

Foundation Year

MA 1101 Mathematics (1)

Propositional and predicate logic. Sets. Mathematical induction. Complex numbers, Determinates and Matrices. Solution of lineas equations using row education method.

Limits of one variable functions continuity and differentiability. Extrema and curve Sketching. Related rates linear approximation Differentiation of derivatives

MA1103 Mathematical Statistics

Descriptive statistics- Measures of central of tendency – Measures of spread – frequency distribution and graphical representation- cumulative frequency distributions – Descriptive statistics for grouped data – Coding of the data- Elements of univariate and bivariate probability distributions - Definition and elementary proprieties of characteristic functions- moment generating function- probability generating function – basic concepts of inferential statistics – Analysis of variance.

MA 1202 Mathematics (2)

Definite and indefinite integrals. The fundamental theorem of calculus and applications of definite integral. Area arc length, volumes and surfaces of revolutions Differentiation and integrations of exponential, logarithmic, trigonometric and transcendental functions. Techniques of integrations, trigonometric and transcendental functions. Techniques of integrations -Im proper integrates.

Geometry: coordinates system, polar coordinates parametric equations second degree equations and applications in rgw plane. Conic sections and properties.

MA 1121 Mathematics (I)

Propositional and predicate logic. Sets. Mathematical induction. Complex numbers, Determinates and Matrices. Solution of lineas equations using row education method.

Limits of one variable functions continuity and differentiability. Extrema and curve Sketching. Related rates linear approximation Differentiation of derivatives

MA1204 Applied Mathematics

Algebra of vectors- Differentiation and integration of vectors-The moments- Couples in the plane and space- Equilibrium and Reactions - The virtual work done- – Shearing forces and bending moments- Center of mass-Flexible strings and chains velocity

MA 1206 Algebra

Mathematical logic and methods of proofs. Relations. Matrix representations of relations and partition order relations.

Integers: Properties and the well ordered principle. Euclid's Algorithm, Greatest common divisor, prime and relatively prime numbers. The fundamental theorem of arithmetic.

Mapping: Properties. Inverses

Composition: The set of 1-1 onto mapping on a set , Binary operations and introduction to some algebraic structures.

MA 1222 Mathematics (II)

Definite and indefinite integrals. The fundamental theorem of calculus and applications of definite integral. Area arc length, volumes and surfaces of revolutions Differentiation and integrations of exponential, logarithmic, trigonometric and transcendental functions. Techniques of integrations, trigonometric and transcendental functions. Techniques of integrations -1m proper integrates.

Geometry: coordinates system, polar coordinates parametric equations second degree equations and applications in rgw plane. Conic sections and properties.

CS1101 Programming

Introduction to tie discipline of computing Computer systems, number systems data representation and basic: computer organization. Basic Math oo«»pts. functions and or positional logic Problem solving, abstraction. design and programming Selection structures, repetition and loop statements Modular programming Basic testing and debugging of programs. Introduction to programming in C++ Professional Ethic for compute/ professionals.



PH1121

Physics (1) (Properties of Matter & Heat) - Preq. (none)

Units and dimensions - Dimensional analysis –Vectors - Vibrating bodies - Vibrating spring - Motion in a circle - Simple harmonic motion motion in a vertical circle – satellite - Elasticity - types of distortion in solid bodies Hooke's law - Elasticity coefficients in solids - practical determination of elasticity coefficients - Surface tension - Methods of determination of surface tension - Flow of fluids - Thermometry and Thermal expansion - Thermal expansion of solids and liquids - Macroscopic description of an

ideal gas -Heat and internal energy: units of heat – the mechanical equivalent of heat -Specific heat and calorimetry – Latent heat
The kinetic theory of gases : Molecular model of an ideal gas - Adiabatic processes for an ideal gas Heat transfer mechanisms - Introduction to thermodynamics.

PH 1222

Physics (2) (Electricity, Magnetism & Geometrical Optics) - Preq. (none)

Properties of Electric Charges- Coulomb's Law- The Electric Field - Gauss's Law - Potential Difference and Electric Potential - Energy Due to Point Charges - Capacitors - Electric Current – Resistance – A Model for Electrical Conduction .Motion of a Charged Particle in a Uniform Magnetic Field - The Magnetic Field of a Solenoid- Magnetic Flux - Gauss's Law in Magnetism. Displacement Current and the General Form of Ampere's Law - Magnetism in Matter - Faraday's Law of Induction - Generators and Motors –Inductance - RL Circuits- The Nature of Light - The Speed of Light - The Ray Approximation in Geometric Optics - Reflection - Refraction. Huygens's Principle. Dispersion and Prisms – Raimbow- Measuring the refractive index by using the prism- Total Internal Reflection- Optical fibres - Images - Thin Lenses - Lens Aberrations - The Camera - The Eye - The Simple Magnifier- The Compound Microscope- The Telescope.

PH1123

General Physics (1) (Properties of Matter & Heat)

Units and dimensions - Dimensional analysis - Vibrating bodies - Vibrating spring - Motion in a circle - Simple harmonic motion – satellite - Elasticity - types of distortion in solid bodies Hooke's law - Elasticity coefficients in solids - practical determination of elasticity coefficients - Surface tension - Methods of determination of surface tension - Flow of fluids - Thermometry and Thermal expansion - Thermal expansion of solids and liquids - Macroscopic description of an ideal gas -Heat and internal energy: units of heat – the mechanical equivalent of heat -Specific heat and calorimetry – Latent heat The kinetic theory of gases : Molecular model of an ideal gas - Adiabatic processes for an ideal gas Heat transfer mechanisms.

PH 1224

General Physics (2) (Electricity, Magnetism & Geometrical Optics)

Properties of Electric Charges- Coulomb's Law- The Electric Field - Gauss's Law - Potential Difference and Electric Potential - Capacitors - Electric Current – Resistance . Motion of a Charged Particle in a Uniform Magnetic Field - The Magnetic Field of a Solenoid- Magnetic Flux - Gauss's Law in Magnetism. Displacement Current and the General Form of Ampere's Law - Magnetism in Matter - Faraday's Law of Induction - The Nature of Light - The Speed of Light - The Ray Approximation in Geometric Optics - Reflection – Refraction - Huygens's Principle – Raimbow- Measuring the refractive index by using the prism- Total Internal Reflection- Optical fibres - Images - Thin Lenses - Lens Aberrations - The Camera - The Eye - The Simple Magnifier- The Compound Microscope.

PH1226

Introduction to Biophysics

Applications of the principles of properties of matter, heat and mechanics in biological systems and medicine.

PH1125 General Physics

The law of universal gravitation – Inertial and gravitational mass – gravitational fields – Potential energy for system of particles – fluid mechanics – Waves in elastic media.

PH 1103 Biophysics (1)

Empirical studies on the living cell, the flexibility of a living cell, the aspect of living material of the cell, the cell surface energies, biological effects of some areas, light: energy and the light switch and absorption, the physical foundations of operations impacts vital therapeutic effects laboratory.

PH 1204 Biophysics (2)

Electromagnetic waves And the spectra of areas vital to measure resistance, the effects of low frequency, microwave radiation, laser radiation, UV radiation, acoustic phenomena are connotation of biophysical units used in acoustic, acoustic generators, considerations of the physical audio-ray absorption.



General Chemistry (1) Code: CH1101

This course covers different topics including units and measurements, electromagnetic radiations, photon energy, atomic spectra and Bohr model of atomic structure, quantum numbers, electronic configuration and periodic table, classification of elements and periodicity of properties. Chemical bonding, Lewis structure, concept of the formal charge, theories of chemical bonding (valence bond theory, hybridization and molecular orbital theory) and chemical calculations, theoretical basis and methods of qualitative analysis of substances or mixtures. States of the matter including the gaseous state (gas laws, ideal and real gases, kinetic theory of gases, Van der Waal's equation and liquefaction of gases), solid state (types of solids, crystal structure and crystal forms, iso- and polymorphism) as well as the liquid state and its properties are provided.

Practical, 3 hrs: Qualitative inorganic analysis: analysis of acid and basic radicals, analysis of mixtures.

General Chemistry (2) Code: CH1202

This is an extension to General Chemistry (I) and handles the topics: solutions (types of solutions, properties of ideal and non-ideal solutions, vapour pressure curves and

colligative properties of solutions), simple chemical kinetics, thermochemistry, chemical equilibrium and le-Chatelier's principle, ionic and phase equilibria, concepts of acids and bases, electrolytes, electrolytic conductance, oxidation-reduction process and introduction to nuclear chemistry. A brief introduction to organic chemistry is also given including classification of organic molecules based on functional groups. This permits the study of one functional group at a time. The properties and reactivity of different functional groups are compared.

Practical, 3 hrs: Simple physical chemistry experiments.



GE 1101 Physical Geology

Introduction, Theories on the origin of the Universe and the Solar System– The atmosphere, the hydrosphere, the lithosphere and the Earth's interior – The Earth's crust – Plate tectonic and the origin of mountains and oceans – Internal geologic processes and tectonic movements – Structures – Earthquakes and Volcanicity – External geologic processes; Weathering (physical and chemical), wind action, running water (rainfall, rivers and deltas), groundwater and its geologic action, waves and current actions in coastal areas, glacial erosion –. Laboratory studies of topographic and geologic maps.

GE 1103 Historical Geology

Introduction to the Earth's history, the most important events occurred during the geologic history of the Earth (e.g. orogenic, sedimentologic, biologic climatic, etc.). The origin of the atmosphere and ocean, orbital forcing and its effect on the earth's climate. Earth's age-dating, origin of life on the Earth, the record of life forms (fauna and flora) that evolved throughout the geologic time. Quaternary history of mammals. Extinct fossil groups and vertebrate evolution. Laboratory studies of paleogeographic and geologic maps.

GE 1202 Earth's Material

This course covers the nature and properties of the materials which make up the earth and is divided into three parts; "*Crystallography, Mineralogy and Petrology*". The first part includes definition of crystallography and crystal formation, and general description of crystal morphology. The second part concerns with the physical and chemical properties of minerals, and classification of minerals. The third part introduces the rock cycle, and the basic concepts of identification, classification and origin of igneous, sedimentary and metamorphic rocks. Laboratory exercises

consist of hand specimen description and classification of crystal models, minerals and rocks.

GE 1204 Introduction to Geophysics

Introduction, definition and branches of geophysics. Gravity field of the Earth. Geoid's, GPS and isostasy. Seismic methods and earthquake. Magnetic and paleomagnetic methods. Electric and Geothermal methods. Borehole geophysics. Practical work of some measured geophysical parameters.

GE 1121 General Geology (1)

The origin of the Earth and creation of the Universe, The Earth's interior (composition and structure), materials of the Earth's crust (crystals, minerals and rocks), continents, ocean basins, lithosphere, hydrosphere, biosphere and atmosphere. Internal processes: volcanism, earthquakes, crustal deformation, mountain building and plate tectonics, External processes: weathering, mass wasting, streams, glaciers, groundwater, deserts and coasts. Exercises include topographic and geologic maps.

GE 1222 General Geology (2)

Introduction, Origin, evolution and mass extinction of major life forms with emphasis on stratigraphic record, development of the geologic time scale and paleogeographic features of the Earth. Absolute and Relative Age, Law of superposition, Major life forms in Precambrian, Paleozoic, Mesozoic and Cenozoic Eras. Laboratory studies include stratigraphic sections and identification and description of invertebrate fossils.



BO1101: General Botany

This course should cover the external and morphological structures of seed plants with emphasis on seed types and seed germination, types of roots, stems and leaves, types of inflorescences and fruits, modification of morphological structures and the adaptation of plants to environmental conditions. This course should also deal with the structure, division of and types of plant cells as well as types of tissues of plant structures. Another major topic of this course should be the primary structure of plant root, stem and leaves and their secondary growth and anatomical adaptations to water, saline and drought conditions.

