.
PHYS	202	Classical Mechanics	3
PHYS	204	Modern Physics	3
PHYS	206	Electromagnetism	3
MATH	306	Special Functions	3
		Elective (General)[1]	3
			15

Fifth Semester			Cr.
PHYS	301	Statistical Physics	2
PHYS	303	Quantum Physics I	3
PHYS	305	Electronics	4
		Elective [2]	3
		Elective (General)[1]	3
			15

Sixth Semester			Cr.
PHYS	304	Quantum Physics II	3
PHYS	306	Nuclear Physics I	4
		Elective [2]	5
		Elective (General)[1]	3
			15

Seventh Semester			Cr.
PHYS	401	Research Topics	1
PHYS	403	Nuclear Physics II	3
PHYS	405	Solid State Physics I	4
PHYS	407	Advanced Atomic Physics	3
		Elective [2]	5
			16

Eighth Semester			Cr.
PHYS	499	Senior Research in Physics	2
PHYS	404	Molecular Physics	3
PHYS	406	Solid State Physics II	4
		Elective [2]	5
			14

[1] A total of 16 credits is required as General University Requirements; 5 credits are selected from the university Mandatory courses list including - ARAB 001 (2 Cr.); ENG 001 (2 Cr.); BLAW 001 (1 Cr.) & another 11credits are selected from the university Elective courses list.

[2] Selected from departmental and faculty elective courses. To qualify for a minor in any field in the Faculty, a minimum of 18 credits must be earned in that field.

Mandatory Courses

PHYS 111 - Principles of Physics I (4 Cr. : 3 Lec : 2 Lab : 1 Tut)

Units and dimensions, mechanical properties of matter, flow of liquids, Bernoulli's equation, viscosity, surface tension, elasticity. Heat and temperature, thermometry, thermal expansion, thermostats, heat measurements, calorimetry, mechanical equivalent of heat, transfer of heat by: Conduction, convection and radiation, kinetic theory of gases, introduction to thermodynamics. Periodic motions, addition of simple harmonic motions, vibrations of physical systems, forced vibrations and resonance, coupled oscillations and normal modes, normal modes of continuous systems, longitudinal and transverse wave motion, standing waves, interference, sound.

PHYS 112 - Principles of Physics II (4 Cr. : 3 Lec : 2 Lab : 1 Tut)

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. Nature of light, theories of light, speed of light, reflection and refraction at a plane surface, Snell's law, total internal reflection, refraction by prisms, reflection and refraction at spherical surfaces, thin lens, thick lens, lens aberrations, optical instruments, the eye and vision, defects of vision. Thomson's experiment, Millikan's experiment, x - ray tube, x - ray spectrum, natural and artificial radioactivity.

PHYS 113 - Biophysics (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

This course covers many topics statics and dynamics, thermodynamics and heat transfer, physics related to hydrotherapy and buoyancy, bioelectricity and biomagnetism, acoustic and electromagnetic radiations in physical therapy, and radiation protection.

PHYS 114 - Elementary Physics (3 Cr. : 2 Lec : 2 Lab : 1 Tut)

Units and dimensions, surface tension, flow of liquids, Bernoulli's equation, viscosity. The ideal gas law, the temperature scale, thermometry, thermal expansion, thermostats, heat measurements, calorimetry, mechanical equivalent of heat, transfer of heat by: Conduction, convection and radiation. Nature of light, theories of light, speed of light, reflection and refraction at a plane surface, Snell's law, total internal reflection, refraction by prisms, reflection and refraction at spherical surfaces, thin lens, thick lens, lens aberrations, optical instruments, the eye and vision, defects of vision, physiological effect of light.

PHYS 115 - Physics & Statistics (3 Cr. : 2 Lec : 2 Lab : 0 Tut)

Units and dimensions, flow of liquids, Bernoulli's equation, viscosity. Heat and temperature, thermometry, thermal expansion, heat measurements, calorimetry, transfer of heat by: Conduction, convection and radiation. Thomson's experiment, Millikan's experiment, x - ray tube, x - ray spectrum, natural and artificial radioactivity. Statistics: Sample space and the algebra of events, conditional probability, permutation and combinations, Baye's theorem, frequency distribution and grouping, measure of central tendency and measure of variability; Normal, poisson and binomial distributions, mathematical expectation, generating functions, moment generating function, cumulative generating function.

PHYS 131 - Physics (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Heat and temperature, thermal expansion, heat measurements, calorimetry, mechanical equivalent of heat, transfer of heat by: Conduction, convection and radiation. Periodic motions, addition of simple harmonic motions, vibrations of physical systems, forced vibrations and resonance, coupled oscillations and normal modes, longitudinal and transverse wave motion, standing waves, interference.

PHYS 201 - Thermal Physics (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Fundamental concepts, the first law of thermodynamics, the non - flow equation, the steady flow equation, reversible and irreversible processes, the second law of thermodynamics, the heat engines, entropy, temperature - entropy diagrams, properties of the ideal and Van der Waals gases, thermodynamic functions and relations, the Maxwell relations, the Clausius - Clapeyron equation, the 3rd law of thermodynamics, applications of thermodynamics to simple systems. Prereq.: PHYS 111.

PHYS 202 - Classical Mechanics (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Mechanics of a system of particles in vector form, conservation of linear momentum, energy and angular momentum, degrees of freedom, generalized coordinates and velocities. Lagrangian, action principle, external action, Euler - Lagrange equations. Constraints, applications of the lagrangian formalism. Generalized momenta, Hamiltonian, Hamilton's equations of motion. Legendre transform, relation to Lagrangian formalism. Phase space, phase trajectories. Applications to systems with one and two degrees of freedom. Central force problem, Kepler problem, bound and scattering motions. Scattering in a central potential, Rutherford formula, scattering cross section. Non inertial frames of reference and pseudo - forces: Centrifugal coriolis and euler forces. Elements of rigid - body dynamics. Euler angles. The symmetric top. Small oscillations normal mode analysis. Normal modes of a harmonic chain. Elementary ideas on general dynamical systems: Conservative versus dissipative systems. Hamiltonian systems and Liouville's theorem. Canonical transformations, poisson brackets. Action - angle variables. Non - integrable systems and elements of chaotic motion.

PHYS 203 - Physical Optics (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Wave nature of light, principles of wave motion, coherence, interference of light, multiple reflection in thin films, theory of multilayer films, interferometers, diffraction of light, resolving power of optical instruments, polarization of light, optical activity, Kerr's and Faraday's effects. Prereq.: PHYS 112.

PHYS 204 - Modern Physics (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Black body radiation, photoelectric effect, quantization of light, Compton effect, Bohr theory of hydrogen atom. The Schrödinger equation in one dimension. The structure of atomic nuclei, law of radioactivity.

PHYS 206 - Electromagnetism (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Electrostatic field in vacuum, electrostatic field in dielectric media, magnetostatics, magnetostatic fields in matter; Magnetic properties of matter, magnetic energy, slowly varying fields; Maxwell's equations. Prereq.: PHYS 112.

PHYS 301 - Statistical Physics (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Scope of statistical physics, probability, statistical equilibrium, the Maxwell - Boltzmann distribution, applications to ideal gases and electromagnetic properties of materials, statistical interpretation of the laws of thermodynamics, the Fermi - Dirac distribution, application to electrons in metals, the Bose - Einstein distribution, application to blackbody radiation, specific heat of a diatomic gas. Prereq.: PHYS 201.

PHYS 303 - Quantum Physics I (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Wave packets and the uncertainty relations, Schrödinger wave equation and probability interpretations, eigenfunctions and eigenvalues, one dimensional potentials and barriers. The general structure of wave mechanics, operator methods in quantum mechanics. N - particle systems, Schrödinger equation in three dimensions, angular momentum, solution of Schrödinger equation for the hydrogen atom. Prereq.: PHYS 202.

PHYS 304 - Quantum Physics II (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Operator matrices and spin, interaction of electrons with electromagnetic fields, addition of angular momentum, perturbation theories, born approximations, relativistic quantum physics, theory of scattering, phase shifts.

PHYS 305 - Electronics (4 Cr. : 3 Lec : 3 Lab : 0 Tut)

PN junction diode, special diodes, bipolar transistor and its applications. Field effect transistors, small signal FET amplifiers, logic circuits, operational amplifiers, basic operational amplifier circuit, active filters, oscillators.

PHYS 306 - Nuclear Physics I (4 Cr. : 3 Lec : 3 Lab : 0 Tut)

General properties of atomic nucleus, scattering of α- particles, nuclear size and its determination, mass spectroscopy, theories of nuclear composition, binding energy, detection and measurements of nuclear radiation, ionization chamber, region of multiplicative operation, proportional counter, Geiger - Müller counter, scintillation counter, solid state detectors.

PHYS 401 - Research Topics (1 Cr. : 1 Lec : 0 Lab : 0 Tut)

The physics seminar covers areas selected and approved by the department board.

PHYS 403 - Nuclear Physics II (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Nuclear forces, the deuteron, nucleon - nucleon scattering, properties of the nuclear forces, the exchange force model, nuclear models, the liquid drop model, parity, the shell model, alpha, beta and gamma decays, nuclear reactions, coulomb scattering, nuclear scattering, cross section, compound nucleus reactions, direct reactions, neutron physics, fission reactions, fusion reactions.

PHYS 404 - Molecular Physics (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Molecular structure: Molecular orbital, theory of diatomic and polyatomic molecules. Molecular rotation and vibration: Spectroscopic transitions, the rotation and vibration of diatomic and polyatomic molecules. Molecular electronic transitions, Hund coupling cases, vibrational transitions, the electronic spectra of polyatomic molecules. The electronic properties of molecules: The response to electrostatic fields, bulk electrical properties. The magnetic properties of molecules. Scattering theory.

PHYS 405 - Solid State Physics I (4 Cr. : 3 Lec : 3 Lab : 0 Tut)

Crystal structure: Elementary crystallography, typical crystal structures, x - ray crystallography. Crystal dynamics: Lattice vibrations of one - dimensional crystals, lattice vibrations of three - dimensional crystals, phonons, phonon heat capacity, anharmonic effects, thermal conduction by phonons.

PHYS 406 - Solid State Physics II (4 Cr. : 3 Lec : 3 Lab : 0 Tut)

Free electrons in metals: The free electron model, transport properties of the conduction electrons, Band theory: Energy bands in solids, electron in a periodic potential, nearly - free electron model, classification of crystalline solids into metals, insulators and semiconductors, the tight - binding model, band structure and the effective mass, Fermi surfaces, construction of Fermi surfaces, electron orbits, quantization of orbits in a magnetic field, de Haas - van Alphen effect, magnetic breakdown.

PHYS 407 - Advanced Atomic Physics (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Rotational motion of the hydrogen atom, angular momentum, operators, the definition of states, composite systems. Group theory, the calculus of symmetry, reduced representation, the full rotation group, techniques of approximations, time dependent perturbation, variation theory, atomic spectra and atomic structure, electronic structure, Hartree - Fock self - consistent field method, electron correlation, density functional theory, semi - empirical methods.

PHYS 499 - Senior Research in Physics (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

An in - depth study of particular topics in physics. The included topics are selected by groups of students and approved by the department board.

Elective Courses

PHYS 209 - Biophysics I (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Electric dipoles, detection and communication by electric fields, electric hazards, leakage currents, strain guage, resistance of living cells, pacemaker, electrophoresis, magnetic navigation in animals, the structure of nerve cells, the resistance and capacitance of an axon, ionic concentration and the resting potential, electroencephalograph and electrocardiograph.

PHYS 210 - Biophysics II (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Radioactivity, carbon dating, radiation dosimetry, nature and effects of ionizing radiation on living cells, applied radiobiology and radionuclides, genetic effects of ionizing radiation and methods of protection, harmful effect of ionizing and non - ionizing radiation, x - rays and gamma - rays, interaction of electromagnetic radiations with matter.

PHYS 211 - Matter & Energy (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

The structure of matter, nuclear energy, solar energy, wind energy, energy conservation, energy resources of the world, relationships between pollution and energy utilization.

PHYS 212 - High Vacuum Science (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Nature and behaviour of gases at low pressures, Gas laws, Kinetic theory of gases, Gas flow viscous and molecular flow, pumping speed and conductance, measurement of pressure in vacuum systems, McLeod, thermal conductivity and ionization gauges, mass spectrometer. Production of vacuum, types of pumps: Rotary and diffusion pumps, cryo pumps, ion pumps, turbo molecular pumps. Materials used in vacuum technology.

PHYS 213 - Evolution of the Physical Universe (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Big Bang theory, evolution of the stars, laws of the physical universe, evolution of the earth, and planetary ecology.

PHYS 214 - Special Theory of Relativity (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Space time metrics, Lorentz transformation, four - vector notation, energy, momentum. Relativistic invariance of physical laws.

PHYS 216 - Circuit Analysis (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Element of DC circuit, series circuit, parallel circuit, series, parallel circuit, methods of analysis, superposition theory, Thevenin's theory, Norton's theory, maximum power transfer theory, element of ac circuit, series; Parallel; Series, parallel circuits; Phase relations, network theorems, resonance circuits.

PHYS 307 - Environmental Health Physics (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

The harmful effect of ionizing and non - ionizing radiations on the living cells, effect and control of radiation in the mammalian systems, radio sensitivity, radiation chemistry, cellular effects, acute and delayed effects in occupational, medical and environmental exposures.

PHYS 308 - Physics of Radiotherapy (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Directly and indirectly ionizing radiation use in radiation therapy causing biological damage in the normal tissue and cancer. Radiation delivery techniques are specifically designed and configured to target the neoplasm. The physics of radiation interactions with matter and the clinical use of radiation are presented in this course. The methods of radiation production, measurement of ionizing radiation, absorbed dose as well as the calculation of dose distributions and treatment - planning systems are presented for all radiation modalities. Radiological physics is covered to the extent necessary to explain the use of CT, MR, and PET images as implemented in the treatment planning process.

PHYS 309 - Accelerators (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Ion source, electrostatic accelerators; Cockroft - Walton, linear accelerator, low energy circular accelerators, cyclotron & betatron, high energy circular accelerators, synchrocyclotron.

PHYS 310 - Nonlinear Optical Processes (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Propagation of electromagnetic waves in nonlinear optical media. Nonlinear optical susceptibilities and symmetry, three wave mixing: Second harmonic generation, phase matching techniques, efficiency, parametric mixing, amplification and oscillation, power considerations. Theory of phase conjugation by four wave mixing. Stimulated raman and brillouin scattering. Optical kerr effect. Nonlinear spectroscopy. Multiphoton processes. Self - focussing self - induced transparency.

PHYS 311 - Radiation Science (3 Cr. : 3 Lec ; 0 Lab : 0 Tut)

Principles of radiation science and safety including interactions of radiation with matter, radiation quantities and protection standards, dosimetry, theory and operation of alpha and gamma spectrometry equipment and liquid scintillation counters for qualitative and quantitative analysis.

PHYS 312 - Microwave & Its Applications (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Microwave generation, microwave propagation, wave guide components, microwave measurements, microwave integrated circuits, microwave materials.

PHYS 313 - Biomedical Ultrasound (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

The basic physics of ultrasound, covering ultrasonic wave generation and propagation, transducers, Doppler effect, reflection and refraction, analysis of the physical bases for the use of high - frequency sound in medicine (diagnosis, therapy and surgery) and biology. Topics include acoustic interactions of ultrasound with gas bodies (acoustic cavitation and contrast agents), thermal and non - thermal biological effects of ultrasound, ultrasonography, dosimetry, hyperthermia and lithotripsy.

PHYS 314 - Resonance Spectroscopy (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Principles of magnetic resonance: Resonance theory, relaxation times. Nuclear magnetic resonance (NMR): Bloch equations, magnetic dipole coupling, chemical shift, Electron Spin Resonance (ESR): Zeeman interaction, nuclear hyperfine interaction, nuclear quadrupole interaction, application to transition metal ions and free radicals. Principles of Nuclear Quadrupole Resonance (NQR), Zeeman effect, phase transition.

PHYS 315 - Atomic Physics (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Discovery of the electron. Dalton, Thompson models of the atom: Failure of these models in the interpretation of the physical phenomena. Rutherford's experiment, Rutherford nuclear model. Bohr model of the atom. The ability to calculate the energy spectrum of hydrogen atoms from first principles is one of the major triumphs of physics. Motion of hydrogen nucleus. Sommerfeld elliptic orbits. Fine structure of hydrogen spectra using Sommerfeld model. Vector model: Quantum numbers, space quantization. Magmetic moment of the atom. The wave like nature of electrons lie at the heart of the structure of atoms and molecules.

PHYS 316 - Advanced Electronics (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Linear and non - linear analog systems, electronic circuit switching and digital methods, combinational and sequential digital systems, metal - oxide semiconductor / large scale integrated (MOS / LSI) digital systems, digital to analog and analog to digital (D / A and A / D) systems.

PHYS 317 - Radiation in Planetary Atmospheres (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

The role of radiation in the generation, maintenance and evolution of planetary atmospheres and climate; Radiation laws, absorption and emission. Simple radiative exchange processes and atmospheric models. Energy balance. Radiation and climatic change. Comparative radiation studies in planetary atmospheres. Pollution and man - made effects.

PHYS 318 - Stars & Galaxies (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Observational techniques: Telescope optics, detectors, noise and signal - to - noise ratio, spectroscopy. Stars: Hydrostatic equilibrium, main sequence stars and evolution, shell - burning stars, white dwarfs, supernovae, neutron stars and black holes. Variable stars, pulsating stars, the period - luminosity relation, the period - density relation. Pulsars: Basic pulsar models, spin - down and characteristic age. Binary star systems, mass and radius determination. Close binary star systems, accretion discs, x - ray binaries. Star formation, the interstellar medium, dust and molecules, Jean's mass, the Hayashi track. Galactic Astronomy: Galaxy types, the discovery of the Galaxy, modern view of the Galaxy, the interstellar medium, dynamics of the galaxy disk, dark haloes, elliptical galaxies, groups and clusters of galaxies, galaxy statistics, active galactic nuclei, gravitational lensing.

PHYS 319 - Electrodynamics (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Maxwell's equations, scalar and vector potentials, gauge transformation, electromagnetic waves in conducting and none conducting media, polarization, electromagnetic radiation, relativistic electrodynamics. Prereq.: PHYS 206.

PHYS 408 - Elementary Particle Physics (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

The properties of elementary particles; Strong, weak, and electromagnetic interactions; Quantum field theory; Cosmic rays; Hadronic structure and interactions in terms of quark and gluon substructure; Nuclear fields; Introduction to electro - weak theory; Quark and lepton interaction at high energy; Current experiments; and detectors in high - energy physics.

PHYS 409 - Plasma Physics (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Characterization of the plasma state, Debye shielding, applications of plasma in physics, plasma and cyclotron frequencies, collision rates and mean - free paths, atomic processes, adiabatic invariance, orbit theory, two - fluid description, heat flow, diffusion, kinetic description, and Landau damping.

PHYS 410 - Physics & Technology of Thin Films (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Preparation methods, thickness measurement and monitoring, analytical techniques of characterization, growth and structure of films, mechanical properties of films, electric properties of films, magnetism of films, thin film devices.

PHYS 411 - Nanoparticles (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Confinement and size effect in free cluster, extended theoretical model, electronic and geometrical structure. Magnetism of nanometer - sized particle and cluster, single particle measurement techniques, experimental verification, influence of temperature on magnetization reversal, individual single domain nanoparticles, preparation and characterization. Application of clusters to the fabrication of nanostructure.

PHYS 412 - Advanced Solid State Physics (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Imperfections in crystals: Lattice vacancies, diffusion, color centers, dislocations. Metallic solutions and compounds: Phase diagrams, thermodynamics of phase equilibria, eutectic phase diagrams, non - equilibrium states. Noncrystalline solids: Diffraction pattern, glasses, amorphous ferromagnets, amorphous semiconductors.

PHYS 413 - Laser & Its Applications (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Thermal radiation. Radiation in vacuum. Radiation and matter. Characteristics of laser radiation. Optical resonators. Gain and saturation effects. Q - modulation. Propagation of gaussian beams. Gas lasers, noble gas ion laser, metal vapour lasers, excimer lasers, crystalline dielectric lasers, amorphous dielectric lasers, semiconductor lasers, dye lasers. Holography. Spectroscopic applications of lasers. Lasers and interaction with matter. Laser fusion, isotope separation, medical applications, photo - chemical applications. Fiber - optic sensors. Lasers as frequency standards.

PHYS 414 - Superconductivity & Its Applications (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Perfect conductivity and meissner effect. Thermodynamic critical field. London equations and penetration depth. Superconductor as a macroscopic quantum state. Flux quantization. Pippard's non - local electrodynamics and coherence length. Thermodynamics of the superconducting phase transition. Ginsburg - Landu theory. Type I and type II superconductors. Nature of mixed state - flux flow and critical density. Superconducting materials. Microscopic (BCS) theory. Cooper pairs and the attractive interaction. BCS ground state and excitations from the ground state. Energy gap and its temperature dependence. Tunneling experiments. Josephson effects. SQUID devices. Superconducting magnet design.

PHYS 415 - Nonlinear Optical Devices (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Physical mechanisms of nonlinear response in materials. Optical bistability, theory of etalon devices. Photorefractive crystals, theory and application to imaging. Electro - optic effect. Acousto - optic effect, scattering of light by sound, analysis of Bragg diffraction, acousto - optic materials and acousto - optic modulators. Magneto - optic effect. Quantum detectors, limits of detection systems, noise in optical detectors.

PHYS 416 - Semiconductors (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Band structure of semiconductors, holes, effective masses in semiconductors, statistics of electrons and holes in intrinsic semiconductors, statistics of extrinsic semiconductors, high electric field and hot electrons, the Gunn effect, the fundamental absorption process, exciton absorption, free - carrier absorption, absorption processes involving impurities, photoconductivity, acoustoelectric effect, thermoelectric effect, drift and diffusion, hall effect, p - n junction, junction transistors, the tunnel diode, Zener diode, Gunn diode, photovoltaic effect, field effect transistor (FET), Metal - Oxide - Semiconductor Field Effect Transistor (MOSFET), quantum hall effect.

PHYS 417 - Applied Magnetics (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Measurement of magnetic moment, permeability and Curie temperature. Faraday balance. Vibrating sample magnetomerter. Rotating sample magnetomerter. Torque magentometer. Soft and hard magnetic materials. Materials for application in trasnformers, permanent magnets and motors: Composition and preparation techniques. Eddy currents and loss mechanisms. Ferrites and their application. Magnetostriction: Principles and materials for transducer application. Propagation of electromagnetic waves in a magnetic medium. Magnetic storage techniques. Magneto - optics. Bubble memories and curie point writing. Amorphous magnetic materials. Production of ultrahigh magnetic fields.

PHYS 418 - Magnetism & Magnetic Order (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Diamagnetism, paramagnetism, the exchange interaction, the Neel model of antiferromagnetism, spin waves, ferromagnetic domains.

PHYS 419 - Low Temperature Physics (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Low temperature thermal and electrical behavior of materials. Phenomena and theories of low and high temperature superconductivity. Superfluidity. Superconductive devices, including Josephson junctions, quantum interference devices, phonon detectors, and computing circuits.

PHYS 420 - Disordered Materials (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Amorphous semiconductors, low dimensional materials, disordered alloys, points and extended defects, classical and quantum liquids.

PHYS 422 - Growth Techniques & Fabrication of Low - Dimensional Structures (3 Cr. : 3 Lec : 0 Lab : 0 Tut)

Epitaxial growth of semiconductors on substrates. Lattice mismatch. Chemical vapor deposition (CVD) methods of CVD techniques. Metalo - Organic Chemical Vapor Deposition (MOCVD) Molecular Beam Epitaxy (MBE) sputtering techniques. Investigation methods for low - dimensional structures: XPS, XRD, TEM, SEM, PL. Optical lithography. Positive and negative photoresist. Electron beam lithography. Mask aligner. Dry etching process. Fabrication of hall bars. Ultrasonic wire welding.

PHYS 424 - Physics of Surfaces & Interfaces (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Formation of clean, "well - defined" surfaces, surface tension and macroscopic shape, surface and interface free energies, surface structure, surface defect structures, surfaces and growing interfaces, theoretical considerations of growing interfaces, metal - metal and metal - semiconductor interface.

University Requirement Elective Course

PHYS 006 - Introduction to Astronomy (2 Cr. : 2 Lec)

Why do astronomy - Origin of the universe - Evidence of Big Bang - Stars and gas in the Milky Way - Dominant geologic processes? - Features of our solar system - How did we get a solar system? - Early in the life of planets - Sun and planets - Solar system - Asteroids - Meteorites - Comets.

Department of Chemistry

Bachelor of Science in Chemistry (120 Cr. Hr.)