BO1202: General Botany

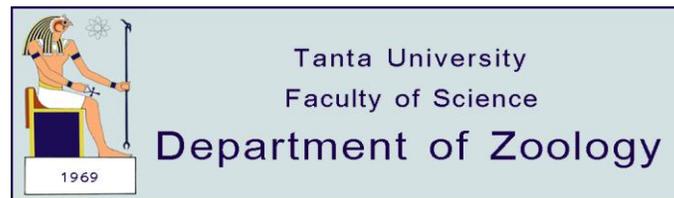
One part of this module deals with the diversity and classification of plants kingdom including non flowering and flowering plants. The topics should cover the occurrence, structure, classification and evolutionary relationships of the major plant groups of non flowering plants with special emphasis on the evolution of stele structure in the different non flowering plants and the life cycles of selected examples. The module will also cover the flower structure and the classification of flowering plants with special reference to selected families. Another part of this course should cover topics in plant physiology particularly the types of solutions, the permeability and transport processes and plant-water relationships. The topics in plant physiology should also be extended to the processes of osmosis, enzymes, photosynthesis and respirations metabolism.

BO1121: General Botany

The aim of this module is to give the students sufficient knowledge on the plant external and internal structures of plants. The external morphology criteria should deal with the following topics: seed types and seed germination, types of roots, stems and leaves, types of inflorescences and the adaptation of plants to the environment. The endo-morphological criteria should deal with the following topics: types of plant cells and tissues, the primary structure of plant body, root, stem leaves secondary thickening and ecological anatomy.

BO1123: Systematic Botany

This module deals with the classification of plants kingdom including non flowering and flowering plants. The topics should cover the occurrence, structure, classification and evolutionary relationships of the major plant groups of non flowering plants with special emphasis on the evolution of stele structure in the different non flowering plants and the life cycles of selected examples. The module will also cover the flower structure and the classification of flowering plants with special reference to selected families.



ZO1101 General Zoology (1)

This course will enable students to gain knowledge and understanding to zoological principles relating to cells, organ systems, genetics, development, physiology and environmental relations. Laboratory exercises illustrating animal structure, physiology, Embryology, and ecology.

EN 1101 Introduction to Entomology (1)

This course will enable students to acquire knowledge and critical understanding of the intimacy between insect and environment .The components of insect success-insect adaptations and their role in the success of insect and gain knowledge of classification of insects.

ZO1202 General Zoology (2)

The module of General Zoology provides an introduction to Animal diversity that considers the heart of zoology sciences. The course will enable students to gain knowledge and understanding about the concept of biodiversity and hierarchical classification system (taxonomy). The aim of this module is to provide a systematic survey of animal-like Protists (Protozoa) with invertebrate and vertebrate animals with an emphasis on Egyptian examples. The course includes practical experience in

the identification of representative organisms with systematic position of different species, using slides, specimens and dissections.

EN 1204 Introduction to Entomology (2)

This course will enable students to acquire knowledge and critical understanding of the general physiological principles and the functional mechanisms of life processes in insect body and how they apply to the integrated functions of organ systems.

ZO1204 Principles of Zoology

The module of principles of Zoology provides an introduction to Animal diversity that considers the heart of zoology sciences. The course will enable students to gain knowledge and understanding about the concept of biodiversity and hierarchical classification system (taxonomy). The aim of this module is to provide a systematic survey of animal-like Protists (Protozoa) with invertebrate and vertebrate animals with an emphasis on Egyptian examples. The course includes practical experience in the identification of representative organisms with systematic position of different species, using slides, specimens and dissections.

ZO1206 Introduction to Zoology

This course will enable students to gain knowledge and understanding to zoological introduction (Cytology, Histology, Embryology, Functional and Environmental Anatomy) relating to cells, organ systems, genetics, development, physiology and environmental relations. Laboratory exercises illustrating animal structure, physiology, Embryology, and ecology.

BIO1101 General Biology

This module deals with the diversity of plant and animal life. The students will learn about the major groups of plant and animal kingdoms with illustrative example from each group. The module deals also the economic importance of selected plants and their role in life. This course will also enable students to gain knowledge and understanding to zoological principles relating to cells, tissues and organ systems. Laboratory exercises illustrating plant and animal groups and structures will be available.



Programme Title **Mathematics Science**

Programme Type **Special**

Department(s) **Mathematics**

MA 2101 Applied Mathematics (1) (MA1101)

Motion of particles in straight line- Motion in the plane- Universal law of gravitation- Relative velocity- Motion in a resistive medium- Projectiles- Motion of particles on the circle- The work, power, and energy-Simple harmonic motion-collision of elastic bodies.

MA 2103 Abstract Algebra (MA1206)

Binary operations on a set. The semi group of mappings groups permutation . groups. Groups of symmetries structures and lattice diagram of subgroups Coset decom position and normal subgroups quotient groups. Homomorphism Rings and ideals integral domains field and some theorems and properties

MA 2105 Mathematical Analysis (1) (MA1202)

Function of several variables limits- Continuity - Differentiability - Integrals- Applications - Differential Equations of First order and First degree- Methods of solutions of Differential Equations- Differential Equations of First order and higher degree- Differential Equations of n order- General solutions of non homogeneous of ordinary Differential Equations of higher-order.

MA 2107 Discrete Mathematics (MA1206)

Counting: Permutations, combinations and Pigeonhole Principle. Recurrence relations. Ordered structures, Finite Boolean.

Algebra: Theorem and properties circuit design. Trees: Minimal spanning. Graphs. Graphs and digraphs. Euler and Hamiltonian paths and circuits. Transport Network Coloring.

MA2109 Selected topic of pure mathematics

ST 2101 Probability Theory (1) (MA1103)

The random experiment – sample space – the event – types of the events – The probability of the event – the probability postulates – the conditional probability The independence of the events – the total probability rule – Bayes theorem – the random variable definition The types of the random variable – the cumulative distribution function – the expectation value – the moments – the moment generating function- the probability generating function – the properties of the moment generating function – the properties of the probability generating function – Some continuous distributions (the normal distribution – the exponential distribution –gamma distribution – Beta distribution- the uniform distribution) – The discrete distributions (Binomial distribution- the geometric distribution- the negative binomial distribution – Poisson distribution) .

ST 2103 Sample Theory (ST1103)

The population and its parameters – The sample – The sample survey – The sampling statistics – The probabilistic and non probabilistic sampling – The random samples – Determination of the sample size (small samples and large samples)- regular samples- Estimation of the population parameters- The estimation of the mean and the variance of the population – Estimation of the proportion - Applications on the sample – The relationships among different types of the samples – Applications.

CS2103 Computer Programming (CS1101)

Overview of basic programming constructs. Functions, parameter passing and files Data modeling with arrays. structures and classes Pointers and linked lists Recursion Bank: program design and analysis, testing and debugging techniques Programming in C++. Program development using modem APIs.

MA2202 Applied mathematics (2) (MA2101)

Motion of particles of variable mass- Motion of particles in the plane- The restricted planar motion of particles- Moments and products of inertia- Planar motion of rigid bodied- Three-dimensional motion of particles.

MA2204 Vector analysis & Solid Geometry (MA2105)

The vector functions in one variable- The derivatives-Integrations-vector fields- The vector functions in multi-variables-Partial derivatives- Jacobi's matrix- Integration of vector multi-variable functions-Line Integral- Gauss' Theorem- Stockes' Theorem- Equilibrium of bodies in 3-dimension- Statics of fluids- The field and potential theory.

Coordinates and vectors in 3 dimensions; Direction cosines; Line; Plane; Sphere; Ellipsoid, Hyperboloid and Paraboloid.

MA 2206 Linear Algebra (MA2103)

Vector spaces and subspaces. Algebra of subspaces. Basis and dimension linear transformations, rank and nullity, the Matrix of linear transformation. Change of basis similarity, eigen values and eigen vectors. Diagonalizable operators product spaces. Some theorems with applications.

MA 2208 Mathematical Analysis (2) (MA2105)

Sequences – limit of Sequences- The Theorems of Convergent Sequences- Cauchy Sequence- Series of number- The tests of Convergent of Series Sequences of functions. Uniformly Convergence Series of functions- Uniformly Convergence of Series- Applications.

ST 2206 Statistical Inference (1) (ST2101)

Definitions of the population – The sample - The statistic – The estimator – The sample types – The properties of the good estimator (unbiasedness – sufficiency – efficiency – consistency) – Some methods of the estimation (point estimation – interval estimation)- The approximate properties of the estimators.

CS2204 Data Structures and Algorithms (CS2103)

The role of data structures in software engineering and algorithm design Abstract data types and classes concepts, data models, and levels of abstraction Recursion Analysis of algorithms. Elementary data structure* and *»eir Implementation arrays, strings, structures and files Specification. Implementation and specification of stacks, queues, hsts. trees and graphs Searching and sorting algorithms.

MA2210 Perturbation Theory (MA1202)

Straightforward expansion method- Lindstedt-Poincare Method- Method of harmonic balance- Multiple-scales method.

MA 2212 Number Theory MA2103)

The fundamental theorem of arithmetic congruence's, the theorems of Fermat and Wilson, Quadratic residues, the quadratic equations.

MA3101 Real Analysis (1) (MA2105)

Series of functions- the concept of orthogonally concept of a Fourier series- Fourier series of an integrable functions- convergence of trigonometric series- convergence of a Fourier series- functions of bounded variation and Riemann- Stieltjes integral – some special criteria for convergence (Dirichlet's Kernel- Absolutely continuous functions) Fourier integrals- Fourier transformation and its applications.

MA3103 Numerical Analysis (1) (MA2208)

Interpolation for equal distances tabulated points; interpolation for non- equal distances tabulated points; Numerical differentiation formulas; Open and closed

numerical integration formulas; numerical methods for initial value problems; Solving algebraic and transcendental equation; Iterative methods for systems of linear equations.

MA3105 Electromagnetism (MA2202)

The conservative and rotational vector fields- Curve linear coordinates- Solution of Poisson and Laplace equations- dielectric materials- electric multi-dipole- Boundary conditions problems- dielectric energy- Magnetostatic.

MA 3107 Algebra 1 (MA2103)

The fundamental isomorphism theorems congruence relations. Direct products of order up to 8. finite Abelian groups. Contumacy and Sylows theorems malls applications, Free products.

MA3109 Approximation Theory (MA2208)

Problem formulation; introduction of the approximation; Norm L^p and Tchebcheff norm; Boolean Algorithm; uniqueness theorems' Least square and algorithm functions.

MA3111 Special Relativity

Einstein and the Lorentz-Einstein transformation – Relativity and measurements of lengths and time intervals – Minkowski space in four dimensions – Relativistic dynamics – Tensor analysis.

MA 3113 Mathematical logic and Boolean algebra (MA2107)

Math logic: Goals and methods. First order logic First order recursive arithmetic. Arithmetization of syntax. Goedel's completeness and in complete mass theorem. Other application.

Boolean Algebra: Axiomatic logic gates and other applications. Boolean rings. Fields of sets Representation of finite Boolean Algebra. Subalgebra.

Stone's Representation of finite Boolean Algebra computer science.

MA3115 Theory of Ordinary Differential Equations (MA2208)

Existence and uniqueness of solutions of solutions; method of successive approximations; continuation of solutions; systems of differential equations; the n-th order equation; dependence of solutions on initial conditions and parameters; complex systems; Linear differential equations; linear homogeneous systems; nonhomogeneous linear systems; linear system with constant coefficients; linear system with periodic coefficients; Linear differential equations of order n; Linear equations with analytic coefficients; Linear systems with isolated singularities (singularities of the first kind); classification of singularities; structure of fundamental matrices; singularities at infinity; the Frobenius method.