Curricula

First Semester			Cr.
MATH	101	Calculus & Analytical Geometry I	2
MATH	103	Applied Mathematics I	2
PHYS	111	Principles of Physics I	4
CHEM	111	Principles of Chemistry I	4
		Elective (General)[1]	3
			15

Second Semester			Cr.
MATH	102	Calculus & Analytical Geometry II	2
MATH	104	Applied Mathematics II	2
PHYS	112	Principles of Physics II	4
CHEM	112	Principles of Chemistry II	4
CMPS	114	Introduction to Programming	2
		Elective (General)[1]	1
			15

Third Semester			Cr.
CHEM	201	Analytical Chemistry I	4
CHEM	203	Organic Chemistry I	4
CHEM	205	Physical Chemistry I	3
		Elective [2]	2
		Elective (General)[1]	2
			15

Fourth Semester			Cr.
CHEM	202	Inorganic Chemistry I	3
CHEM	204	Organic Chemistry II	4
CHEM	206	Physical Chemistry II	3
		Elective [2]	3
		Elective (General)[1]	2
			15

Fifth Semester			Cr.
CHEM	301	Spectroscopic Analysis	3
CHEM	303	Physical Chemistry III	3
CHEM	317	Chemistry of Biomolecules	3
CHEM	307	Inorganic Chemistry II	3
		Elective [2]	2
		Elective (General)[1]	2
			16

Sixth Semester			Cr.
CHEM	318	Analytical Chemistry II	3
CHEM	320	Physical Chemistry IV	3
CHEM	322	Materials Science	2
CHEM	324	Petrochemical Industry	2
		Elective [2]	4
		Elective (General)[1]	2
			16

Seventh Semester			Cr.
CHEM	401	Research Topics	1
CHEM	405	Solid State Chemistry	2
CHEM	407	Quantum Chemistry	3
CHEM	419	Physical Organic Chemistry	2
		Elective [2]	4
		Elective (General)[1]	2
			14

Eighth Semester			Cr.
CHEM	499	Senior Research	2
CHEM	404	Nuclear & Radiochemistry	2
CHEM	420	Analysis of Organic Compounds	3
		Elective [2]	5
		Elective (General)[1]	2
			14

[1] A total of 16 credits is required as General University Requirements; 5 credits are selected from the university Mandatory courses list including - ARAB 001 (2 Cr.); ENG 001 (2 Cr.); BLAW 001 (1 Cr.) & another 11credits are selected from the university Elective courses list.

[2] Selected from departmental and faculty elective courses. To qualify for a minor in any field in the Faculty, a minimum of 18 credits must be earned in that field.

Mandatory Courses

CHEM 111 - Principles of Chemistry I (4 Cr. : 3 Lec : 2 Lab : 1 Tut)

Introduction to the basic concepts and principles of chemistry including: Atoms, molecules, mole concept, chemical reactions and calculations, stoichiometry. Periodic table and properties of the elements, nomenclature. Theories of atomic structure, atomic spectra. Theories of chemical bonding. Covalent bonding and molecular structure: Molecular geometry, VSEPR theory, valence bond theory, hybrid orbital and molecular orbital theory. Practical: Applied experiments related to the above topics.

CHEM 112 - Principles of Chemistry II (4 Cr. : 3 Lec : 2 Lab : 1 Tut)

Topics discussed are the three physical states of matter (gases, liquids and solids). Properties of solutions. Chemical equilibrium. Ionic equilibria. Rates of chemical reactions. Introduction to the basic chemical thermodynamics and thermochemistry. Practical: Applied experiments related to the above topics.

CHEM 201 - Analytical Chemistry I (4 Cr. : 3 Lec ; 3 Lab : 0 Tut)

Introduction to quantitative chemical analysis including theories and principles of gravimetric and volumetric techniques (acid - base, redox, precipitation, complexometric reactions and titrations) Practical: Applied experiments related to the above topics. Prereq.: CHEM 112.

CHEM 202 - Inorganic Chemistry I (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Theories of Brönsted Lewis acid and base. Basic concepts of coordination compounds: Nomenclature, bonding, structure, stability, magnetic properties, stereochemistry. Crystal and ligand field theories. Practical: Applied experiments related to the above topics. Prereq.: CHEM 111.

CHEM 203 - Organic Chemistry I (4 Cr. : 3 Lec : 3 Lab : 0 Tut)

Principles of organic chemistry including nomenclature, physical properties and reactions with mechanisms of alkanes and cycloalkanes, alkenes (addition and elimination reactions), alkynes, alcohols, ethers, alkyl halides (nucleophilic substitution reactions), stereochemistry practical: Applied experiments related to the above topics.

CHEM 204 - Organic Chemistry II (4 Cr. : 3 Lec : 3 Lab : 0 Tut)

Continuation of organic chemistry I, studying aromatic compounds, carbonyl compounds, carboxylic acids and derivatives, amines and phenols. Practical: Applied experiments related to the above topics. Prereq.: CHEM 203.

CHEM 205 - Physical Chemistry I (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Principles and applications of the first and second laws of thermodynamics. Third law of thermodynamics. Thermodynamics of solutions. Practical: Applied experiments related to the above topics. Prereq.: CHEM 112.

CHEM 206 - Physical Chemistry II (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Liquid - solid, Liquid - gas, liquid - liquid and solid - gas interfaces. Classification, properties and applications of the colloidal state. Practical: Applied experiments related to the above topics.

CHEM 301 - Spectroscopic Analysis (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Theory and application of instrumental methods to qualitative and quantitative chemical analysis. Methods include ultra-violet, visible and infrared spectroscopy, fluorescence spectroscopy, flame atomic absorption, electrothermal and plasma atomic emission. Practical: Applied experiments related to the above topics.

CHEM 303 - Physical Chemistry III (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Rates and orders of chemical reactions, kinetics of simple and complex reactions, effect of temperature on reaction rates, collision theories of reaction rates, determination of reaction mechanism, chain reactions and explosion, kinetics of fast reactions, kinetic isotope effect, reactions in solutions. Practical: Applied experiments related to the above topics. Prereq.: CHEM 205.

CHEM 307 - Inorganic Chemistry II (3 Cr. : 3 Lec : 0 Lab : 0 Tut)
Organometallic compounds of transition metals: Alkyls, hydrides, carbonyls, olefinic, allylic, butadiene, η^5 and η^6 complexes. Group theory. Prereq.: CHEM 202.

CHEM 317 - Chemistry of Biomolecules (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Introduction to the chemistry of carbohydrate. Chemistry of lipids and fats, amino acids, peptides, proteins. Study of nucleosides, nucleotides and nucleic acids. Practical applied experiments related to the above topics. Prereq.: CHEM 204.

CHEM 318 - Analytical Chemistry II (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Liquid - liquid extraction. Chromatographic methods of analysis: Gas chromatography, high performance liquid chromatography. Thin layer chromatography and electrophoresis. Introduction to electroanalytical chemistry (ion selective electrode, coulometry and electrogravimetry). Practical: Applied experiments related to the above topics. Prereq.: CHEM 201.

CHEM 320 - Physical Chemistry IV (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Principles of electrochemistry. E.M.F applications. Electrochemistry of solutions. Deby - Hückel theory. Theory of the electrical double layer. Electrochemical techniques: Potentiometry (direct and indirect) and nonpotentiometric techniques (polarography and amperometry, cyclic voltammetry, anodic stripping voltametry, coulometry, conductometry and electrochemical impedence spectroscopy). Practical: Applied experiments related to the above topics. Prereq.: CHEM 205.

CHEM 322 - Materials Science (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Introduction to materials science. Major classes of materials. Principles and applications of some spectroscopic and microscopic techniques for the characterization of materials.

CHEM 324 - Petrochemical Industry (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Petrochemical industry, chemical process technology. Chemistry and industrial applications of petrochemicals including ethylene production by steam craking, ethylene derivatives, propylene derivatives, butadiene and butenes, benzene, toluene and xylene production and derivatives, steam reforming and related processes.

CHEM 401 - Resaerch Topics (1 Cr. : 1 Lec)
Presentation of important research topics in chemistry.

CHEM 404 - Nuclear & Radiochemistry (2 Cr. : 2 Lec : 0 : Lab : 0 Tut)
Introduction to nuclear and radiochemistry including: The fundamentals of nuclear stability and structure, radioactive - decay modes and nuclear reactions. Interactions of radiation with matter, detection and measurement of radiation, radiation protection and applications of radiochemical methods.

CHEM 405 - Solid State Chemistry (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Bonding in solids, crystal structures, x - ray diffraction, electron models, band theory, crystal defects. Electrical, thermal, optical and magnetic properties of solid state materials from a chemical perspective. Fabrication techniques and modern applications.

CHEM 407 - Quantum Chemistry (3 Cr. : 3 Lec : 0 Lab : 0 Tut)
Classical mechanical treatment of the simple harmonic oscillator, black - body radiation, photoelectric effect, Compton's effect, de Broglie relation, the Heisenberg uncertainity principal, derivation and solutions of the Schroedinger equation for several simple systems with some chemical applications. Prereq.: CHEM 205.

CHEM 419 - Physical Organic Chemistry (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Conformational analysis and reactivity in acyclic and cyclic systems. Methods for investigation of reaction mechanisms. Electrophilic aromatic substitution. Linear free energy relationship and Hammett equation, Taft's equation, selectivity and reactivity. Molecular rearrangement and orbital asymmetry. Prereq.: CHEM 204.

CHEM 420 - Analysis of Organic Compounds (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Structure analysis and identification of organic compounds by chemical analysis (elemental analysis, functional groups classification, identification and derivatization reactions) and spectroscopic studies including Infrared, UV - VIS, NMR, mass spectrometry. Practical: Applied experiments related to the above topics.

CHEM 499 - Senior Research (2 Cr. : 2 Lec)
Experimental or theoretical research project carried on by the student under the supervision of staff members. Includes literature search, laboratory and / or theoretical work and conferences with the staff members. Written report and a final oral examination on that report are required.

Non - Chemistry Major

CHEM 107 - Chemistry I (3 Cr. : 2 Lec : 2 Lab : 0 Tut)
Introduction to the basic concepts of chemistry including: Chemical reactions and calculations. Theories of atomic structure, chemical bonding and molecular structure. The three physical states of matter (gases, liquids and solids). Introduction to organic chemistry, including nomenclature, stereoisomerism and reactions of alkanes, cycloalkanes, alkenes and alkynes. Alkyl halides, alcohols and ethers. Practical: Applied experiments related to the above topics.

CHEM 108 - Chemistry II (3 Cr. : 2 Lec : 2 Lab : 0 Tut)
Properties of solutions and colloids. Chemical equilibrium. Acids and bases. Ionic equilibria. Study of aromatic compounds, carbonyl compounds, carboxylic acids and derivatives, Amines and phenols. Practical: Applied experiments related to the above topics. Prereq: CHEM 107.

CHEM 109 - Basic Chemistry (For Nursing) (2 Cr. : 1 Lec : 2 Lab : 0 Tut)
Introduction to the basic concepts of chemistry, chemical reactions and calculations. The three physical states of matter (gases, liquids and solids). Solutions, chemical equilibrium, ionic equilibrium. Practical: Applied experiments related to the above topics.

CHEM 115 - General Chemistry (For Dentistry) (3 Cr. : 2 Lec : 2 Lab : 0 Tut)
Introduction to the basic concepts of chemistry including: Chemical reactions and calculations. Theories of atomic structure, chemical bonding and molecular structure. Properties of solutions and colloids. Chemical equilibrium. Ionic equilibrium. The three physical states of matter (gases, liquids and solids). Fundamentals of organic chemistry, including nomenclature, stereoisomerism and reactions of aliphatic and aromatic hydrocarbons, alcohols, alkyl halides, carbonyl compounds, carboxylic acids and derivatives, and amines with brief introduction to carbohydrate chemistry. Practical: Applied experiments related to the above topics.

CHEM 117 - General Chemistry (For Health Science) (3 Cr. : 2 Lec : 2 Lab : 0 Tut)
Introduction to basic concepts of chemistry, chemical reactions and calculations, the three physical states of matter (gases, liquids and solids), solutions, chemical equilibrium, ionic equilibrium. Periodic table and properties of the elements, nomenclature. Theories of atomic structure, atomic spectra, and chemical bonding. Practical: Applied experiments related to the above topics.

CHEM 118 - Organic Chemistry (For Health Science) (3 Cr. : 2 Lec : 2 Lab : 0 Tut)
Chemistry of saturated and unsaturated aliphatic and aromatic hydrocarbons: Preparations, reactions and mechanisms. Study of the chemistry of alkyl halides, alcohols, carbonyl compounds, carboxylic acids, amines and phenols. Substitution and elimination reactions. Practical: Applied experiments related to the above topics.

CHEM 221 - Biorganic Chemistry (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Carbohydrate chemistry, lipids, amino acids, peptides and proteins. Study of Nucleosides, nucleotides and nucleic acids. Chemistry of heterocyclic compounds. Practical: Applied experiments related to the above topics. Prereq.: CHEM 108.

CHEM 222 - Chemistry III (3 Cr. : 2 Lec : 2 Lab : 0 Tut)
Basic principles of chemical thermodynamics, chemical kinetics and catalysis. Introduction to the theories and principles of quantitative methods of analysis. Practical: Applied experiments related to the above topics. Prereq.: CHEM 108.

CHEM 225 - Analytical Chemistry I (For Health Sciences Students) (4 Cr. : 3 Lec : 2 Lab : 0 Tut)
Introduction to quantitative chemical analysis including theories and principles of gravimetric and volumetric

techniques (acid - base, redox, precipitation, complexometric reactions and titrations). Practical: Applied experiments related to the above topics. Prereq.: CHEM 117.

CHEM 226 - Analytical Chemistry II (For Health Sciences Students) (4 Cr. : 3 Lec : 2 Lab : 0 Tut)
Liquid - liquid extraction. Chromatographic methods of analysis: Gas chromatography, high performance liquid chromatography. Thin layer chromatography, electrophoresis, spectrophotometry, fluorometry, automated chemical analysers. Practical: Applied experiments related to the above topics. Prereq.: CHEM 225.

CHEM 354 - Chemistry of Natural Products (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Introduction to natural products sources, classes and applications. Natural products biosynthetic pathways. Structural analysis, biosynthesis and applications.

Elective Courses

CHEM 207 - Environmental Chemistry (2 Cr. : 2 Lec)
Chemistry of ozone layer in the atmosphere, particulate matter and control of air pollution. Global warming. Waste management: Treatment and disposal. Mass energy transfer, material balance. Risk, dose response and human exposure assessment. Hazard identification. Risk characterization. Water resources and pollutants. BOD and waste water.

CHEM 210 - Phase Rule & Molecular Kinetic Theory of Gases (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Phase equilibria in heterogeneous systems. Phase rule and its application in one, two and three component systems. Molecular kinetic theory and transport phenomena. Practical: Applied experiments related to the above topics. Prereq.: CHEM 205.

CHEM 211 - Chemistry of Silicates (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Nomenclature of the silicates. Molecular composition and crystal structures. Properties and applications.

CHEM 212 - Chemistry of the Elements (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Chemistry of S and P block elements, metals, metalloids and nonmetals. Preparations, reactions and physical properties. Prereq.: CHEM 111.

CHEM 214 - Water Analysis (3 Cr. : 2 Lec : 3 Lab : 0 Tut)
Physico - chemical aspects of water. Inorganic and organic substances in water: Occurrence, significance and methods of determination. Biochemical process consuming oxygen. Practical: Applied experiments related to the above topics.

CHEM 309 - Chemistry of Polymers (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Introduction to polymer science with emphasis on background chemistry, nomenclature and synthesis. Selected processing, characterization techniques and applications. Fibers and applications.

CHEM 310 - Petroleum & Natural Gas (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Petroleum and natural gas sources and extraction methods. Petroleum refining, fractionation and treatment processes. Catalytic reforming and catalytic cracking processes. Fuel types and applications, including gasoline blending process.

CHEM 311 - Heterocyclic Chemistry (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Chemistry of five and six membered heterocycles, including pyrroles, furans, thiophenes, indoles, pyridines, pyrimidines, purines and their derivatives. Introduction to the chemistry of polynuclear compounds.

CHEM 313 - Environmental Analysis (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Modern methods used in the analysis of environmental samples. Standard and advanced techniques of air, water and soil analysis are covered including spectrometric and chromatographic methods.

CHEM 314 - Catalysis (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Homogeneous and heterogeneous catalysis. Selectivity. Kinetics of catalytic reactions. Catalysis processes and their industrial applications. Prereq.: CHEM 303.

CHEM 315 - Regulatory Aspects of Industrial Chemicals (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Survey of regulations, handling, use, transportation, and disposal of hazardous substances.

CHEM 409 - Industrial Organic Chemistry (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Topics cover a wide variety of industrial applications, including, chemistry of fibers and dyes, polymers, soaps and detergents, natural products industry and Biofuels.

CHEM 410 - Industrial Inorganic Chemistry (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Industrial production of construction materials: Glass, cement and ceramics. Raw materials, manufactures, reactions involved, chemistry and physical properties of different products.

CHEM 411 - Physical Photochemistry (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Basic principles and concepts of photochemistry. Photochemical reaction types. Kinetic mechanisms. Prereq: CHEM 303.

CHEM 412 - Conducting Polymers (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Conducting polymers, dielectric, electrical and electro - optical properties of polymers. Behaviors of amorphous and semi - crystalline polymers.

CHEM 416 - Thin Film Materials Science (2 Cr. : 2 Lec : 0 Lab : 0 Tut)
Overview of the major thin film deposition techniques (PVD, MBE, CVD). Fundamental surface processes of epitaxial growth. Thin film characterization.

CHEM 418 - Medicinal Chemistry (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Classification of drugs. Drug action at enzymes, receptors and nucleic acids. Pharmacodynamics. Quantitative Structure - Activity Relationships (QSAR). Antibacterial agents, anticancer and peripheral nervous system drugs.

CHEM 422 - Corrosion Chemistrty (3 Cr. : 2 Lec : 3 Lab : 0 Tut)

Definition of corrosion. Consequencies of corrosion. Causes of corrosion. Electrochemical aspects of corrosion (irreversible process), electrode kinetics, corrosion rate measurements. Thermodynamics of corrosion, passivity and passivity breackdown. Corrosion prevention (anodic protection, cathodic protection, corrosion inhibitors, coatings). Forms of corrosion. Practical: Applied experiments related to the above topics. Prereq.: CHEM 320.

CHEM 425 - Instrumental Analysis (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Thermal analysis: Thermogravimetry, differential thermogravimetry, differential thermoanalysis, differential scanning, calorimetry. Magnetic measurement of solids: Magnetic susceptibility, electron paramagnetic resonance. Conductivity of solids.

CHEM 426 - Mechanisms of Inorganic Reactions (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Kinetic studies of ligand replacement reactions, ion pairs formation, water exchange. Metal complex formation. Macrocyclic complexes. Kinetic background. Activation parameters. Substitution reactions of four, five and six - coordinate complexes. Trans effect. Stereochemical change. Redox mechanism. Catalysis. Electron transfer reactions. Prereq.: CHEM 307.

CHEM 428 - Bioinorganic Chemistry (2 Cr. : 2 Lec : 0 Lab : 0 Tut)

Metals in photosynthesis. Iron - containing oxygen carriers and their synthetic models. Copper enzymes. The enzyme nitrogenase. Metals in medicine: Platinum - containing anticancer agents.

CHEM 430 - Analysis of Inorganic Compounds (2 Cr.: 2 Lec : 0 Lab : 0 Tut)

Physical characteristic: Elemental analysis. Mass spectroscopy. Spectroscopy / structural methods: UV - visible, IR absorption and Raman spectroscopy. NMR. X - ray methods. Prereq.: CHEM 301.

Department of Biological & Environmental Science

Bachelor of Science in Biology (120 Cr. Hr.)

Curricula

First Semester			Cr.
BIOL	101	Botany I	3
BIOL	103	Zoology I	3
CHEM	107	Chemistry I	3
MATH	115	Calculus & Analytical Geometry	2
		Elective (General)[1]	4
			15

Second Semester			Cr.
BIOL	102	Botany II	3
BIOL	104	Zoology II	3
CHEM	108	Chemistry II	3
MATH	114	Elementary Physics	3
		Elective (General)[1]	4
			16

Third Semester			Cr.
BIOL	203	Histology	3
BIOL	205	Invertebrates Zoology	3
BIOL	209	Introduction to Environmental Studies	2
CHEM	221	Bioorganic Chemistry	3
		Elective [2]	2
		Elective (General) [1]	2
			15

Fourth Semester			Cr.
BIOL	202	Cell Biology	3
BIOL	204	Comparative Anatomy	3
BIOL	206	Principles of Genetics	2
BIOL	220	Microbiology	3
BIOL	210	Embryology of Vertebrates	2
CHEM	222	Chemistry III	3
		Elective [2]	2
			18

Fifth Semester			Cr.
BIOL	301	Plant Physiology	3
BIOL	323	Immunology	2
BTEC	303	Introduction to Biotechnology	2
BIOL	321	Molecular Biology	3
BCHM	313	Structural Biochemistry	3
		Elective [2]	2
			15

Sixth Semester			Cr.
BIOL	302	Human Physiology	3
BIOL	306	Parasitology	3
BCHM	306	Hormones	2
BIOL	320	Entomology	2
		Elective [2]	2
		Elective (General) [1]	2
			14

Seventh Semester			Cr.
BIOL	431	Research Topic	1
BIOL	403	Principles of Ecology	3
BIOL	405	Biology of Vascular Plants	3
BIOL	417	Mycology	3
		Elective [2]	2
		Elective (General)[1]	2
			14

Eighth Semester			Cr.
BIOL	408	Industrial Microbiology	3
BIOL	499	Senior Research in Biology	2
		Elective [2]	6
		Elective (General)[1]	2
			13

[1] A total of 16 credits is required as General University Requirements; 7 credits are selected from the University Mandatory courses list including ARAB 001 (2 Cr.), ENGL 001 (2 Cr.), CMPG 001 (2 Cr.), BLAW 001 (1 Cr.) and another 9 credits are selected from the University Elective courses list.

[2] Selected from Departmental and Faculty Elective courses. To qualify for a minor in any field in the Faculty, a minimum of 18 credits must be earned in that field.

Bachelor of Science in Biochemistry (120 Cr. Hr.)

Curricula

First Semester			Cr.
BIOL	101	Botany I	3
BIOL	103	Zoology I	3
CHEM	107	Chemistry I	3
MATH	115	Calculus & Analytical Geometry	2
		Elective (General)[1]	4
			15

Second Semester			Cr.
BIOL	102	Botany II	3
BIOL	104	Zoology II	3
CHEM	108	Chemistry II	3
PHYS	114	Elementary Physics	3
		Elective (General)[1]	4
			16

Third Semester			Cr.
BIOL	203	Histology	3
BIOL	205	Invertebrates Zoology	3
BIOL	209	Introduction to Environmental Studies	2
CHEM	221	Bioorganic Chemistry	3
		Elective [2]	2
		Elective (General) [1]	2
			15

Fourth Semester			Cr.
BIOL	202	Cell Biology	3
BIOL	204	Comparative Anatomy	3
BIOL	206	Principles of Genetics	2
BIOL	220	Microbiology	3
BIOL	210	Embryology of Vertebrates	2
CHEM	222	Chemistry III	3
		Elective [2]	2
			18

Fifth Semester			Cr.
BCHM	301	Biochemistry I	2
BTEC	303	Introduction to Biotechnology	2
BCHM	305	Biochemical Techniques	2
BIOL	321	Molecular Biology	3
BIOL	323	Immunology	2
		Elective [2]	2
		Elective (General)[1]	2
			15

Sixth Semester			Cr.
BCHM	302	Biochemistry II	2
BCHM	324	Enzymes	3
BIOL	302	Human Physiology	3
BCHM	306	Hormones	2
		Elective (General)[1]	2
		Elective [2]	2
			14

Seventh Semester			Cr.
BIOL	431	Research Topic	1
BCHM	403	Physical Biochemistry	3
BCHM	417	Metabolism	3
		Elective [2]	6
		Elective (General)[1]	2
			15

Eighth Semester			Cr.
BCHM	406	Medical Biochemistry	3
BCHM	418	Bioenergetics & Metabolic Regulation	3
BCHM	499	Senior Research in Biochemistry	2
		Elective [2]	4
			12

[1] A total of 16 credits is required as General University Requirements; 7 credits are selected from the University Mandatory courses list including ARAB 001 (2 Cr.), ENGL 001 (2 Cr.), CMPG 001 (2 Cr.), BLAW 001 (1 Cr.) and another 9 credits are selected from the University Elective courses list.

[2] Selected from Departmental and Faculty Elective courses. To qualify for a minor in any field in the Faculty, a minimum of 18 credits must be earned in that field.

Bachelor of Science in Biotechnology (120 Cr. Hr.)