MA3202 Analytical dynamics (MA2208):

Motion of a rigid body in three dimensions – Motion of a rigid body about a fixed point – Euler's equations – The motion of symmetric top – Euler's geometrical equations – Lagrange's equations and Hamilton theory – Hamilton's equations and

Routhian function – Hamilton’s principle – Canonical transformations and Bracket theory

MA3204 Topology (1) (MA3101)

Topology of the real Line and Plane; Topological spaces (Topology- open and closed sets- Neighborhood- Accumulation point- Derived set- interior of a set- Exterior of a set- subspaces comparison of topological- series and convergence- bases- sub bases – local bases –continuity and homeomorphisms) continuous mapping- local continuity –Topological properties- Axioms of accountability- countable spaces of type one and two separable spaces.

MA3206 Quantum Mechanics (1) (MA3103)

Postulates of Quantum Mechanics – Statistical interpretation of Quantum Mechanics- Simple one-dimensional systems- Free particle- potential barrier- Schrodinger Box-Linear harmonic oscillator-Potential step-Heisenberg uncertainty principle- The Angular momentum in 3-dimension-Hydrogen atom

MA3208 Mathematical Programming (MA1204)

Linear programming; Simplex Algorithm; Advanced topic in Linear programming; Sensitivity analysis and duality; Transportation, Assignment, and Transshipment problems.

MA3210 Optimal control (1) (MA3103)

Introduction to linear optimal control, standard regulator problem, Hamelton jacubian equation, solution of the finite time of regulator problem, discrete time system; infinite time regulator problem, stability of time invariant, cross product terms and second variation theorem, regular with a degree of stability; Tracking system properties; Properties of regulator system.

MA3212 Special functions (MA3101)

Gamma and Beta functions; Legendare equation; Bessel’s equation; Hermit equation; Using the series for solve the ordinary differential equations.

MA 3214 Measure Theory (MA3101)

System of sets (lings sets- semiring of sets- the ring generated by a semiring Borel algebra in the plane- Measure of elementary of sets- The ring lebesgue Measure of plane sets- Measure on a semiring- Count a laly additive measured- Extensions of Measures). Integration (Measurable Functions- The Lebesgue integral- Fasters properties of the Legesgue integral).

MA3216 Elasticity Theory (MA2202)

Theory of stresses – Differential equations of equilibrium – Surface conditions – Cauchy surface of stresses – Applications – Theory of strain – Compatibility equations – Tensor character of strain at a given point – Generalized Hooks' law – Solution of the elasticity problem in terms of displacements - Solution of the elasticity problems in terms of stresses

MA 4101 Functional Analysis (1) (MA3210)

Metric Spaces (Definition of metric space Cauchy inequality – Holder inequality- Minkowski inequality Example- limit in metric spaces- closure of a subset of metric space- Cauchy sequence- Complete metric spaces- Examples- Theorem of instead closed spaces – Completion of metric space- Contraction mappings fixed point theorem- Application of the principle of contraction mapping in Algebra and Analysis – Normal Spaces- Banach Spaces- Hilbert Spaces- Compactness in metric space- Examples and Application

MA4103 Fluid Mechanics (1) (MA3103)

Definition of the fluids – Kinematic and kinetic equations – Euler's equation – Bernoulli's equations – Potential fluids – Motion in two dimensions.

MA4105 Operations Research (1) (MA3208)

Integer programming; Decision making under uncertainty; Goal programming and Multiattribute utility Theory; Game Theory.

MA4107 Differential Geometry (1) (MA2204)

Concept of curve in E^3 ; Main geometric properties of curves (Frenet equations, . . .); Involutes and Evolutes; Bertrand curves; Fundamental theorem of curves; Convexity – rotation index; Concept of simple surfaces; 1st and 2nd fundamental forms and applications; Geodesics (concept, examples); Types of a curvature (K_1 , K_n , K_g , K , H); Gauss formula and applications; Classification of points on a surface; Geodesics (concept, examples).

MA4109 Numerical Analysis (2) (MA3202)

The theory of linear difference equations; Spectral methods for linear two-point boundary value problems; The method of finite differences for linear boundary value problems; The method of nets for partial differential equations; The method of lines for elliptic equations; The approximate methods for linear and nonlinear integral equations; Linear programming problems.

MA4111 Topology (2) (MA3204)

Separation Axioms; Hausdorff Topological spaces T_1 , T_2 , T_3 , T_4 . Compactness (compact sets and compact spaces- compactness and separation- successive

compactness) Bolezano-weiertrass theorem- compactness in metric spaces (compactness – the compact sets and compact spaces- compactness of real line).

MA4113 General theory of Relativity (MA3105)

Tensor analysis – Tensor analysis on Riemannian spaces – Geodesics – The curvature tensor – Einstein's theory of gravitation – The Schwarzschild solution.

MA4115 Quantum Mechanics (2) (MA3206)

Helium atom – Scattering theory – Matrix method – Perturbation methods.

MA4202 Complex Analysis (MA3103)

The complex number system with geometric interpretation; Functions of complex variables; Continuity; Differentiability; Cauchy Riemann equations; Harmonic functions; Analytic functions; Complex line integrations; Power series; Conformal mappings; Complex integrations; Applications.

MA 4204 Algebra 2 (MA3204)

Ring and ideals. Homolog pluses congruence relation quotient ring. The isomorphism the orws. Maxiwal and prime ideals. The field of quotient of an integral domain. Polynomial rings. Field extensions, Finite extensions Modules. Composition series.

MA4206 Partial differential equations (MA2208)

Linear partial differential equations of order one and its solution by using Lagrange method. Superposition principle. Canonical forms. Classification of second order partial differential equations. Some standard methods for solving partial differential equations of higher order with constant coefficients (homogeneous and nonhomogeneous). Solution of parabolic equations (method of separation of variables, heat flow, diffusion equation). Solution of hyperbolic equations (viabration of stretched and flexible string, D'Alembert solution of the wave equation. Solution of elliptic equations (two dimensional diffusion equation, Laplace equations, Dirichlet problem and Neumann problem for a rectangular plate). Some applications.

MA4208 Review Article and Research

MA4210 Fluid Mechanics (2) (MA4103)

Viscous fluids – Stress tensor – Navier-Stockes equation – Laminar flow – Steady viscous fluids – Theory of aerofoil.

MA4212 Differential Geometry (2) MA4107)

The definition of the gauss map and its fundamental properties; The Gauss map in local coordinates; vector Fields; Minimal surfaces; Isometric and conformal maps; The exponential map and Geodesic polar coordinates; Properties of Geodesics and convex neighborhoods.

MA 4214 Functional Analysis (2) (MA4101)

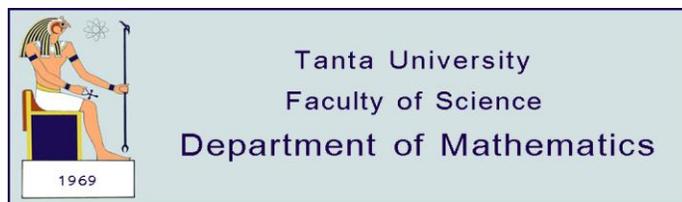
Spectra and the Resolvent set- the Spectra of two particular transformation-
Approximate proper values. Introduction to Banach Algebra Analytic vector-
valued functions 8- Normal and Banach Algebras Identity- An Analytic Function-
The Resolvent Operator Spectral radius and the spectral Mapping Theorem for
Polynomials- The Gelfand theory weak topologies and the Gelfand topological vector
spaces and operator topologies Spectral Theorem of Bounded- Self Adjoin operator

MA4216 Real Analysis (2) (MA3101)

Open and closed sets- continuous functions and homeomorphisms- convergence and
completeness- uniform continuity and uniformity- Metric spaces Cauchy inequality-
Holder inequality- Minkowski's inequality- complete metric spaces- Everywhere
dense sets- Isometric metric spaces- completion of metric spaces.

MA4218 Electrodynamics (MA3202)

Electromotive force – Faraday law – Maxwell's equations – Reflection and
Transmission – Guided waves – Radiation.



Programme Title **Statistics Program**

Programme Type **Special**

Department(s) **Mathematics**

ST 2101 Probability Theory (1) (ST1103)

The random experiment – sample space – the event – types of the events – The probability of the event – the probability postulates – the conditional probability The independence of the events – the total probability rule – Bayes theorem – the random variable definition The types of the random variable – the cumulative distribution function – the expectation value – the moments – the moment generating function- the probability generating function – the properties of the moment generating function – the properties of the probability generating function – Some continuous distributions (the normal distribution – the exponential distribution –gamma distribution – Beta distribution- the uniform distribution) – The discrete distributions (Binomial distribution- the geometric distribution- the negative binomial distribution – Poisson distribution) .

ST 2103 Sampling Theory (ST1103)

The population and its parameters – The sample – The sample survey – The sampling statistics – The probabilistic and non probabilistic sampling – The random samples – Determination of the sample size (small samples and large samples)-regular samples- Estimation of the population parameters- The estimation of the mean and the variance of the population – Estimation of the proportion - Applications on the sample – The relationships among different types of the samples – Applications.

MA2103 Abstract Algebra & Linear algebra (MA1206):

Binary operations on a set; The semi group of mapping groups permutation groups; Groups of symmetries structures and lattice diagram of subgroups Coset decomposition and normal subgroups quotient groups. Vector spaces and subspaces; Algebra of subspaces; Basis and dimension linear transformations, rank and nullity, the matrix of linear transformation. Eigenvalues and eigenvectors.

MA 2105 Mathematical Analysis (MA1202)

Function of several variables limits- Continuity - Differentiability – Integrals- Applications - Differential Equations of First order and First degree- Methods of solutions of Differential Equations- Differential Equations of First order and higher degree- Differential Equations of n order- General solutions of non homogeneous of ordinary Differential Equations of higher-order.

ST2107 Applied Statistics (ST1103)

Descriptive statistics- Measures of central tendency – Measures of spread – frequency distribution and graphical representation- cumulative frequency distributions – Descriptive statistics for grouped data – Coding of the data- Elements of univariate and bivariate probability distributions - Definition and elementary properties of characteristic functions- moment generating function- probability generating function – basic concepts of inferential statistics – Analysis of variance.

CS2103 Computer Programming (CS1101)

Overview of basic programming constructs. Functions, parameter passing and files Data modeling with arrays, structures and classes Pointers and linked lists Recursion Bank: program design and analysis, testing and debugging techniques Programming in C++. Program development using modem APIs.

CS2105 File Processing (CS1101)

File processing environment: Overview ' of files, blocking and buffering, secondary storage devices Sequential access' Sequential file organization, external sort/merge algorithms. Random access Direct -addressing, hashing, perfect hashing, Dynamic hashing. Tree-structured file organization: High-balanced binary search trees, B-tree, B**tree, indexed sequential file organization. List* structured file organization: Multiple-key, and inverted files. The merits. of these file organizations and the optimum choice for a given application.

ST2202 Stochastic Processes (ST2101)

Introduction to stochastic processes – Description and definition – Introduction and basic concepts of Markov process – Stochastic approximations Poisson process- Renewal processes – Stationary processes – Some general properties – Congestion processes – Stochastic processes in reliability.

ST2204 Distribution Theory (ST2101):

Binomial Distribution; Poisson Distribution; General Gamma Distribution; Normal Distribution; χ^2 – Distribution; T- Distribution; F- Distribution.

ST 2206 Statistical Inference (1) (ST2101)

Definitions of the population – The sample - The statistic – The estimator – The sample types – The properties of the good estimator (unbiasedness – sufficiency – efficiency – consistency) – Some methods of the estimation (point estimation – interval estimation)- The approximate properties of the estimators.