Curricula

First Semester			Cr.
BIOL	101	Botany I	3
BIOL	103	Zoology I	3
CHEM	107	Chemistry I	3
MATH	115	Calculus & Analytical Geometry	2
		Elective (General)[1]	4
			15

Second Semester			Cr.
BIOL	102	Botany II	3
BIOL	104	Zoology II	3
CHEM	108	Chemistry II	3
PHYS	114	Elementary Physics	3
		Elective (General)[1]	4
			16

Third Semester			Cr.
BIOL	203	Histology	3
BIOL	205	Invertebrates Zoology	3
BIOL	209	Introduction to Environmental Studies	2
CHEM	221	Bioorganic Chemistry	3
		Elective [2]	2
		Elective (General) [1]	2
			15

Fourth Semester			Cr.
BIOL	202	Cell Biology	3
BIOL	204	Comparative Anatomy	3
BIOL	206	Principles of Genetics	2
BIOL	220	Microbiology	3
BIOL	210	Embryology of Vertebrates	2
CHEM	222	Chemistry III	3
		Elective [2]	2
			18

Fifth Semester			Cr.
BCHM	305	Biochemical Techniques	2
BIOL	321	Molecular Biology	3
BIOL	323	Immunology	2
BCHM	313	Structural Biochemistry	3
		Elective [2]	2
		Elective (General)[1]	2
			14

Sixth Semester			Cr.
BTEC	304	Bioinformatics	2
BTEC	306	Genetic Engineering Techniques	3
BTEC	308	Molecular Genetics	3
BCHM	312	Metabolic Biochemistry	3
		Elective [2]	2
		Elective (General)[1]	2
			15

Seventh Semester			Cr.
BIOL	431	Research Topic	1
BTEC	401	Applications in Biotechnology I	3
BTEC	413	Stem Cell Engineering	3
		Elective [2]	6
		Elective (General)[1]	2
			15

Eighth Semester			Cr.
BTEC	402	Applications in Biotechnology II	3
BTEC	404	Molecular Diagnostics	3
BTEC	499	Senior Research in Biotechnology	2
		Elective [2]	4
			12

[1] A total of 16 credits is required as General University Requirements; 7 credits are selected from the University Mandatory courses list including ARAB 001 (2 Cr.), ENGL 001 (2 Cr.), CMPG 001 (2 Cr.), BLAW 001 (1 Cr.) and another 9 credits are selected from the University Elective courses list.

[2] Selected from Departmental and Faculty Elective courses. To qualify for a minor in any field in the Faculty, a minimum of 18 credits must be earned in that field.

Bachelor of Science in Environmental Science (120 Cr. Hr.)

Curricula

First Semester			Cr.
BIOL	101	Botany I	3
BIOL	103	Zoology I	3
CHEM	107	Chemistry I	3
MATH	115	Calculus & Analytical Geometry	2
		Elective (General)[1]	4
			15

Second Semester			Cr.
BIOL	102	Botany II	3
BIOL	104	Zoology II	3
CHEM	108	Chemistry II	3
PHYS	114	Elementary Physics	3
		Elective (General)[1]	4
			16

Third Semester			Cr.
BIOL	203	Histology	3
BIOL	205	Invertebrates Zoology	3
BIOL	209	Introduction to Environmental Studies	2
CHEM	221	Bioorganic Chemistry	3
		Elective [2]	2
		Elective (General) [1]	2
			15

Fourth Semester			Cr.
BIOL	202	Cell Biology	3
BIOL	204	Comparative Anatomy	3
BIOL	206	Principles of Genetics	2
BIOL	208	Microbiology	3
BIOL	210	Embryology of Vertebrates	2
CHEM	222	Chemistry III	3
		Elective [2]	2
			18

Fifth Semester			Cr.
ENVI	301	Planet Earth	2
ENVI	303	Ecosystems & Biosphere	2
ENVI	305	Climate Change: Past & Future	2
ENVI	307	Fundamentals of Ecology	2
BCHM	313	Structural Biochemistry	3
		Elective [2]	3
			14

Sixth Semester			Cr.
ENVI	302	Environmental Pollution	3
ENVI	304	Coastal & Marine Ecosystem	2
ENVI	306	Environmental Risk Assessment	2
ENVI	308	Energy Resources	2
ENVI	310	Natural Disasters	2
		Elective (General)[1]	2
		Elective [2]	2
			15

Seventh Semester			Cr.
BIOL	401	Research Topic	1
ENVI	403	Waste Recycling	2
ENVI	405	GIS & Arc / Info	2
ENVI	407	Environmental Toxicology	2
		Elective (General)[1]	2
		Elective [2]	4
			13

Eighth Semester			Cr.
ENVI	499	Senior Research in Environmental Science	2
ENVI	402	Environmental Impact Assessments	2
ENVI	404	Environmental Microbiology	2
		Elective (General)[1]	2
		Elective [2]	6
			14

[1] A total of 16 credits is required as General University Requirements; 7 credits are selected from the University Mandatory courses list including ARAB 001 (2 Cr.), ENGL 001 (2 Cr.), CMPG 001 (2 Cr.), BLAW 001 (1 Cr.) and another 9 credits are selected from the University Elective courses list.

[2] Selected from Departmental and Faculty Elective courses. To qualify for a minor in any field in the Faculty, a minimum of 18 credits must be earned in that field.

Mandatory Courses

Biology

BIOL 101 - Botany I (3 Cr. : 2 Lec : 2 Lab)

Plant morphology: General morphology of a common flowering plant, seeds and germination, morphology of roots, stems and leaves. Plant anatomy: Plant cell structure and contents, meristems, types of primary and secondary plant tissues, anatomy of young stems, roots and leaves, secondary growth of stems and roots, ecological anatomy. Plant physiology: Absorption & transport systems, major biological molecules, enzymes & catalysis, metabolism of macromolecules, photosynthesis & cellular respiration. Practical: Applications and experiments related to the above topics.

BIOL 102 - Botany II (3 Cr. : 2 Lec : 2 Lab)

Systematic botany: Principles of classification of the plant kingdom. Representative examples of the various classes of the plant kingdom, viruses, bacteria, algae, fungi, bryophyta, pteridophyta, gymnosperms and angiosperms. Economic and medicinal uses of algae and fungi. Practical: Experiments related to theoretical part. Prereq.: BIOL 101.

BIOL 103 - Zoology I (3 Cr. : 2 Lec : 2 Lab)

Introduction to zoology: Sub - science of zoology, manifestations of life, chemical composition of protoplasm, organic compounds of biological importance, animal cell and its contents(structure and functions at all levels), cell division (mitosis and meiosis), histology (principle types of animal tissues), vertebrate physiology (nutrition, digestion, metabolism, circulation, respiration, excretion, nervous and hormonal coordination), vertebrate embryology, animals and their environment. Embryology: Gametogenesis, structure of sperm, types of eggs, early development of amphioxus, toad and chick embryo, embryonic membrane, structure of teeth, pentadactyl limp, joints. Practical: Dissection of all systems of Bufo including muscular, general viscera, urinogenital system & blood system (proper, portal & arterial) skeletal system of toads, histology (all system tissues) of toad & rabbit.

BIOL 104 - Zoology II (3 Cr. : 2 Lec : 2 Lab)

Description of the major animal phyla, protozoa (free living and parasitic), porifera, coelenterata, platyhelminthes, nemathelminthes, annelida, arthropoda, animal association. Medical Entomology: The general characteristics of the phylum arthropoda, relation of insects to pathogenic condition of man and animals, insects as vectors of pathogenic organisms, insect as intermediate host of helminthes with emphasis on special common disease - bearing insects. Practical: Experiments related to theoretical part. Prereq.: BIOL 103.

BIOL 107 - Biology (2 Cr. : 2 Lec)

Life, chemical composition of protoplasm; importance; Physical characteristics of protoplasm. Cell division, mammalian physiology; Nutrition, digestion, metabolism, circulation, respiration, excretion, chemical and nervous coordination. Principles of taxonomy. Structure, biology and life cycle of the following phyta: Protozoo, coelenterata, platyhelminthes, aschelminthes, annelida and arthopoda.

BIOL 115 - Botany & Genetics (2 Cr. : 1 Lec : 2 Lab)

Systematic of non flowering plants (representative examples of the various classes of plant kingdom, viruses, bacteria, algae, fungi, bryophyte, pteridophyta and gymnosperms, economic and medicinal uses of bacteria and algae. Principles of Genetics.

BIOL 119 - Zoology (2 Cr. : 1 Lec : 2 Lab)

Introduction to zoology: Sub - science of zoology, manifestations of life, chemical composition of protoplasm, organic compound of biological important animal cell and its contents (structure and functions of both organelles and inclusion at light and ultrastructure level), cell division (mitosis and meiosis) and cell cycle, histology (principle type of animal tissues), vertebrate physiology (nutrition, digestion, metabolism, circulation, respiration, excretion, nervous and hormonal coordination).

BIOL 122 - Basic Parasitology (2 Cr. : 1 Lec : 3 Lab)

The course introduces nursing students to different types of parasitic diseases. Classification - Protozoa - Helminths - Arthropods. Selected medical parasites will be covered and their life cycles will be highlighted. Sources of parasitic infection, modes of transmission, methods of control and prevention are more important components of the course, epidemiology of parasitic infections. Practical: Classification of parasites: Methods of sampling materials from infected persons. Methods of diagnosis. Management of patients with communicable parasitic diseases.

BIOL 202 - Cell Biology (3 Cr. : 2 Lec : 2 Lab)

Structure and function of cellular organelles and components, the functional interaction of the cells with its microenvironment. Practical: Histochemical techniques that provide an understanding of the structure of cellular organelles in both plants & animals. Prereq.: BIOL 103.

BIOL 203 - Histology (3 Cr. : 2 Lec : 2 Lab)

A comparative study of the microscopic structure of certain tissues in some animals, methods of preparation of museum jars, theoretical basis of microscopical techniques, whole mounts of different animals and microscopical slides of the different organs, scanning and transmission electron microscopy. Practical: Applications of theoretical topics. Prereq.: BIOL 103.

BIOL 204 - Comparative Anatomy (3 Cr. : 2 Lec : 2 Lab)

Anatomy of representative fish, amphibian, and mammals and their evolutionary development. Practical: Dissection of representative forms of chrodates along with microscopical slides, and demonstrating models. Prereq.: BIOL 103.

BIOL 205 - Invertebrates Zoology (3 Cr. : 2 Lec : 2 Lab)

A study of selected invertebrate animals that represent the following major phyla: Annelida, arthropoda, mollusca and echinodermata, with emphasis on: Morphology, life history, ecology and evolution. Practical: Morphological and anatomical study for different coelomate invertebrate phyla. Prereq.: BIOL 104.

BIOL 206 - Principles of Genetics (2 Cr. : 2 Lec)

Basic principles of classical and modern genetics with emphasis on the analysis of genetic material and genetic processes at the molecular level. Prereq.: BIOL 103.

BIOL 209 - Introduction to Environmental Studies (2 Cr. : 2 Lec)

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

BIOL 210 - Embryology of Vertebrates (2 Cr. : 1 Lec : 2 Lab)

Principles of vertebrate development from fertilization of the egg to the formation of organs and systems. Practical: Studying different syages of the embryonic development (frog, amphioxus) along with microscopical slides, and demonstrating models (amphioxus, bony fish, cartlagenous fish, mammals, etc,...) of different models. Prereq.: BIOL 103.

BIOL 220 - Microbiology (3 Cr. : 2 Lec : 2 Lab)

Introduction to microbiology, morphology and structure of prokaryotic cells, culture requirements and identification procedures, pure cultures and methods of preservation, bacterial nutrition, cultivation and culture media, bacterial reproduction and growth, factors affecting microbial growth, prokaryotic diversity, general properties of viruses, methods of isolation and identification of viruses, structural components, taxonomy of plant and animal viruses, bacteriopages. Practical: Preparation of culture media, isolation of bacteria from different sources, staining of bacteria, bacterial count, pure culture techniques. Prereq.: BIOL 102.

BIOL 301 - Plant Physiology (3 Cr. : 2 Lec : 3 Lab)

Water relations, mineral nutrition, growth and development, role of auxins. Practical: Translocation of water through plant body, transpiration, cell & tissue cultures, experiments showing the role of auxins in plant growth & developments. Prereq.: BIOL 101.

BIOL 302 - Human Physiology (3 Cr. : 2 Lec : 3 Lab)

Introduction to human physiology, blood, autonomic nervous system, endocrine system and excitable system, Prereq.: BIOL 103.

BIOL 306 - Parasitology (3 Cr. : 2 Lec : 2 Lab)

An introduction to parasitism, selected specimens of some medically important parasites, with emphasis on: Classification, morphology, life cycle, physiology and pathogenicity. Practical: Studying selected specimens of some parasites. Prereq.: BIOL 205.

BIOL 320 - Entomology (2 Cr. : 1 Lec : 3 Lab)

General characteristics of insects, structure of head, thorax and abdomen and their modifications, structure of the

different types of insect metamorphosis, introduction to parasitism, insects as vectors of diseases, orders of insects of medical importance and their roles as disease transmitters and methods of biological control. Practical: Studying different types of antennae, mouth parts modifications, thoracic and abdominal modifications, insect leg, wing and genital appendages modifications, metamorphosis, dissection of cockroach, insect classification, representatives of insects of medical importance. Prereq.: BIOL 205.

BIOL 321 - Molecular Biology (3 Cr. : 2 Lec : 3 Lab)

Nucleic acid structure (DNA and RNA), DNA is the Genetic Material, DNA replication, transcription, translation, post translation modification, RNA silencing, epigenetics. Overview of molecular biology techniques: Isolation and purification of nucleic acids, PCR, Southern, Northern and Western blotting, sequencing, introduction to cloning.

BIOL 323 - Immunology (2 Cr. : 2 Lec : 0 Lab)

Introduction to basic immunology, non - specific immunity, complements, antigens, immunologlobulins structures & function, antigen - antibody reactions. Cells involved in immuno responses, lymphocytes and antigen recognition, major histocompatibility complex, response to antigen & processing presentation. Cell - cell interactions in specific immune response, cell - mediated immunity. MHC; Genetics & role in transplantation. Tolerance. The evolution of the immune system, phagocytosis, ontogeny of cells of the immune system. Endocrine glands and their hormones, general classes of chemical messengers, physiological roles of hormones, endocrine pathophysiology, mechanisms of hormone action. Prereq.: BIOL 202.

BTEC 303 - Introduction to Biotechnology (2 Cr. : 2 Lec : 0 Lab)

An overview of the field of biotechnology: The basic principles of recombinant DNA technology and genetic engineering to produce transgenic plants, animals and microbes. Applications of biotechnology to improved / novel uses of microbes, plants, animals, aquatic organisms, biological treatments of wastes and industrial spills, bioremediation, material recovery principles.The human genome project. Forensics applications. The impact on society and the environment. Prereq.: BIOL 206.

BCHM 306 - Hormones (2 Cr. : 2 Lec)

Introduction to endocrine glands, target organs and hormones, hormone receptor theory and its dependence on the hormone nature, endocrine glands and their hormones, the manifestations or changes occur upon hyper - secretion or hypo - secretion of hormones.

BCHM 313 - Structural Biochemistry (3 Cr. : 2 Lec : 3 Lab)

Structures, classification and function of Carbohydrates and lipids. Chemical, physical properties and classification of amino acids, proteins, nucleotides and nucleic acids. Micronutrients.

BIOL 403 - Principles of Ecology (3 Cr. : 2 Lec : 3 Lab)

Ecosystem structure and functions, the interaction of animals with their environments, principles of quantitative methods in ecology: Conservation of natural resources. Practical: Applications on theoretical topics. Prereq.: BIOL 104.

BIOL 405 - Biology of Vascular Plants (3 Cr. : 2 Lec : 3 Lab)
Pteridophyta: Origin, classification and representative examples, gymnospermae: Classification & representative examples; angiospermae: Systems of classification of flowering plants emphasizing on descriptive morphology and densification, examples of some common families in Lebanon. Practical: Representative genera of pteridophyta and gymnospermae, flower parts, the inflorescence, the fruit, and selected families of angiospermae. Prereq.: BIOL 102 and BIOL 101.

BIOL 417 - Mycology (3 Cr. : 2 Lec : 3 Lab)
Morphology and taxonomy of fungi internal structure and chemical composition of fungal cells, classification of fungi, microbial nutrition, metabolism, development and growth. Practical: Study of some representative example of fungi (myxomycotina, phycomycetes, ascomycetes, bacidiomycetes and deuteromycetes) studying the effects of different media and other factors on fungal growth. Prereq.: BIOL 102.

BIOL 408 - Industrial Microbiology (3 Cr. : 2 Lec : 3 Lab)
Microbial growth, growth kinetics, microbial metabolism, industrial microbial strains: Isolation and characteristics, fermentation techniques and types of fermentors, application for some microbial industries (S.C.P, organic acids, antibiotics, enzymes, etc...), immobilization techniques and its application. Prereq.: BIOL 201.

BIOL 431 - Research Topic (1 Cr.)

BIOL 499 - Senior Research in Biology (2 Cr. : 2 Lec : 0 Lab)
Prereq.: BIOL 431.

Biochemistry

BCHM 301 - Biochemistry I (2 Cr. : 1 Lec : 3 Lab)
Chemical and physical properties and classification of amino acids, proteins, nucleotides and nucleic acids. Prereq.: CHEM 221.

BIOL 302 - Human Physiology (3 Cr. : 2 Lec : 3 Lab)
Introduction to Human physiology, blood, autonomic nervous system, endocrine system and excitable system. Prereq.: BIOL 103.

BCHM 302 - Biochemistry II (2 Cr. : 1 Lec : 3 Lab)
Chemical and physical properties and classification of carbohydrates and lipids, molecular constituents and architecture of biological membranes. Prereq.: BCHM 301.

BCHM 324 - Enzymes (3 Cr. : 2 Lec : 3 Lab)
Classification. Kinetics. Cofactors. Inhibition. Allosteric control. Enzyme specificity. Mechanism of catalysis. Clinical applications. Prereq.: BCHM 301.

BCHM 305 - Biochemical Techniques (2 Cr. : 1 Lec : 2 Lab : 1 Tut)

Chromatographic techniques [column, high performance liquid chromatography (HPLC), adsorption, partition, ion - exchange, exclusion, affinity, thin - layer and paper chromatography], electrophoretic techniques, immunochemical techniques [production of polyclonal and monoclonal antibodies; Radioimmunoassay (RIA) enzyme - linked immunosorbent assay (ELISA)].Prereq.: CHEM 221.

BCHM 306 - Hormones (2 Cr. : 2 Lec : 0 Lab)

Introduction to endocrine glands, target organs and hormones, hormone receptor theory and its dependence on the hormone nature, endocrine glands and their hormones, the manifestations or changes occur upon hyper - secretion or hypo - secretion of hormones.

BIOL 321 - Molecular Biology (3 Cr. : 2 Lec : 3 Lab)

Nucleic acid structure (DNA and RNA), DNA is the Genetic Material, DNA replication, transcription, translation, post translation modification, RNA silencing, epigenetics. Overview of Molecular Biology techniques: Isolation and purification of nucleic acids, PCR, Southern, Northern and Western blotting, sequencing, introduction to cloning.

BIOL 323 - Immunology (2 Cr. : 2 Lec : 0 Lab)

Introduction to basic immunology, non - specific immunity, complements, antigens, immunologlobulins structures & function, antigen - antibody reactions. Cells involved in immuno responses, lymphocytes and antigen recognition, major histocompatibility complex, response to antigen & processing presentation. Cell - cell interactions in specific immune response, cell - mediated immunity. MHC; Genetics & role in transplantation. Tolerance. The evolution of the immune system, phagocytosis, ontogeny of cells of the immune system. Endocrine glands and their hormones, general classes of chemical messengers, physiological roles of hormones, endocrine pathophysiology, mechanisms of hormone action. Prereq.: BIOL 202.

BIOL 431 - Research Topic (1 Cr.)

BCHM 403 - Physical Biochemistry (3 Cr. : 2 Lec : 3 Lab)

Water characteristics and buffers, bioenergetics, muscle contraction, protein functions, oxygen binding proteins, protein - ligand interactions (hill plot) Cellular interactions and membrane fusion, solute transport across membrane, ionophores, signal transduction (scatchard analysis), membrane channels and receptors, mechanism of vision. regulation of cellular activities. Prereq.: BCHM 302.

BCHM 406 - Medical Biochemistry (3 Cr. : 2 Lec : 3 Lab)

Correlation of laboratory analyses with pathophysiology addressing organ system disease, metabolic disease, nutrition, and special topics in clinical biochemistry. Electrolytes and acid base disorders, plasma proteins, amino acid disorders, nitrogen metabolism and renal disease, hepatobiliary disorders, disorders of porphyrin metabolism. gastric, pancreatic and intestinal function, carbohydrates, lipids and lipoproteins disorders. Prereq.: BIOL 302 & BCHM 417.

BCHM 417 - Metabolism (3 Cr. : 2 Lec : 3 Lab)

Glycolysis. Citric acid cycle, gluconeogenesis and biosynthesis of carbohydrates, photosynthesis, regulation of carbohydrates metabolism, digestion and transport of lipids, oxidation, omega oxidation, biosynthesis of lipids. Catabolism and anabolism of proteins and nucleotides. Prereq.: BCHM 301, BCHM 302.

BCHM 418 - Bioenergetics & Metabolic Regulation (3 Cr. : 2 Lec : 3 Lab)

The conversion of energy in biological processes, aerobic and anaerobic systems. Energy generation, electron transport chain, oxidative phosphorylation. Regulation of carbohydrates and lipid metabolism. Metabolic importance of amino acids. Prereq.: BCHM 417.

BTEC 303 - Introduction to Biotechnology (2 Cr. : 2 Lec : 0 Lab)

An overview of the field of biotechnology: The basic principles of recombinant DNA technology and genetic engineering to produce transgenic plants, animals and microbes. Applications of biotechnology to improved / novel uses of microbes, plants, animals, aquatic organisms, biological treatments of wastes and industrial spills, bioremediation, material recovery principles. The human genome project. Forensics applications. The impact on society and the environment. Prereq.: BIOL 206

BCHM 499 - Senior Research in Biochemistry (2 Cr. : 2 Lec : 0 Lab)

Student chooses one of the subjects selected and offered by the department committee members. Prereq.: BIOL 431.

Biotechnology

BIOL 321 - Molecular Biology (3 Cr. : 2 Lec : 3 Lab)

Nucleic acid structure (DNA and RNA), DNA is the Genetic Material, DNA replication, transcription, translation, post translation modification, RNA silencing, epigenetics. Overview of Molecular Biology techniques: Isolation and purification of nucleic acids, PCR, Southern, Northern and Western blotting, sequencing, introduction to cloning.

BIOL 323 - Immunology (2 Cr. : 2 Lec : 0 Lab)

Introduction to basic immunology, non - specific immunity, complements, antigens, immunologlobulins structures & function, antigen - antibody reactions. Cells involved in immuno responses, lymphocytes and antigen recognition, major histocompatibility complex, response to antigen & processing presentation. Cell - cell interactions in specific immune response, cell - mediated immunity. MHC; Genetics & role in transplantation. Tolerance. The evolution of the immune system, phagocytosis, ontogeny of cells of the immune system. Endocrine glands and their hormones, general classes of chemical messengers, physiological roles of hormones, endocrine pathophysiology, mechanisms of hormone action. Prereq.: BIOL 202.

BCHM 313 - Structural Biochemistry (3 Cr. : 2 Lec : 3 Lab)

Structures, Classification and Function of Carbohydrates and lipids. Chemical, physical properties and classification of amino acids, proteins, nucleotides and nucleic acids. Micronutrients. Prereq.: CHEM 221.

BCHM 305 - Biochemical Techniques (2 Cr. : 1 Lec : 2 Lab : 1 Tut)

Chromatographic techniques [column, high performance liquid chromatography (HPLC), adsorption, partition, ion - exchange, exclusion, affinity, thin - layer and paper chromatography], electrophoretic techniques, immunochemical techniques [production of polyclonal and monoclonal antibodies; Radioimmunoassay (RIA) enzyme - linked immunosorbent assay (ELISA)]. Prereq.: CHEM 221.

BCHM 312 - Metabolic Biochemistry (3 Cr. : 2 Lec : 3 Lab)

Enzymes classification, kinetic and inhibition. Metabolism of Biomolecules including carbohydrates, lipids and amino acids. Regulation of metabolism. Prereq.: BCHM 313.

BTEC 304 - Bioinformatics (2 Cr. : 1 Lec : 3 Lab)

Organization of the human genome, comparison with other organism genomes. The human genome project: History, ethics, revelations and medical implications. Genomic databases and web resources (genbank, protein data bank, OMIM, molecular biology databases); Finding genes and relation to diseases, finding functional and regulatory motifs, multiple sequence alignment; Protein sequence motifs; RNA secondary structure analysis; Designing PCR primers, discovering transcriptional regulatory signals. Prereq.: BIOL 321.