ST2208 Mathematical Statistics (MA1103)

Descriptive statistics- Measures of central of tendency – Measures of spread – frequency distribution and graphical representation- cumulative frequency distributions – Descriptive statistics for grouped data – Coding of the data- Elements of univariate and bivariate probability distributions - Definition and elementary proprieties of characteristic functions- moment generating function- probability generating function – basic concepts of inferential statistics – Analysis of variance.

ST 2210 Advanced Probability (ST2101)

Bayesian probability – Conditional Expectation – Regular conditional distribution physical probability – Geometric probability – Inductive probability – Degree of belief – Rough and fuzzy probability- Dempster Shafer Theory.

MA 2212 Number Theory MA2103)

The fundamental theorem of arithmetic congruence's, the theorems of Fermat and Wilson, Quadratic residues, the quadratic equations.

MA2220 Numerical Analysis (MA2103)

Interpolation for equal distances tabulated points; interpolation for non- equal distances tabulated points; Numerical differentiation formulas; Open and closed numerical integration formulas; numerical methods for initial value problems; Solving algebraic and transcendental equation; Iterative methods for systems of linear equations.

CS2204 Data Structures and Algorithms (CS2103)

I The rote of data structures in software engineering and algorithm design Abstract data types and classes concepts, data models, and levels of abstraction Recursion Analysis of algorithms. Elementary data structure* and *»eir Implementation arrays, strings, structures and files Specification. Implementation and specification of stacks, queues, hsts. trees and graphs Searching and sorting algorithms.

CS3103 Design and Analysis of Algorithms (CS2202)

Design and o«qoer. greedy methods, tree and grap as sort-ng and searching, travel- ng setesperson. and knapsack Theory of complftidly.

ST 3101 Correlation Theory (1) (ST2206)

Correlation and regression – linear correlation – correlation measures – regression by method of least square – the standard error for estimates – the regression line and the linear correlation coefficient -The product-moment correlation coefficient– Testing the significance of regression coefficient – the ordered correlation – the correlation in time series – the sampling theory for the correlation and regression.

ST3103 Experimental Design (ST2206)

Introduction to Design; types of Designs; Two-Group experimental designs (probabilistic equivalence- Random selection and Assignment); Classifying experimental designs; Factorial designs (Factorial design variations); Randomized Block designs; covariance designs; Hybrid experimental designs.

ST3105 Theory of Inventory (ST2101)

Components of inventory models – Main definitions of the inventory models – Deterministic continuous review models –The EOQ model – The EOQ model with quantity discounts – A deterministic periodic review model – A stochastic continuous review model.

ST3107 Analysis of Categorical Data ST2206

Varieties of categorical data; cross classifications and contingency tables; Tests for independence; Combining 2×2 tables. Multidimensional tables and log linear models-maximum-likelihood estimation and tests for goodness of fit. Generalized linear models and multinomial response models.

ST3121 Probability Theory (2) (ST2101)

Joint Probabilities - Bivariate Distributions – Marginal Distributions – Multivariate Distributions –Multinomial Distribution – Functions of Random Variables – Techniques of transformation : one variable and several variables- moment generating function technique.

MA3103 Operations Research (1)

Integer programming; Decision making under uncertainty; Goal programming and Multiattribute utility Theory; Game Theory.

MA3109 Approximation Theory (MA2208)

Problem formulation; introduction of the approximation; Norm L^p and Tchebcheff norm; Boolean Algorithm; uniqueness theorems' Least square and algorithm functions.

ST 3202 Regression of Analysis (ST3101)

The simple linear regression model – The multiple linear regression – Prediction – nonlinear regression models – Transformations, extrapolation and outliers –

Applications with the computer packages to the regression analysis – The multiple regression by matrices – the variance and covariance matrix.

ST 3204 Statistical programs (ST2202)

Introduction in computer programming – Some statistical applications – Defining some main statistical packages for example SPSS, Excel, MINITAB and discussing how to use them in statistical analysis.

ST3206 Order Statistics ST2101:

Distribution of order statistics; Joint distribution of two order statistics or more-some properties of order statistics; Distribution of the median, range and some other statistics-Discrete order statistics; Dependence structure of order statistics from some specific distributions (e.g. Bernoulli, binomial, Poisson, exponential; Uniform and normal distributions); Moment relations, bounds and approximations; type of order statistics data, order statistics in statistical inference; Asymptotic theory (exponential order statistics-sample maximum, minimum and other extreme order statistics.

ST 3208 Theory of Statistical Decision (ST3101)

The Main Theories of the Statistical Decision Theory – Prior and Posterior Distributions – Decision criteria – The theory of games- The Minimax criterion- The Bayes criterion –The problems of the several decisions.

ST3210 Correlation Theory (2) (ST3101)

The multiple correlation – regression equation – regression level – regression by least square method – regression and correlation levels – the standard error for the estimation –the multiple correlation coefficient – generalization for more than three variables – partial correlation – the relationship between the partial correlation and the multiple correlation coefficients – the nonlinear multiple regression.

ST3212 Statistical Methods ST3105:

Sampling distribution; Point and confidence estimation; one and two sample tests-one and two-way ANOVA; goodness of fit tests-tests of independence in contingency tables.

ST3214 Selected topic in statistics (1)

MA3210 Optimal control (1) (MA3103)

Introduction to linear optimal control, standard regulator problem, Hamelton jacobian equation, solution of the finite time of regulator problem, discrete time system; infinite time regulator problem, stability of time invariant, cross product terms and second variation theorem, regular with a degree of stability; Tracking system properties; Properties of regulator system.

ST4101 Non-parametric statistical (ST2206)

The single sample sign test; Wilcoxon signed rank test; The paired sample sign test; The Wilcoxon matched pairs signed rank test; the U test; The H test; tests based on runs; The rank correlation coefficient.

ST 4103 Reliability Theory (ST3101)

Statistical concepts in reliability – order statistics – Dynamic redundant systems- Estimation of the reliability – Applications of the use of the exponential distribution and Weibull distribution in reliability.

ST 4105 Statistical Inference (2) (ST2206)

The Null and Alternative Hypotheses – Types of Errors – The Critical Regions- The Power function of the test –Testing of Hypothesis: errors and problems –two samples and paired samples – Handling variances.

ST 4107 Estimation Theory (MA1202)

Point estimation of the parameter – methods of point estimation – The method of moment – The maximum likelihood method – The properties of the estimators : unbiasedness – consistency – sufficiency – efficiency – Bayes method for estimation – estimation by confidence intervals.

ST4115 Selected topic in statistics (2)

MA4105 Operations Research (2) (MA3103)

Deterministic inventory Models; Probabilistic inventory Chains; Deterministic Dynamic programming; Probabilistic Dynamic programming; Queuing Theory.

MA4121 Topology (MA3101)

Topology of the real Line and Plane; Topological spaces (Topology- open and closed sets- Neighborhood- Accumulation point- Derived set- interior of a set- Exterior of a set- subspaces comparison of topological- series and convergence- bases- sub bases – local bases –continuity and homeomorphisms) continuous mapping- local continuity –Topological properties- Axioms of accountability- countable spaces of type one and two separable spaces.

MA4123 Complex & Functional analysis (MA3101)

The complex number system with geometric interpretation; Functions of complex variables; Continuity; Differentiability; Cauchy Riemann equations; Harmonic functions; Analytic functions; Power series. Metric spaces; Complete metric spaces; Normal spaces; Banach spaces; Hilbert spaces.

CS4121 Simulation Technique

Data Flow; Data sets; Profile Generation; surface properties; Cloud properties; Local variability; AvnSim File format; NCEP Aviation Forecast output; Acronyms.

ST4202 Review Article and Research

ST 4204 Time Series Analysis (ST4101)

The time series – The trends of the times series – estimates of the general trend-
Deseasonalizing data – estimates of the cyclical variations – The forecasting.

ST 4206 Multivariate Statistics (ST3105)

Matrices algebra – Multivariable normal distributions – The partial and multivariate correlation – Testing of hypothesis in the case of the multivariate normal distribution (one sample – two samples – several samples)- T statistics – Categorical data – Applications.

ST4208 Statistical Data Mining ST4105

Approaches to finding the unexpected in data-pattern recognition; classification; association-graphical methods-classical and computer-intensive statistical techniques and problem solving emphasis on data-centered-non-inferential statistics for large or high-dimensional data-and building report writing skills.

ST4210 Statistical Software ST4105

Structure, content and programming aspects of a modern statistical package; Advanced techniques in the use of a statistical software system for data analysis; Introduction to graphical methods in statistics and a macro programming language.

ST4212 Statistical quality control ST3210

Use of statistics for quality control and productivity improvement; Controlchart calculations and graphing, process control and specification, sampling plans- and reliability; Computer use will be stressed for performing calculations and graphing.

ST4214 Queuing Theory (ST3212)

Some Queuing Terminology; Modeling Arrival and service processes; Birth-Death processes; The $M/M/1/GD/\infty/\infty$ Queuing system and the queuing formula $L = \lambda/w$; The $M/M/1/GD/c/\infty$ Queuing system; The $M/M/s/GD/\infty/\infty$ Queuing system; The $M/G/\infty/GD/\infty/\infty$ and $G/G/\infty/GD/\infty/\infty$ Models.

MA4226 Partial differential equations & special functions (MA2105)

Linear partial differential equations of order one and its solution by using Lagrange method. Superposition principle. Canonical forms. Classification of second order partial differential equations. Some standard methods for solving partial differential equations of higher order with constant coefficients (homogeneous and nonhomogeneous). Solution of parabolic equations (method of separation of variables, heat flow, diffusion equation). Solution of hyperbolic equations (viabration of stretched and flexible string, D'Alembert solution of the wave equation. Gamma and Beta functions; Legendare equation; Bessel's equation; Hermit equation.



Programme Title **Computer Program**

Programme Type **Special**

Department(s) **Mathematics**

CS2101 Computer Systems

Describes language constructs; Creating a very high-level language as a tool for computer system design; Describe the complexity of a computer system; Various cross-section of system structure; Descriptions of system hardware; system software; The interactions between system hardware and software.

CS2103 Computer Programming (CS1101)

Overview of basic programming constructs. Functions, parameter passing and files Data modeling with arrays. structures and classes Pointers and linked lists Recursion Bank: program design and analysis, testing and debugging techniques Programming in C++. Program development using modem APIs.

CS2105 File Processing (CS1101)

File processing environment: Overview ' of files, blocking and buffering, secondary storage devices Sequential access' Sequential file organization, external sort/merge algorithms. Random access Direct -addressing, hashing, perfect hashing, Dynamic hashing. Tree-structured file organization: High-balanced binary search trees, B-tree, B**tree, indexed sequential file organization. List* structured file organization: Multiple-key, and inverted files. The merits. of these file organizations and the optimum choice for a given application.

MA 2103 Abstract Algebra (MA1206)

Binary operations on a set. The semi group of mappings groups permutation . groups. Groups of symmetries structures and lattice diagram of subgroups Cosel

decomposition and normal subgroups quotient groups. Homomorphisms Rings and ideals integral domains field and some theorems and properties

MA 2105 Mathematical Analysis (1) (MA1202)

Function of several variables limits- Continuity - Differentiability – Integrals- Applications - Differential Equations of First order and First degree- Methods of solutions of Differential Equations- Differential Equations of First order and higher degree- Differential Equations of n order- General solutions of non homogeneous of ordinary Differential Equations of higher-order.

MA 2107 Discrete Mathematics (MA1206)

Counting: Permutations, combinations and Pigeonhole Principle. Recurrence relations. Ordered structures, Finite Boolean.