BTEC 306 - Genetic Engineering Techniques (3 Cr. : 3 Lec)

The basic principles of recombinant DNA technology, isolation of nucleic acids, DNA cloning, PCR types (RT - PCR, RFLP, qPCR), DNA fingerprinting, in vitro mutagenesis, hybridization techniques, DNA libraries, finding disease genes. Introduction to protein engineering. Tissue culture: Techniques available for growth and maintenance, primary cells vs. cell lines and different applications. Prereq.: BIOL 206 and BIOL 321.

BTEC 308 - Molecular Genetics (3 Cr. : 3 Lec)

Classification of mutations, mutation to phenotype, molecular markers of genetic disorders, cystic fibrosis, ataxia telangiectasia, xedroderma pigmentosum, discovering disease - susceptibility genes, inherited vs. acquired genetics, general epigenetics (methylation and histone remodeling) and mutations, pharmacogenomics, DNA damage and cancer initiation, oncogenes and tumor suppressor genes. Prereq.: BIOL 206 and BIOL 321.

BIOL 431 - Research Topic (1 Cr.)

BTEC 401 - Applications in Biotechnology I (3 Cr. : 3 Lec)

Applications of biotechnology in the plant and agriculture fields. Genetic engineering of plants. Using plants as bioreactors to produce therapeutic drugs, edible vaccines. Genetically engineered crops for higher yield (corn), higher nutritional value (golden rice), herbicide resistance, pest resistance (Bt genes). Control on genetically modified organisms (GMOs), effect of consumption on humans and the environment. Influence of the biotech. industry. Cultural acceptance social impact in developed and developing countries. Prereq.: BTEC 306.

BTEC 402 - Applications in Biotechnology II (3 Cr. : 3 Lec)

Applications of biotechnology in the medical, scientific, and legal fields. Pharmacogenetics principles and its currently available tests. Forensic biotechnology and the legal field including paternity andcrime scene testing, DNA fingerprinting, CODIS panels, sequencing and biomarker analysis. Using gene libraries to clone genes and understand diseases. Animal models of disease, using animals for research, cloning mammals. Genetically engineered bacteria and animals as therapeutic drug factories. Bioremediation. Ethical considerations. Prereq.: BTEC 401.

BTEC 404 - Molecular Diagnostics (3 Cr. : 3 Lec)

Current advances in diagnostic medicine using genetic polymorphisms such as SNPs and STRs as well as gene expression and miRNA signatures to classify tumors and for disease diagnosis and prognosis. Whole genome arrays, whole genome testing and pseudoscience. Next Gen Sequencing and its impact on the future of medicine. A review of currently available tests, their significance, and the technologies and instrumentation involved. Prereq.: BTEC 308.

BTEC 413 - Stem Cell Engineering (3 Cr. : 3 Lec)

Developmental genetics: Homeobox genes, growth, differentiation, morphogenesis, cellular kinetics, fertilization, cell division, dormancy, germination, metamorphosis, regeneration. Introduction to stem cells, classification and differentiation, induced pluripotency and medical advances of stem cell technology: Tissue and organ regeneration, mammalian cloning; Ethical and social considerations. Prereq.: BIOL 321.

BTEC 499 - Senior Research in Biotechnology (2 Cr. : 2 Lec)

Student chooses one of the subjects selected and offered by the department committee members. Prereq.: BIOL 431.

Environmental Science

ENVI 301 - Planet Earth (2 Cr. : 2 Lec)

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

ENVI 302 - Environmental Pollution (3 Cr. : 3 Lec)

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

ENVI 303 - Ecosystems & Biosphere (2 Cr. : 2 Lec)

The ecosystem; Definition and structure. Types of ecosystems. The ecosystem concept, population and the species concept, habitat and the concept of ecological factors. Analysis of biotic communities. Functions in the ecosystem; Energy flow, food chains and productivity. Biosphere; Definition, the web of life, man and biosphere.

ENVI 304 - Coastal & Marine Ecosystem (2 Cr. : 1 Lec : 3 Lab)

Introduction to coastal environments & marine ecosystems and their resources. Tools for monitoring, management and development of coastal & marine ecosystems pollution sources & its impact. Conservation and protection of marine natural communities, Lebanon coastal environments and its management and development programs.

ENVI 305 - Climate Change: Past & Future (2 Cr. : 1 Lec : 3 Lab)

History of the earth and natural cycles of changing climate. Global warming. Green house effect. Rate of climate change. Reduce carbon emissions. Difference between climate and weather. Physical impacts. Social impacts of climate change.

ENVI 306 - Environmental Risk Assessment (2 Cr. : 2 Lec)

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 307 - Fundamentals of Ecology (2 Cr. : 1 Lec : 1 Lab)

This course will focus on providing a basic understanding of ecological principles, concentrating on an ecosystem approach. The laboratory will provide practical experience pertaining to the study of ecology, as well as exercises intended to provide an understanding of the types of projects and studies conducted by the professional ecologist.

ENVI 308 - Energy Resources (2 Cr. : 2 Lec)

Renewable natural sources of energy and clean technologies. Solar, wind, geothermal hydropower, & tidal energy. Natural resources (water, forests, fuels, etc) management, exploitation and disposal of natural resources, non - renewable natural sources of energy. Conventional fuels (mining fuels, natural gases, etc...) Nuclear energy. Implications in the environment.

ENVI 310 - Natural Disasters (2 Cr. : 2 Lec)

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.

BIOL 401 - Research Topic (1 Cr. : 1 Lec : 1 Lab : 1 Tut)

ENVI 403 - Waste Recycling (2 Cr. : 1 Lec : 3 Lab)

Types of wastes and waste treatment technologies. Problems associated with the conventional methods of waste treatment & disposal. Various options and modern technologies employed in waste treatment, disposal and recycling using biological systems.

ENVI 404 - Environmental Microbiology (2 Cr. : 1 Lec : 3 Lab)

The course covers the following: Introduction to microbiology, metabolic diversity, terrestrial environments, aerosol environments, aquatic environments, microbial interactions and transport, biogeochemical cycling, microbes and pollutants, microbes and agriculture, indicator organisms, waste and water treatment.

ENVI 405 - GIS & ARC / INFO (2 Cr. : 1 Lec : 3 Lab)

Principles, characteristics and applications of environmental remote sensing. GIS as an environmental monitoring tool. Photographic systems and interpretation, thermal and multispectral scanning, satellite remote sensing, and digital image processing. Application of techniques to topics in the field of resource inventory, land use mapping or environmental monitoring.

ENVI 408 - Environmental Impact Assessment (2 Cr. : 1 Lec : 3 Lab)

Definition and objectives of environmental impact assessment (EIA), activities involved in EIA, major components and subcomponents, characteristics of impacts, EIA methods, checklists, overlay mapping, networks, matrices, estimates of resources demand for EIA studies, recommended methodologies for rapid EIA case studies, guidelines for EIA in developing countries.

ENVI 409 - Environmental Toxicology (2 Cr. : 1 Lec : 3 Lab)

The distribution of pollutants in the environment; Their entry, movement, storage and transformation within the environment. The effects of pollutants on living organisms. At an individual level toxicants may disturb the biochemical, molecular, and physiological structure and function which will in turn have consequences on the structure and function of communities and ecosystems.

ENVI 499 - Senior Project in Environmental Science (2 Cr.)

Elective Courses for Biology, Biochemistry & Biotechnology

- **Students can choose any of these classes as an elective.**
- **Students can also choose required courses from other majors as an elective.**
- **Prerequisite requirements should be completed with a satisfactory grade before enrollment in any class.**

BIOL 207 - Membrane Biology (2 Cr. : 2 Lec)

A survey of the structural components of biomembranes and the forces that dictate membrane structure. General membrane functions, such as compartmentalization and membrane transport, are analyzed in view of the principles of membrane structure. The structure, function, and biogenesis of the membrane organelles in cells are covered in detail. Diseases whose pathology originates with biomembranes, such as cystic fibrosis and heart disease, are discussed as examples illustrating membrane structure and function. Prereq.: BIOL 202.

BIOL 211 - Human Anatomy (2 Cr. : 1 Lec : 3 Lab)

An anatomical approach to the study of cardiovascular, nervous, endocrine, muscular, respiratory, excretory, digestive

and reproductive systems.

BIOL 222 - Global Warming Biology (2 Cr. : 2 Lec)

Addresses ways in which humans are altering the global environment, with consequences for the ecology of animals, plants, and microbes. Discussion on how these biologically oriented questions relate to human society, politics, and the economy.

BIOL 213 - Introduction to Biometry (2 Cr. : 2 Lec)

Principles of probability and statistics applied to biological data. Binomial, chi - squares, and normal distributions, including analysis of variance, regression, and correlation.

BIOL 224 - Ornithology (2 Cr. : 2 Lec)

A thorough introduction to the biology of birds, covering topics ranging from avian anatomy and physiology to behavior, natural history, ecology, evolution, and conservation. Examples from both local and global avifauna.

BIOL 216 - Evolutionary Biology (2 Cr. : 2 Lec)

An integrative treatment of evolutionary biology that covers the principle theories of evolutionary processes, Mechanisms of speciation and the generation of biological diversity, basic research methods, eugenics, and the history of life.

BIOL 218 - Natural Hazards (2 Cr. : 2 Lec)

Seismic hazards; Volcanoes; Atmospheric hazards; Floods and hydrologic hazards; Landslides and rockfalls; Human interaction with the environment; Risk maps; Case studies.

BIOL 309 - Plant Pigments & Hormones (2 Cr. : 2 Lec)

Organization of plant cells; Photosynthesis; Allaloids and flavonoids; Plant hormones. Biosynthesis of carotenoid pigments; Biochemistry of plant development; The plant cell wall structure, formation and growth; Lignin formation; Free amino acids, pyrimidines, purines and nucleosides in plants; Metabolism of auxins, gibberellins and cytokinins; Synthetic growth regulators and herbicides and herbicides; Structure - function relationship of plant hormones.

BIOL 325 - Biology of Cancer (2 Cr. : 2 Lec)

Subject matter includes a discussion of representative examples of the principal categories of dominantly acting oncogenes. The role in oncogenesis of tumor suppressor genes (recessive oncogenes) is also considered, as are anti - apoptotic oncogenes such as Bcl. The roles that the proteins encoded by these genes play in growth hormone signal transduction, gene regulation, cell cycle regulation, and programmed cell death will be examined. Prereq.: BIOL 206.

BIOL 313 - Introductory Plant Pathology (2 Cr. : 2 Lec)

Introduction to study of plant diseases including relation of plant disease to crop production, environment, and man. Studying issues to microbe, insects, and weeds pests of plants in agricultural, landscape, and natural ecosystem.

BCHM 314 - Genetic Polymorphism (2 Cr. : 2 Lec)

Subject includes principles of DNA profiling and repetitive DNA in the human genome; Individualization versus identification; How genetic polymorphisms arise and is maintained; Continuous versus discrete allele systems; DNA isolation methods; RFLP (Restriction Fragment Length Polymorphism) analysis methods; Short Tandem Repeat (STR) markers; PCR - based typing systems; Automated systems and DNA databases; Applications of mitochondrial DNA analysis; Linkage, pedigree analysis, and reverse paternity; Introductory applied statistics for genetic polymorphisms. Prereq.: BIOL 206.

BIOL 315 - Food Microbiology (2 Cr. : 1 Lec : 3 Lab)

Miroorganisms associated with food borne diseases. Detection of pathogens, food preservation, microbiology of dairy and fermented food. Microorganisms as source of food and their role in health improvement. Prereq.: BIOL 201.

BIOL 316 - Pollution of Marine Environment (2 Cr. : 2 Lec)

Introduction to the marine ecosystems, sources and types of pollutants, environmental degradation and its impact. Marine pollution management. Waterborne diseases (bacterial, protozoan, viral) as a function of environmental change (including chemical and biological pollution and climate change). Current waterborne diseases of humans and aquatic fauna, detection of waterborne pathogens, microbial evolution, microbial physiology. Water regulations and protection of drinking water. International legislation for the conservation of marine environment. Prereq.: BIOL 201.

BIOL 317 - General Virology (2 Cr. : 2 Lec)

Introduction to viruses; Systematics of viruses; Morphology of viruses (DNA and RNA viruses); Viral replication; Selected viral diseases; Antiviral drugs and vaccination. Prereq.: BIOL 201.