Algebra: Theorem and properties circuit design. Trees: Minimal spanning. Graphs. Graphs and digraphs. Euler and Hamiltonian paths and circuits. Transport Network Coloring.

MA2121 Mathematical Methods (MA1101):

Fourier Series; Fourier Integration; Laplace Transform; Laplace Transform for solving the Ordinary differential equations; Using Laplace Transform of Derivatives and Integrals.

ST 2101 Probability Theory (1) (ST1101)

The random experiment – sample space – the event – types of the events – The probability of the event – the probability postulates – the conditional probability The independence of the events – the total probability rule – Bayes theorem – the random variable definition The types of the random variable – the cumulative distribution function – the expectation value – the moments – the moment generating function- the probability generating function – the properties of the moment generating function – the properties of the probability generating function – Some continuous distributions (the normal distribution – the exponential distribution –gamma distribution – Beta distribution- the uniform distribution) – The discrete distributions (Binomial distribution- the geometric distribution- the negative binomial distribution – Poisson distribution) .

CS2202 Digital Logical & Algorithm (CS2103)

Basic logic concepts Logic states number systems, Boolean algebra basic logical operation gates and truth tables combinational logic. Minimization techniques, Multiplexers and de-Multiplexers encoders decoders adders and subtractors, look ahead carry comparators programmable logic arrays, and memories, design with MSI, logic families tri-state devices CMOS and TTL logic interfacing/ sequential logic Flip- flops monostable multivibrators latches and registers counters, shift registers Analog to digital conversion digital-to- analog conversion data acquisition microprocessor.

CS2204 Data Structures and Algorithms (CS2103)

The role of data structures in software engineering and algorithm design Abstract data types and classes concepts, data models, and levels of abstraction Recursion Analysis of algorithms. Elementary data structure* and *»eir Implementation arrays, strings, structures and files Specification. Implementation and specification of stacks, queues, hsts. trees and graphs Searching and sorting algorithms.

ST 2206 Statistical Inference (1) (ST2101)

Definitions of the population – The sample - The statistic – The estimator – The sample types – The properties of the good estimator (unbiasedness – sufficiency – efficiency – consistency) – Some methods of the estimation (point estimation – interval estimation)- The approximate properties of the estimators.

MA 2208 Mathematical Analysis (2) (MA2105)

Sequences – limit of Sequences- The Theorems of Convergent Sequences- Caucluy Sequence- Series of number- The tests of Convergent of Series Sequences of functions. Uniformly Convergence Series of functions- Uniformly Convergence of Series- Applications.

MA 2212 Number Theory MA2103)

The fundamental theorem of arithmetic congruence's, the theorems of Fermat and Wilson, Quadratic residues, the quadratic equations.

CS2208 Object Oriented Programming (CS2103)

In-depth study of a typical object-oriented programming language (C++) from a software engineering perspective. with emphasis on features supporting the development of large, efficient and reusable object-onened applications. Principles ana practice of three software development paradigms: developing classes from scratch, reuse of existing classes, incremental extension of frameworks Encapsulation, templates, polymorphism, dynamic binding aod virtual methods, operators overloading, complex associations, dynamic aggregation, mhentance (single and muttpto). exception handling, the standard template horary. Introduction to UML for describing program designs

MA2220 Linear Algebra & Solid Geometry (MA2103)

Vector spaces and subspaces; Algebra of subspaces; Basis and dimension linear transformations, rank and nuillity, the matrix of linear transformation; eigenvalues and eigenvectors. Coordinates and vectors in 3-dimensions; Direction cosines; Line; Plane; Spher; Elleipsoid; Hyperboloid and Parapole.

CS2206 Data basic system (CS2103)

Conventional baseness data processing; Software system process and react to continual inputs from many sources; Human operators requires one to rethink the

fundamental architecture of a DBMS for this application area; Describe the basic system architecture; a stream-oriented set of operators; Optimization tactics; support for real-time operation.

CS3101 Computer Organization and Assembly Language Programming (CS2202)

Description of a hypothetical computer system, the CPU main memory. I/O subsystem and AU related components & discussion of the architecture of the Intel 80x86 based microprocessor and of available assemblers and managers and debugging tools Macro assembler programming techniques invoking buffering maintaining Ubranes. and using assembler pseudo-op* and directives. Debugging and testing technique Interfacing a high level language with an assembly language. Chip level programming of microprocessor type systems Topics covered include I/O ports. I/O devices and controllers DMA channels priority interrupts.

CS3103 Design and Analysis of Algorithms (CS2202)

Design and analysis of greedy methods, tree and graph as sorting and searching, traveling salesman. and knapsack Theory of complexity.

CS 3105 Combinatorics and Graph theory

Combinatorics: pairing Stirling, formula Recurrence relation and generating functions. The inclusion exclusion principle.

Graph theory: Bipartite graphs. Directed acyclic graph and tournament Matching, Gall's Theorem and Berge's theorem as well as algorithms of prime, Dijkstra, Kruskal, and Ford. Fulkerson. Trees connectivity and Menger's theorem. Planarity and chromatic number. Application

CS3107 Concepts of Programming Languages

Comparative study of abstraction, syntax, semantics, binding times, data and sequence control, run-time resources, translators, and storage of programming languages. Programming project using selected programming languages to enhance practical aspects. Introduction Facts, objects, and Predicates'. Expressing facts turbo prolog objects. Prolog variables'- Using variables, bound and free variables, anonymous variables, compound goals, I backtracking, variable rules. Using rules' Rules, variables in rules, prolog execution rules, using the trace, unification, execution control, the built-in predicate. Simple input and output. Controlling execution- Success through failure; the fail predicate, exclusion using the fail predicate, recursion, and the cut. Arithmetic operations. Compound objects Dynamic database. Lists. String operations.

MA3103 Numerical Analysis (1) (MA2208)

Interpolation for equal distances tabulated points; interpolation for non- equal distances tabulated points; Numerical differentiation formulas; Open and closed numerical integration formulas; numerical methods for initial value problems; Solving algebraic and transcendental equation; Iterative methods for systems of linear equations.

MA 3113 Mathematical logic and Boolean algebra (MA2107)

Math logic: Goals and methods. First order logic First order recursive arithmetic. Arithmetization of syntax. Goedel's completeness and in complete mass theorem. Other application.

Boolean Algebra: Axiomatic logic gates and other applications. Boolean rings. Fields of sets Representation of finite Boolean Algebra. Subalgebra.

Stone's Representation of finite Boolean Algebra computer science.

MA3121 Real analysis & Measure Theory (MA2208)

Series of functions- the concept of orthogonally concept of a Fourier series; Functions of bounded variation and Riemann-Stieltes integral; Fourier transformation and its applications.

System of sets; Measure of elementary of sets; Measure of plane sets; Measure on a semiring; Extensions of Measures; Integration.

MA3125 Topology

Topology of the real Line and Plane; Topological spaces (Topology- open and closed sets- Neighborhood- Accumulation point- Derived set- interior of a set- Exterior of a set- subspaces comparison of topological- series and convergence- bases- sub bases – local bases –continuity and homeomorphisms) continuous mapping- local continuity –Topological properties- Axioms of accountability- countable spaces of type one and two separable spaces.

CS3202 Theory of Automata

Alphabets and languages. Finite representation of language. Deterministic and non-deterministic finite automata and their applications. Equivalence considerations. Regular expressions. Context-free languages. Context-free grammars. - Regular languages, pushdown automata. Properties of context-free languages. Determinism and parsing top-down parsing, and bottom-up parsing. Turing machines: Computing with Turing machines, combining Turing machines, and nondeterministic Turing machines.

CS3204 Operating Systems (CS2202)

Operating systems concepts and structure. The Kernel, interrupts, system calls. Process concepts, operations, and implementation. Threads Concurrency, interprocess communication and synchronization. Process scheduling. Resources and deadlocks. Memory management swapping, paging, segmentation, virtual memory. File system

interface, organization, and implementation. Protection. Case study: UNIX.

CS3206 Computer Architecture (CS3103)

The objectives of this course are to introduce the principles of Modern Computer Architecture and design Topics to be discussed include Instruction Set Architectures. Arithmetic Logic Unit design. CPU data path design, CPU pipelining, memory hierarchy, cache and virtual memory, and introduction to I/O.

CS3208 Systems Simulation (CS2107)

Simulation modeling with emphasis on discrete event simulation The design of a simulation experiment. Simulation languages. Probability and distribution theory. Statistical estimation and inference. Random number generators. The generation of random variates Verification and validation techniques. Presentation of a number of typical simulation models. Students work in teams on a term project

CS3210 Systems Analysis and Design (CS2101)

General concepts and problem-solving steps of systems analysis, introduction to systems analysis, feasibility ^ system study and system design, implementation and control.

CS3212 Software Design & Analysis (CS2204)

Basic concepts of software engineering project management, ethical and social issues as well as the software development cycle. Techniques for software specification, design, implementation, validation, verification and documentation. State-of-the art tools for computer-aided software engineering (CASE tools) are used to support term projects.

MA3210 Optimal control (1) (MA3103)

Introduction to linear optimal control, standard regulator problem, Hamiltonian equation, solution of the finite time of regulator problem, discrete time system; infinite time regulator problem, stability of time invariant, cross product terms and second variation theorem, regular with a degree of stability; Tracking system properties; Properties of regulator system.

ST3212 Stochastic Processes (ST2105)

Introduction to stochastic processes – Description and definition – Introduction and basic concepts of Markov process – Stochastic approximations Poisson process- Renewal processes – Stationary processes – Some general properties – Congestion processes – Stochastic processes in reliability.

MA4105 Operations Research (1) (MA1204)

Integer programming; Decision making under uncertainty; Goal programming and Multiattribute utility Theory; Game Theory.

CS4101 Database Management Systems (CS3204)

An overview of database management; what is a database system, ^operational data, data independence, relational systems and "others. An architecture of a database system-' The three levels of architecture, the external level, the conceptual level, the internal level, mappings, the database administrator, the database management system. The internal level: Database accesses, page sets and files, indexing. Hashing, pointer chains, comparison techniques. An overview of DB2- Relational databases, the SQL language, major system components. Relational algebra: A syntax for the relational algebra, traditional set operations, special relational operations. Relational calculus- Tuple-oriented relational calculus, relational calculus vs. relational algebra, domain-oriented relational calculus, query

by examples. Data definition: Base tables, indexing. Data Manipulation-' Simple queries, join queries, built-in functions, advanced features, update operations. The system catalog: Querying the catalog, updating the catalog. View: View definition, DML operations and view, logical data independence, advantages of views. Embedded SQL Operations not involving cursors, operations involving cursors, a comprehensive example, dynamic SQL. Database environment: Recovery and concurrence security and integrity, database product family.

CS4103 Theory of Computation (CS3101)

Finite automata and regular expressions, context-free grammars and push-down automata, nondeterminism. Context-sensitive grammars and the Chomsky hierarchy of grammars. Turing machine and the halting problem. Undecidable problems. Church's Conjecture and its implications.

CS4105 Computer Graphics (CS2202)

Overview of graphic systems and interactive devices. Output primitives and their attributes. Two-dimensional transformations, segments, windowing, and clipping. Introduction to three-dimensional representation and viewing.

CS4107 Advanced Programming in Java (CS3101)

Advanced programming concepts in the Java programming language. Virtual machines, dynamic type checking and object serialization, inheritance and polymorphism in Java, interfaces and packages. Java Applets and event handling. Multithreaded and Network-based application development in Java. File manipulation in Java and coverage of selected topics including Remote Method Invocation, Cryptography and Web Services.

CS4109 Selected topic in computer sciences

CS4111 Expert Systems (CS3101)

Introduction: Knowledge based expert systems, conventional programming versus knowledge engineering. Human problem solving: Human information processing, the production system as a processing model, problem solving, varieties of knowledge, and the nature of expertise. Representation of knowledge: An informal look at a knowledge base, strategies for representing knowledge, semantic networks, object attribute value triplets, rules, frames. Representing facts and relationships using logic. Drawing inferences; Inferences control, the future of representation and inference. Languages and tools: Levels of software, the languages tool continuum, AI languages and environments, knowledge engineering tools. Expert shells. Building a small knowledge system'- The role of small systems, selection of an appropriate problem, development of a prototype system.

MA 4121 Modern Algebra and Topology (MA3125)

Algebra the structures theory of Groups and Rings. The groups Polynomial rings lattice and some ordered structures in computer science

Metric and Topological spaces open and closed sets. Continuous functions product of topological spaces, connectedness, compactness separation and countability axioms some applications.

CS4202 Review Article and Research

CS4204 Compiler Design (CS3202)

Principles and practices in the design of compilers. Lexical analysis. Syntax analysis. Top-down and bottom-up parsing. Syntax-directed translation and syntax tree. Declarations, types, and symbol management. Run-time environments, storage organization, parameter passing, dynamic storage allocation. Intermediate languages and Machine code generation. Code generation and optimization.

CS4206 Image Processing (CS4105)

Scope and applications of image processing. Perspective transformations (Modeling picture taking, perspective transformations in homogeneous coordinates and with two reference frames). The spatial frequency domain (The sampling theorem, template matching and the convolution theorem, spatial filtering). Enhancement and Restoration, image segmentation. Image representation: (Spatial differentiation and smoothing, template matching, region analysis, contour following). Descriptive methods in scene analysis. Hardware and software considerations. Applications.

CS4208 Computer Security Techniques (CS4101)

Overview: Characteristics of computer intrusion, points of security vulnerability, methods of defense. Basic encryption and decryption: Different types of ciphers, characteristics of good ciphers, crypt analysis. Secure encryption systems: Hard problems & complexity. Properties of arithmetic, public-key systems, single-key systems and the data encryption standard (DES), enhancing cryptographic security. Security involving programs: Information access problems, viruses and worms, controls against attack, operating system control, administrative controls. Design of secure operating systems: Models of security, penetration of operating systems, examples of security in general purpose operating systems. Database security: reliability and integrity, sensitive data, the inference problem, multilevel data security. Personal computer security: Security measures. Protection for files, copy protection. Computer network security and Communication security.

CS4210 Computer Networks (CS4101)

Introduction- The use of computer networks, network structure, network architecture, the ISO reference model, examples of networks. Network topology: Connectivity analysis, delay analysis, backbone design, local access network design. The physical layer: The theoretical basis for data communication, the telephone system, transmission and multiplexing, terminal handling errors. The data link layer Elementary data link protocols, sliding window protocols, analysis of protocols. The network layer: Virtual circuits and datagrams, routing algorithms, satellite packet broadcasting. Local networks: Carrier sense networks, ring networks, shared memory systems. The transport and session layers: Transport

protects design issues, interconnection of packet-switching networks. The presentation layer: network security and privacy, text compression, virtual terminal protocols, file transfer protocols. The application layer: Distributed data base systems, distributed computations.

CS4212 Distributed systems (CS4101)

Introduction to parallel and distributed architectures Mode computation: SISD. SIMD. MISD. and MIMD Computers Sh[^] memory SIMD computers. Interconnection-network S Computers: Lnear array, two-dimensional array, tree conneci perfect shuffle connection, cube connection. Analyzing algorit* Some parallel computer algorithms: selection, merging sor and searching. Parallel programming languages. compilers. Parallel operating systems.

CS4214 Neural Networks (CS4101)

Introduction and a historical review: Overview of neurocomputing,. history of neuro-computing. Neural network concepts: Basic definition, connections, processing elements. Learning laws: Self-adaptation equations, coincidence learning, performance learning, competitive learning, filter learning, spatio-temporal learning. Associative networks: Data transformation structures, Linear association network, learn matrix network, recurrent associative networks. Mapping networks: Multilayer data transformation structures, the mapping implementation problem, Kolmogorov theorem, the back-propagation neural network, self-organizing map, counter propagation network. Spatiotemporal, stochastic, and hierarchical networks: Saptio-temporal" pattern recognizer neural network, the Boltzman machine network, and the neurocognition network.

ST 4204 Time Series Analysis (ST4101)

The time series – The trends of the times series – estimates of the general trend- Deseasonalizing data – estimates of the cyclical variations – The forecasting.

MA4224 Optimal control (2) (MA3210)

Introduction (background); Asymptotic properties and quadratic weight selection; State estimator design; System design using states estimators; Frequency shaping.



B.Sc. Physics (Special)

Program title	Physics
Program type	Special
Department(s)	Physics

PH2111

Experimental Physics I - Preq. (none)

12 different physics experiments covering different branches of physics.

PH2121 Waves - Preq. PH1221

Simple harmonic ad damped harmonic motions - Energy of simple harmonic motion - Simple harmonic vibrations in electric system

The vector representation of the simple harmonic motion - Damping coefficient – Ballistic galvanometer - The Q - factor for damping harmonic motion in electric circuit - The effect of the force on vibration - Isolation of vibration - Q- factor as amplifying coefficient - The forced oscillator – Coupled oscillators - Inductance coupling of electrical oscillators, Coupled oscillations of a loaded string - Waves on transmission lines- ideal transmission line - Waves in more than one dimension- Wave equation in 2-dimension - Reflection of a 2- dimensional wave at rigid boundaries.

PH2131 Thermodynamics - Preq. PH1121

Scope of thermodynamics, systems, state of system properties - pressure process- thermal equilibrium and temperature - The Zero law of thermodynamics thermodynamic equilibrium- Empirical and thermodynamic temperature - Equation of state (Equation of state of an ideal gas P-V-) - P-V-T surface for an ideal gas equation of state for real gas -P-V-T surface for a real gas and equation of a state of other than P-V-

T system (real gases). partial derivatives. Expansivity and compressibility - First law of thermodynamics - Entropy and the second law of thermodynamics - Combined of 1 and 2 law thermodynamics (heat engine) - Thermodynamic potentials - Applications of thermodynamics - Maxwell's equations.

PH2141 Acoustics - Preq. PH112

Mechanical waves: physical properties, the properties of the center-proliferation, the spread of the models sound like, sound waves interact with biological tissue (Reflection - fragmentation - refraction - coral - overlap - Suction), the sound intensity in the tissue, the appointment of interesting voice echoed in the tissues, Applications of ultrasound in medical imaging using ultrasound.

**PH2151
Electromagnetic Theory I - Preq. PH1222**

**Revision of scalars, vector quantities- Scalar and vector fields.
The three coordinate systems used in the course - Coulomb's law in vector notation - the electric field- Line ,surface and volume charge densities - Electrostatic field of different charge distributions: discrete and continuous
Faraday's experiment of the two spheres - Electric flux density- Gauss' law-
Applications of Gauss's law - First Maxwell equation under static conditions- the divergence of the displacement vector.**

**PH2161
Mathematical physics I – Preq. PH1222**

Matrices and vector spaces - Normal modes - Vector calculus - Line, surface and volume integrals - Fourier series - Integral transforms - First-order ordinary differential equations - Higher-order ordinary differential equations

**PH2212
Experimental physics II – Preq. (none)**

12 different physics experiments covering different branches of physics.

**PH2222
Physical optics – Preq. PH1222**

Light wave and interference- The superposition of waves - Interference of two beams of light – Interference involving multiple reflection - Young's Experiment - Newton's fringes - Fresnel's Biprism - Michelson interferometer - Fabry- Perot interferometer - Diffraction- Fresnel diffraction - Cornu spiral - Diffraction at a circular hole and at a circular barrier – Semi-harmonic regions- Diffraction grating

- Fhernover diffraction- intensity of diffraction grating - Step diffraction gratin - Polarization: Absorption and polarization of light - Polarization by diffraction , refraction and double refraction - Polarization using calcite crystal - Nickol prism, Polarization and dispersion of light - Circular and elliptical polarization, Rotation of polarizing plane in solids- liquid and vapors.

PH2232

Energy Physics – Preq. PH1121

Energy and Society - Physical basis for energy - Fossil Fuels - Electric energy - Electric Power Plants and the environment - Automobiles and the environment - Thermodynamic principles - Atmospheric problems - Nuclear Power and Solar energy - Other energy systems - Nuclear breeder and nuclear fusion reactors - Energy conservation.

PH2242

Analytical Physics – Preq. PH2141

The motion a mass point in two dimensions (Kepler's laws) -The motion a mass point in three dimensions - Dynamics of the system of particles - Collision of particles

D'Almbert's principal and Lagrangian Formalism - Classification of mechanical systems - The principal of least action - Hamilton's canonical equations of motion - Velocity and acceleration of particles relative to the moving and fixed coordinate system.

PH2252

Electromagnetism II – Preq. PH2151

Work done to move a charge in an electric field, potential and potential difference in vector notation- Potential gradient and the electric field of a dipole - Current and continuity equation - Magnetic field laws - 2nd Maxwell equations -3rd Maxwell equations - Magnetic flux, 4th Maxwell equation under static conditions.

PH2262

Mathematical physics II - – Preq. PH2161

Series solutions of ordinary differential equations - Eigenfunction methods for differential equations - Special functions - Quantum operators - Partial differential equations: general and particular solutions - Partial differential equations: separation of variables and other methods - Calculus of variations -Integral equations

PH2272

Modern physics - Preq. PH1222

Special Theory of Relativity - Galilean transformation speed of light - Michelson-Morley experiment - Einstein's postulates - Simultaneity, time dilation space

contraction, invariant intervals, rest frames - Proper time, proper length - Lorentz transformation - Doppler effect.

PH2282

Alternating current – Preq. PH1222

DC and AC- phase angle – mean and effective values of AC current- Power of electric source - Components of AC circuits - current and power of circuit of ohmic resistor only or an ideal inductor - Power in a circuit containing an ideal capacitor - Resistor, capacitor and inductor in series - Resonance in series connection circuits - Parallel connections - Multi-element circuits -Complex connection circuits - Resonance in parallel connection circuits - Power in AC circuits - Circuit analysis using complex quantities- Quality factor - AC Bridges - Energy levels and bands in semiconductors, types of semiconductors , PN junction, diodes. Characteristic curve of the diode- the diode approximation problem- Zener diode and its characteristic curve - Diode circuits.

PH3113

Experimental physics III – Preq. (none)

10 different physics experiments covering different branches of physics

PH3121

Statistical physics I – Preq. PH2131& PH2141

Introduction to statistical Mechanics - Ensembles and Definitions - Distribution law - Boltzmann statistics MBS - Alternative Derivation of MBS - Examples of counting in statistical Mechanics - Fermi Dirac Statistics F.D.S, Bose- Einstein statistics B.E.S - Thermodynamic laws in statistical Mechanics - Applications of M.B.S - Paramagnetic systems - Applications of F.D.S - Applications of B.E.S - The classical limit, Kinetic theory of Gases.

PH3131

Quantum Mechanics I – Preq. PH2262

Historical review - Operators, Eigen value Equation - State function, expectation values - Time development of state function - Particle in a box, Dirac notation - Hermitian operators - Adjoint properties - Superposition principle - Commutator relations - Time development, conservation theorems and Parity - Harmonic oscillator - Unbound states, Barrier problems – Tunneling - Ramsauer effect - Hydrogen atom.