BIOL 318 - Bioremediation (2 Cr. : 2 Lec)

An emphasis on genetically engineered organisms that affect the environment. Bioremediation; Pesticide plants and their effects on non - target organisms; Genetically modified crops, salt and drought plants, phytoremediation of mercury and organic pollutants, sentinels of aquatic pollution, genetically modified fish farming, ethical perspective. Prereq.: BTEC 303.

BIOL 319 - Nutrition (2 Cr. : 2 Lec)

Digestion and absorption of nutritional constituents, dietary intake and energy metabolism of macronutrients, fat - soluble and water - soluble vitamins and their roles in metabolism and energy production, the biological importance of minerals and trace elements.

BTEC 320 - Gene Expression & Regulation (2 Cr. : 2 Lec)

Principles of gene expression and regulation starting with transcription and translation and including epigenetic regulation, methylation, chromatin remodeling, mRNA and protein degradation, microRNA, small interfering RNA and a survey of modern gene expression analysis techniques such as microarrays and realtime PCR. Prereq.: BIOL 321.

BIOL 404 - Toxicology (2 Cr. : 2 Lec)

Introduction to toxicology and toxicological chemistry, dose - response relationship, relative toxicities, reversibility

and sensitivity, xenobiotic and endogenous substances, teratogenesis, carcinogenesis, immune system effects, and reproductive effects, health hazards, toxic chemicals: Inorganic & organic.

BIOL 406 - Flora of Lebanon (2 Cr. : 1 Lec : 3 Lab)

Ecosystem development, ecological succession, and concepts of climate & ecosystem equilibrium and stability, desert ecosystems, principles of ecological modeling. Scope of phytogeography, integration of evolutionary ecological, & phytogeographical concepts, limits of species distribution, geographic distribution limitation by biotic interactions, species adaptation and gene flow, past changes in the physical geography of the earth, the idea of continental drift, distribution of natural vegetation, vegetation of the world, endemism, discontinuity and cosmopolitanism, phytogeography of Lebanon. Practical: Identification of the flora of Lebanon, collection of the dominant species of different habitats and preparation of herbarium specimens, characteristics of some cultivated plants (fruit trees, ornamental trees and crops), determination of phytomass, measuring plant growth rate, leaf area index. Prereq.: BIOL 102.

BIOL 409 - Advanced Plant Physiology (2 Cr. : 2 Lec)

Photosynthesis: Chloroplast structure, photosynthetic pigments, light absorption by chlorophyll and energy transfer, Emerson effect, photosynthetic phosphorylation (cyclic and non - cyclic), carbon dioxided fixation, characteristics of C3 and C4 plants, photorespiration, factors affect the rate of photosynthesis, respiration: Glycolysis, fermentation, Krebs cycle, electron transport system and phosphorylation, cyanideresistant respiration, the alternative pathway, hexose monophosphate shunt, glyoxylate cycle, factors affecting the rate of respiration, some related metabolic pathways. Practical: Quantitative determination of total organic N2, quantitative determination of amino acids and other organic acids, factors affecting the rate of photosynthesis, separation of pigments by paper chromatography, determination of the rate of respiration in germinating seeds, respiratory quotient, anaerobic respiration.

BTEC 411 - Proteomics & Functional Genomics (2 Cr. : 2 Lec)

Survey of modern techniques of protein biochemistry, bioinformatics, proteomics, and functional genomics, including basic concepts of protein structure and function, protein folding, protein characterization and purification, enzyme kinetics, NMR and x - ray crystallography, mass spectrometry, and various techniques and approaches to functional and structural genomics. Prereq.: BTEC 304.

BCHM 412 - Cell Signaling (2 Cr. : 2 Lec)

The molecular mechanisms of action of various extracellular mediators including hormones, neurotransmitters, growth factors, cytokines, etc. and cell signaling events. Several areas will be discussed including (1) mechanisms of mediator synthesis, (2) interaction of mediators with specific receptors, (3) modulation by mediators of various second messenger systems including cyclic nucleotides, inositol phospholipids, calcium, protein phosphorylation, ion flux, etc. and (4) intra - and inter - cellular mechanism for regulating mediator action. Prereq.: BIOL 321.

BCHM 413 - Nucleic Acid - Protein Interaction (2 Cr. : 2 Lec)

A comprehensive view of the structural properties of DNA and RNA that promote molecular interactions and biological function. Topics will include the physical properties of nucleic acids, the formation and biological importance of higher order structures, RNA enzymatic activities, nucleic acid-protein interactions, and RNA metabolism. Prereq.:

BIOL321.

BIOL 413 - Environmental Assessment & Management (2 Cr. : 2 Lec)

The role of the biologist and biology in modern environmental law and its application; Environmental impact analysis; The biologist as consultant and activist; Laboratory consists of analyses of actual problems facing society and government.

BCHM 424 - Neurobiochemistry (2 Cr. : 2 Lec)

Organization of the nervous system. Chemical composition of nervous tissue. Nucleic acid metabolism of brain, lipid metabolism of brain, transport of amino acids in brain, biochemistry of synaptic function. Neurotransmitters. Biochemistry of brain disorders. Prereq.: BCHM 407.

BTEC 414 - Nanobiotechnology (3 Cr. : 3 Lec)

Advanced biotechnologies that include solid phase and bead microarrays, nano - PCR, qPCR, Pyrosequencing. Emphasis on the technologies and instrumentation. A review of the biotechnology industry and its effect on the medical field. Prereq.: BTEC 303.

BIOL 415 - Advanced Human Physiology (2 Cr. : 2 Lec)

Cardiovascular system, digestive system, renal system, respiratory system and central nervous system. Prereq.: BIOL 302.

BIOL 416 - Pathophysiology (2 Cr. : 2 Lec)

Acquaints the student with pathological deviations from the normal physiological activities of the major systems of the human organisms. Immunological and genetic aspects of diseases will be included. Prereq.: BIOL 415.

BTEC 416 - Advanced Topics in Genetic Analysis (2 Cr. : 2 Lec)

A survey of contemporary research on complex genotype - phenotype correlations in human populations. Topics will include mammalian genome structure and evolution, intra - species variation, and molecular tools developed for modern gene discovery projects. The analytical approaches of formal linkage analysis and Whole Genome Association Studies will be explored through primary publications on various complex traits including bipolar disorder, diabetes, and cancer susceptibility. Prereq.: BTEC 303.

BIOL 419 - Forensic Biology (2 Cr. : 2 Lec)

Introduction to the importance, collection, and analysis of biological forensic evidence. Course covers ecological, entomological, and biotechnological techniques and some law enforcement, criminology, and wildlife enforcement. Prereq.: BIOL 206 & BIOL 321.

BIOL 420 - Cell & Tissue Culture (2 Cr. : 2 Lec)

A study of cell culture techniques, emphasizes the principles and practices of initiation, cultivation, maintenance, and the preservation of cell lines and primary cells including applications such as transfection and transduction. Prereq.: BIOL 202.

BIOL 421 - Mechanisms of Microbial Diseases (2 Cr. : 2 Lec)

Infection and disease, host - pathogen relationship, mechanism of host immune response, microbial flora of the body, a survey of microorganisms involved, antimicrobial chemotherapy. Prereq.: BIOL 201.

BIOL 422 - Neurobiology (2 Cr. : 2 Lec)

Anatomy and physiology of the nervous systems; The mechanisms of neuronal functions. Prereq.: BIOL 302.

BTEC 423 - Gene Therapy (3 Cr. : 2 Lec : 1 Tut)

Emphasis on virology and viral gene delivery methods. Overview on non - viral methods. In vivo, in vitro, and in utero gene therapy, marker genes, expression and regulation of introduced genes, overview of current gene therapy trials. Safety and ethical considerations, social impact. Prereq.: BIOL 321.

University Requirement Elective Course

GKMA 003 - Science Methods in Education (2 Cr. : 2 Lec)

Theory and practice in methods of teaching science in the elementary and secondary schools with observation and practice teaching. Concepts and trends needed to design and teach curriculum materials for science education. (Not Offered for Arts Students).

Elective Courses for Enviromental Science

ENVI 309 - Bioremediation (1 Cr. : 1 Lec)

Factors affecting the biodegradation of organic chemicals in the environment. Procedures for both physical and biological remediation. Selection of selected case histories of existing sites.

ENVI 312 - Introduction to Marine Science (3 Cr. : 3 Lec)

Introduction to physical, chemical, geological and biological processes in the oceans and coastal environments and their interactions; Interrelationships of man and the marine environment.

ENVI 314 - Plant Physiology (3 Cr. : 3 Lec)

Water relations, mineral nutrition, growth and development, role of auxins. Practical: Translocation of water through plant body, transpiration, cell & tissue cultures, experiments showing the role of auxins in plant growth & developments. Prereq.: BIOL 101.

ENVI 316 - Medical Entomology & Biological Control (3 Cr. : 2 Lec : 3 Lab)

General characteristics of insects, structure of head, thorax and abdomen and their modifications, structure of the different types of insect metamorphosis, introduction to parasitism, insects as vectors of diseases, orders of insects of medical importance and their roles as disease transmitters and methods of biological control. Practical: Studying different types of antennae, mouth parts modifications, thoracic and abdominal modifications, insect leg, wing and genital appendages modifications, metamorphosis, dissection of cockroach, insect classification, representatives of insects of medical importance. Prereq.: BIOL 205.

ENVI 406 - Environmental Policy Economics & Laws (2 Cr. : 2 Lec)

An introduction to the history, organization, goals and ideals of environmental protection. Legal aspects of environmental regulations. Historical perspectives and current regulations for air, land and water quality. Political implications of shifts in emphasis from nature protection to pollution control to sustainability. Economic and law approaches are combined studies in environmental policy making.

ENVI 407 - Metabolic Biotransformations of Environmental Chemicals (3 Cr. : 2 Lec : 3 Lab)

Biochemical processes controlling transport and metabolism of hazardous chemicals. Toxicokinetics (absorption, distribution, metabolic conversation & elimination) molecular basis of toxic action, target organ toxicity, mutagenesis & carcinogenesis selected chemical agents that adversely affect human health.

ENVI 411 - Conservation Biology & Biodiversity (3 Cr. : 2 Lec : 2 Lab)

Application of ecological and evolutionary theory to the management of rare and threatened species, communities, and ecosystems.

ENVI 412 - Genetic Engineering & Applications (3 Cr. : 3 Lec)

Nucleic acid structure (DNA and RNA), DNA is the genetic material, DNA replication, transcription, translation, post translation modification, isolation and purification of nucleic acids (DNA and RNA), isolation of genes (genomic library construction and screening, DNA library construction and screening, PCR library construction and screening), identification of the cloned genes (southern blotting, northern blotting, Western blotting, South - western blotting - screening method), recent techniques in molecular biology (DNA - microarray, proteomics, metallomics, cellomics).

ENVI 413 - Medical Microbiology (3 Cr. : 2 Lec : 2 Lab)

Transmission, symptoms, diagnosis, pathogenesis and treatment of viral, bacterial and fungal diseases.

ENVI 414 - Aquatic & Wetland Vascular Plants (3 Cr. : 3 Lec)

Identification, ecology, and adaptations of vascular aquatic and wetland plants.

ENVI 416 - Human Physiology (3 Cr. : 2 Lec : 2 Lab)

Methodologies in physiology, nutrition, absorption and metabolism of food, respiration, body fluids and their circulation, excretion, osmotic and ionic regulation, reproduction and mechanisms that governs body functions in man. Practical: applications on theoretical topics. Prereq: BIOL 103.

University Requirement Elective Courses

ENVI 001 - Water Resources (2 Cr. : 2 Lec)

Introduction - Our planet Earth and water balance - Distribution of Earth water - Human population and water cycle - Surface water - Surface water and flooding - Climate changes - Water quality and water pollution - Lebanon and Litani - Underground water - The future of the water resources of the Arab world - Flood hazards and hydrology - Dams and reservoirs - Water resources and economic development - Hydro - Politics of Middle East.

ENVI 002 - Natural Hazards (2 Cr. : 2 Lec)

Introduction - Constitution and dynamics of our planet - Mechanics and consequences of plate tectonic - Earthquakes - Earthquakes and Tsunamis - Global worming and climate change - Floods and volcanism - Mass movement - Sever storms, Hurricanes - Tornadoes and fire and smoke.

ENVI 007 - Man & Environment (2 Cr. : 2 Lec)

What is Environment? - Sign of life - How about environment of Human? - What is living object? - What are differences between living and non - living objects? - Growth and development - Interactions - Adaptation - Response - Biotic components cannot survive in isolation - Energy - Matter - How did life emerge on the life - Human environment - Natural environment: 4 spheres.