PH3141

Atomic physics - Preq. PH2272

Waves and Particle - De Broglie hypothesis- Velocity of De Broglie waves associated with a particle and its relation to the velocity of light - wave and

group velocities and particle velocity and the mathematical relations between them - Schrödinger equation for a single particle - Photons: Particle-like properties of radiation – the photoelectric effect - Compton effect – Equation of Compton shift -pair production and pair annihilation - Atomic structure : Thomson atomic model- Rutherford atomic model - Bohr's atomic model – the atomic spectrum- Sommerfeld's atomic model - Quantum atomic model – the four quantum numbers – Zeeman effect - Atomic spectra - Spectroscopy- Spectrum analysis –Different types of spectra: continuous – characteristic - Atomic spectral lines – absorption spectrum – spectrometer - X- Rays and X- ray production - continuous and characteristic x-ray – Ionization and Excitation of the spectra.

PH3151

Electrical circuits - Preq. PH1222

Simple circuits- Nodal analysis – Mesh analysis – Linearity and superposition - Thévenin and Norton theorems – Source transformations – General nodal and loop analysis – Inductance and capacitance: duality – Simple RL and simple RC circuits- The RLC circuit – Transient and steady state – Sinusoidal forcing function – Phasor admittance – frequency response – average power and RMS – two-port networks.

PH3161

Solid state physics I – Preq. PH1121

The study of crystal faces - The crystal state -The unit cell and 14 Bravais Lattices - The seven crystal systems - The stereographic projection -Inversion axes - The reciprocal lattice - Brillouin zones –examples - Space groups - Interatomic forces in solids - X- rays - Types of photographs - Absorption of X- ray and Bragg's law.

PH3171

Electrodynamics I – Preq. PH2252

Curvilinear coordinates- The Dirac Delta Function – The theory of vector field – Electrostatics: Coulomb's law –Electric field – Electrostatic potential - Solution of electrostatic problem (special techniques) -Laplace's Equation – The Method of images - Electric fields in Matter – Polarization– Electric Displacement - Linear Dielectrics - The steady magnetic field – magnetic flux – the scalar and vector magnetic potentials - Magnetic forces – the nature of magnetic materials - Magnetization and permeability.

PH3181

Computational physics – Preq. PH1222

Introduction to FORTRAN and its numerical model - Mathematical expressions and internal functions in FORTRAN - Steps of solving problems by computer and examples - Types of flow charts and examples on it - Methods of representation of concepts and variables - General formula of inputs and outputs - If statements -

Programs on if statements - Do loops - Nested Do loops - Programs on Do loops - Adding , subtracting and multiplying matrices by using computers

PH3191

Environmental physics – Preq. PH1121

The forces of nature – different types of energy - Heat and radiation - Solids, liquids and gases - The Earth's climate and climate change - Sound and noise – Radioactivity- radiation safety - nuclear physics.

PH3212

Solar energy physics – Preq. PH2131

The sun as a source of clean and renewable energy source - Basic principles of heat transfer - Dimensionless numbers and their physical meanings - Nussett Number , Renold Number , brandtell Number , Railey number and forrier number Measurements of solar radiation intensity -Solar collectors - Efficiency calculations of solar collectors -Factors effecting the efficiency of solar collectors Some other solar energy conversion thermal applications (solar cooking , solar ponds and solar distillers - Solar energy storage - Solar cells - I – V measurements of solar cells and their efficiency.

PH3214

Experimental physics IV – Preq. (none)

10 different physics experiments covering different branches of physics

PH3222

Laser Physics - Preq. PH3141

Invention of lasers – general properties anf applications - Types of coherence , coherence length and coherence types , spectral purity and their determination - Quantum transition between atomic energy levels : Einstein relations and the ratio between spontaneous and stimulated emission - Normal distribution of atoms in different energy states and the case of population inversion - Optical feedback and optical resonator – conditions of stability - Power gain and threshold conditions - Laser pumping and creation of population inversion - Laser models : 2-3-4 level laser systems - Laser output : line shape broadening - Axial and transverse modes and their examinations and control - Power rate , gain oscillations , power output interrelations and gain saturation - Modifying laser output : mode selection , Q – switching and mode locking - Types of lasers : gas and solid lasers.

PH3232

Quantum mechanics II – Preq. PH3131

Elementary matrix - The energy representation - Angular momentum- the paulispiv matrices - Scattering in 3 dimensions - Partial waves- s- wavePhase shift. scattering at low energies - The wave function and normals state of H- atom - Time – independent, non degenerate perturbation - Theory – the perturbed Harmonic

oscillator - The normal Helium atom - The variational integral and its properties-
The normal state of the Helium atom.

PH3252

Electronics and devices – Preq. PH3151

Voltage regulator , Ripple factor , filter in rectifier circuits - Inductor filter-
capacitor filter- L- section filter - Bipolar transistor : construction and
characteristics

Transistor biasing circuits - Transistor small-signal amplifier (CE amplifier, CC
amplifier, CB amplifier) - Common emitter connection

Frequency response of amplifiers - Feedback : different feedback types –
advantages of negative feedback - Effect of feedback on input and output
impedance, on band width and gain - Field effect transistors - Operational amplifier
(theory and application)

PH3262

Nuclear Physics – Preq. PH1121

Nuclear Force and Nucleon Structure -Brief Early History of Nuclear Physics -
Two-Nucleon Systems -Bulk Properties of Nuclei Electromagnetic and Weak
Nuclear Collective Motion -Microscopic Models of Nuclear Structure - - Interaction
Nuclear Reactions

PH3264

Mathematical Physics III – Preq. PH2262

Complex variables - Applications of complex variables - Tensors - Numerical
methods - Group theory - Representation theory -Probability - Statistics

PH3272

Electrodynamics II - Preq. PH3171

The magnetic circuit- potential energy and forces on magnetic materials - Time-
varying fields (Faraday's law – displacement current) - Maxwell's equations in
point form and in integral form – the related potentials - Wave motion in free space
and in perfect dielectrics - Plane waves in lossy dielectrics – the poynting
vector and power consideration - Propagation in good conductors : skin effect -
Reflection of uniform plane waves - The transmission- line equations -Waveguide
and antenna fundamentals.

PH3292

Radiation physics - Preq. PH1121

Interaction of Radiation with Matter - Ionization, Moeller Scattering, Bhabha
Scattering, Electron-Positron Annihilation, Bremsstrahlung, Cherenkov Radiation -
Elastic Scattering, Inelastic Scattering, Transmutation, Radiative Capture , Fission,
Total Cross Section, Passage of Neutrons through Matter -Radiation Dosimetry -

**Radiation-Protection Criteria and -Chemical and Biological Effects of Radiation
External Radiation Protection - Internal Dosimetry and -Exposure Limits
Radiation Protection**

PH4115

Experimental physics V – Preq. (none)

9 different physics experiments covering different branches of physics

PH4171

Solid state physics II – Preq. PH3161

Crystal geometry : Lattices - Lattices in the trigonal systems , families of planes and inter-planar spacings - Reciprocal lattice – rotational symmetry of lattices -

Space groups: 2 dimensional space groups - 3 dimensional space groups– analysis of the space groups symbols - Intensity of scattering by X ray by crystals : path difference – combination of 2 waves – Argand diagram - Combination of N waves – combined scattering from the contents of unit cell - Phase difference - scattering by atoms – structure factor - Phase problem in structure analysis - Structure factor for a centro-symmetric crystal – limiting conditions and systematic absences- Determination of the unit cell type structure factors and symmetry elements - Limiting conditions from screw axis symmetry – centro-symmetric Zones – Different space Group examples.

PH4163

Detectors and accelerators – Preq. PH3262

Gas Filled Detectors - Liquid Filled Detectors - Proportional Counters - Solid State Detectors - Semiconductor Detectors - Scintillation Detectors and Photodetectors - Position Sensitive Detection and Imaging - Some Important Terminologies and Physics of -Transverse Motion - Synchrotron Motion - Quantities – Accelerators Electron Storage Rings - Special Topics in Beam Physics

PH4153

Digital Electronics – Preq. PH3252

Introduction to binary numbers, octal numbers & hexadecimal numbers - Codes: Weighted binary codes and non-weighted binary codes - Basic logic gates: AND , OR, NOT - Electric circuits for basic logic gates - Combinations of logic gates: NAND, NOR, XOR, XNOR gates - Integrated circuits IC and gates conversion.

Rules and laws of Boolean Algebra - Addition and subtracting circuits (parallel adder, serial adder, subtraction, parallel subtraction) - Subtraction using adder circuits

Flip Flops, (R-S) type Flip Flop, clocked Flip Flop, D-type flip Flop, JK Flip Flop, Triggering of Flip Flops -Counters: Ripple counters, parallel counters and other

counters -Shift registers: Serial load shift register, parallel load shift register and other types - D/A and A/D converters: different types.

PH4113

Physical Electronics - Preq. PH3161

Electronic properties of semiconductors - Semiconductor materials, free electron energy spectrum, semiconductor band structure, Fermi distribution, doping to produce charge carriers - Semiconductor junctions - Recombination, p-n junction, reverse bias, breakdown - Semiconductor electronic devices - Junction field effect transistor, MOS field effect transistor, bipolar junction transistor.

PH4193

Materials science I - Preq. PH3212

Atomic Structure - Atomic Bonding in solids - Imperfections in Solids -

Mechanical Properties - Failure: Fundamentals of Fracture - Fatigue Testing -

Crack Propagation - Steel : Manufacture - Iron-Carbon Phase Diagram -

Introduction to ceramics -Introduction to polymers - Introduction to composites

PH410 Astrophysics I - Preq. PH1222

The Solar System: An Introduction to Comparative Planetology

Earth: Our Home in Space -The Moon and Mercury: Scorched and Battered Worlds

History of the Moon and Mercury - Venus: Earth's Sister Planet

Internal Structure - Mars: A Near Miss for Life? -Jupiter: Giant of the Solar System

Saturn: Spectacular Rings and Mysterious Moons - Uranus, Neptune, and Pluto: The Outer Worlds of the Solar System- Solar System Debris: Keys to Our Origin The Formation of Planetary Systems: The Solar System and Beyond.

PH4105

Biophysics I - Preq. PH1222

Electron Microscopy - Spectroscopy - Light Microscopy

X-Ray Crystallography - NMR spectroscopy - Basic Principles of NMR

NMR Theory and Experiment - NMR in Medicine.

PH4216

Experimental Physics VI - Preq. (none)

10 different physics experiments covering different branches of physics.

PH4214

Condensed matter physics - Preq. PH4171

Basic magnetic properties and units in magnetism - Localized magnetism associated with ion cores - Magnetism associated with band electrons - Magnetic dipoles in applied fields -Classes of magnetic materials (transition and rare earth metals) - Exchange interactions in magnetism and hyperfine fields - Pauli paramagnetism and theory - Amorphous and glassy state of matter - Glass formation in chalcogenide systems and the periodic system of elements - Different types of glasses - Some physico chemical properties of some glasses.

PH4274

Plasma physics - Preq. PH2272

Fundamentals of plasma: introduction to gas discharges Definition, conditions for plasma existence - Plasma parameters: the degree of ionization, plasma temperature - Debye length - plasma sheath, Diffusion of charged particles in plasma, plasma frequency - plasma types: thermal plasma, cold plasma - Plasma generation and plasma sources: DC discharges, pulsed DC discharge - RF discharge: Capacitively coupled discharge, inductively coupled discharge - Microwave discharges -Dielectric barrier discharges - plasma production using beams - plasma diagnostics: gas phase diagnostics, surface diagnostics - laser induced fluorescence: advantage , disadvantage, relative densities, spatial resolution.

PH4234

High energy physics - Preq. PH3131

Historical Introduction to the Elementary Particles -Elementary Particle Dynamics - Relativistic Kinematics - Symmetries - Bound States - The Feynman Calculus - Quantum Electrodynamics : Electrodynamics and Chromodynamics of Quarks - Weak Interactions - Gauge Theories –Neutrino Oscillations.

PH4224

Applications of laser physics - Preq. PH3222

Semiconductor Physics Background - Semiconductor Lasers, Ray Tracing in an Optical System - Gaussian Beams - Optical Cavities Optics of Anisotropic Media - The Electro-Optics and Acousto-Optic Effects and Modulation of Light Beams - Wave Propagation in Nonlinear Media - Detection of Optical Radiation -Laser applications

PH4294

Materials science II - - Preq. PH4193

Ceramics - Polymers – Composites- Corrosion and degradation of materials Electrical properties of different materials - Thermal properties- Magnetic properties - Optical properties.

PH4204**Astrophysics II - Preq. PH4103**

The Sun: Our parent star -Measuring the stars: Giants, Dwarfs, and the Main sequence -The Solar Neighborhood - Luminosity and apparent brightness -The interstellar medium: Gas and dust among the stars - Interstellar Matter- Emission Nebulae - Star Formation: A Traumatic Birth -Stellar Evolution: The Life and Death of a Star- Leaving the Main Sequence -Stellar Explosions: Novae, Supernovae, and the Formation of the Elements - Neutron Stars and Black Holes: Strange States of Matter- Galaxies And Cosmology - The Milky Way Galaxy - Galaxies and Dark Matter: The Large-Scale Structure of the Cosmos - Cosmology: The Big Bang and the Fate of the Universe.

PH4206 Biophysics II - Preq. PH4105

Molecular Modeling - Macromolecular Structure -Introduction to Energy Pathways in Biology – Neurobiophysics.

PH4244**Molecular Physics II - Preq. PH4171**

Rutherford model for the hydrogen atom -Sommerfeld elliptic orbits: degree of freedom -General characteristics of Sommerfeld elliptic orbits - Central field and angular momentum - Orbital Magnetic dipole moment - Spin magnetic dipole moment -Stern Gerlach experiment - spin orbit interaction - determination of the term type for the electron configuration - Russel Saunders coupling - Zeeman effect - Complicated or Anomalous Zeeman effect - Introduction to molecular spectroscopy.

PH4264**Nuclear analytical techniques -- Preq. PH4163**

Pulse Signals in Nuclear Electronics - The NIM Standard - Signal Transmission - Electronics for Pulse Signal Processing - Pulse Height Selection and Coincidence Technique - Electronic Logic for Experiments - Timing Methods and Systems - Computer Controlled Electronics: CAMAC - X-Ray Florescence - Mössbauer XPS - Neutron Activation Analysis - Ion-Beam Spectroscopic Techniques - Atomic Absorption Spectrometry.

MA2121 Differential equations & special functions (MA1202)

Linear partial differential equations of order one and its solution by using Lagrange method. Superposition principle. Canonical forms. Classification of second order partial differential equations. Some standard methods for solving partial differential equations of higher order with constant coefficients (homogeneous and nonhomogeneous). Solution of parabolic equations (method of separation of variables, heat flow, diffusion equation). Solution of hyperbolic equations (viabration of stretched and flexible string, D'Alembert solution of the wave equation. Gamma and Beta functions; Legendare equation; Bessel's equation; Hermit equation.



Program title	Material Science
Program type	Special
Department(s)	Physics

MS2131

Mechanics – Preq. PH1121

Kinematics and statics – Motion in one dimension- Vectors and motion in two dimensions- The laws of motion- potential and kinetic energy- Momentum and collisions- Rotational energy and gravity- Rotational equilibrium and rotational dynamics

MS2111

Materials Science Lab I – Preq. (none)

Selected experiments in different aspects.

PH2121

Waves - Preq. PH1221

Simple harmonic ad damped harmonic motions - Energy of simple harmonic motion - Simple harmonic vibrations in electric system

The vector representation of the simple harmonic motion - Damping coefficient – Ballistic galvanometer - The Q - factor for damping harmonic motion in electric circuit - The effect of the force on vibration - Isolation of vibration - Q- factor as amplifying coefficient - The forced oscillator – Coupled oscillators - Inductance coupling of electrical oscillators, Coupled oscillations of a loaded string - Waves on transmission lines- ideal transmission line - Waves in more than one dimension- Wave equation in 2- dimension - Reflection of a 2- dimensional wave at rigid boundaries.

MS2141

Thermodynamics of Materials - Preq. PH1121

Fundamental concepts - Scope of thermodynamics, systems, state of system properties - pressure process- thermal equilibrium and temperature - The Zero law of thermodynamics thermodynamic equilibrium- Empirical and thermodynamic

temperature - Equation of state - Work in Thermodynamic Processes - The First Law of Thermodynamics - Heat Engines and the Second Law of Thermodynamics – Entropy.

PH2151

Electromagnetic Theory I - Preq. PH1222

Revision of scalars, vector quantities- Scalar and vector fields.

The three coordinate systems used in the course - Coulomb's law in vector notation - the electric field- Line, surface and volume charge densities - Electrostatic field of different charge distributions: discrete and continuous

Faraday's experiment of the two spheres - Electric flux density- Gauss' law-

Applications of Gauss's law - First Maxwell equation under static conditions- the divergence of the displacement vector.

PH2161

Mathematical physics I – Preq. PH1222

Matrices and vector spaces - Normal modes - Vector calculus - Line, surface and volume integrals - Fourier series - Integral transforms - First-order ordinary differential equations - Higher-order ordinary differential equations

PH2222

Physical optics – Preq. PH1222

Light wave and interference- The superposition of waves - Interference of two beams of light – Interference involving multiple reflection - Young's Experiment - Newton's fringes - Fresnel's Biprism - Michelson interferometer - Fabry- Perot interferometer - Diffraction- Fresnel diffraction - Cornu spiral - Diffraction at a circular hole and at a circular barrier – Semi-harmonic regions- Diffraction grating - Fraunhofer diffraction- intensity of diffraction grating - Step diffraction grating - Polarization: Absorption and polarization of light - Polarization by diffraction, refraction and double refraction - Polarization using calcite crystal - Nicol prism, Polarization and dispersion of light - Circular and elliptical polarization, Rotation of polarizing plane in solids- liquid and vapors.

PH2252

Electromagnetic Theory II – Preq. PH2151

Work done to move a charge in an electric field, potential and potential difference in vector notation- Potential gradient and the electric field of a dipole - Current and continuity equation - Boundary conditions and properties of conductors. Poisson's and Laplace's equations - Magnetic field laws - 2nd Maxwell equations -3rd Maxwell equations - Magnetic flux, 4th Maxwell equation under static conditions.

PH2262

Mathematical physics II - – Preq. PH2161

Series solutions of ordinary differential equations - Eigenfunction methods for differential equations - Special functions - Quantum operators - Partial differential equations: general and particular solutions - Partial differential equations: separation of variables and other methods - Calculus of variations -Integral equations

PH2272

Modern physics - Preq. PH1222

Special Theory of Relativity - Galilean transformation speed of light - Michelson-Morley experiment - Einstein's postulates - Simultaneity, time dilation space contraction, invariant intervals, rest frames - Proper time, proper length - Lorentz transformation - Doppler effect.

MS2212

Materials Science Lab II – Preq. (none)

Selected experiments in different aspects

MS2232

Mechanical Properties - Preq. MS2131

Concepts of stress and strain - Elastic properties of materials - Tensile properties Plastic deformation – Hardness – Dislocations - Deformation by twinning – Strengthening - Failure .

MS2242

Alternating current and electrical circuits - Preq. PH1222

DC and AC- phase angle – mean and effective values of AC current- Power of electric source - Components of AC circuits - current and power of circuit of ohmic resistor only and that containing an ideal capacitor - Resistor, capacitor and inductor in series - Parallel connections - Multi- element circuits - Complex connection circuits (parallel- series) - Power in AC circuits - Circuit analysis using complex quantities- Quality factor - AC Bridges - diodes - Characteristic curve of the diode- the diode approximation problem- Zener diode and its characteristic curve - Diode circuits: full and half - wave rectifiers- regulators - voltage multipliers - voltage doublers and limiters.

MS3113

Materials Science Lab III -- Preq. (none)

Selected experiments in different aspects.

MS3121

Atomic and molecular spectroscopy - Preq. PH2272

Spectra of alkali atoms , vector atom model , LS and jj couplings , normal and anomalous Zeeman effect , Stark effect - Symmetric and antisymmetric wave functions, Slater determinants , constant field approximation , Hartree-Fock method , Born-Oppenheimer approximation - Fine structure of spectral lines , nuclear spin and hyperfine structure , spectra of diatomic molecules , polyatomic molecules - Raman Spectroscopy , magnetic resonance , ESR and MNR spectra , Lasers , interaction of laser with atoms - Measurement of linear absorption coefficient - Polarisation of light (anisotropic medium)

MS3141

Crystallography - Preq. PH1121

Crystallography; crystallographic calculations; properties of common crystal structures of engineering materials - The stereographic projection and its use in depicting angular relationships in crystals and as a tool for solving crystallographic problems - The theory of diffraction of X-rays, including the determination of both the direction and intensities of diffracted beams; calculation of the structure factor and using it in diffraction problems - The reciprocal lattice, including an introduction to the concept of reciprocal space and the reciprocal lattice and the expression of diffraction phenomena in terms of the reciprocal lattice.

MS3111

Solar energy conversion devices I - Preq. PH2131

The electronic and optical mechanisms, as well as the manufacturing of photovoltaic devices - Topics include electronic charge separation, transportation and recombination- optical concentration, trapping and confinement; materials system for photovoltaics; bulk crystal, thin-film and organic photovoltaic device configurations - The course also covers the process and equipment for the manufacturing of various photovoltaic cells. Special emphasis is on the low-cost manufacturing of practical photovoltaic systems. Measurements of solar radiation intensity - Solar collectors - Efficiency calculations of solar collectors Factors effecting the efficiency of solar collectors - Some other solar energy conversion thermal applications (solar cooking , solar ponds and solar distillers) - Solar energy storage.

MS3133

Materials Kinetics - Preq. PH2131

Kinetics of Materials begins with diffusion, offering a description of the elementary manner in which atoms and molecules move around in solids and liquids. Next, the more complex motion of dislocations and interfaces is addressed. Finally, still more

complex kinetic phenomena, such as morphological evolution and phase transformations, are treated.

PH3161

Solid state physics I – Preq. PH1121

The study of crystal faces - The crystal state -The unit cell and 14 Bravais Lattices - The seven crystal systems - The stereographic projection -Inversion axes - The reciprocal lattice - Brillouin zones –examples - Space groups - Interatomic forces in solids - X- rays - Types of photographs - Absorption of X- ray and Bragg's law.

PH3181

Computational physics – Preq. PH1222

Introduction to FORTRAN and its numerical model - Mathematical expressions and internal functions in FORTRAN - Steps of solving problems by computer and examples - Types of flow charts and examples on it - Methods of representation of concepts and variables - General formula of inputs and outputs - If statements - Programs on if statements - Do loops - Nested Do loops - Programs on Do loops - Adding , subtracting and multiplying matrices by using computers

PH3191

Environmental physics – Preq. PH1121

The forces of nature – different types of energy - Heat and radiation - Solids, liquids and gases - The Earth's climate and climate change - Sound and noise – Radioactivity- radiation safety - nuclear physics.

MS3214

Materials Science Lab IV- Preq. (none)

Selected experiments in different aspects.

MS3252

Analogue Electronics – Preq. MS2242

Introduction to the technical concepts of electronic components, circuits and theory; principles of current and voltage control devices; basic circuits for power supplies, amplifiers, oscillators, and use of basic test instruments.

MS3222

Laser spectroscopy – Preq. PH2262

Advances of Laser Spectroscopy, Fundamentals of Absorption and Emission of Light, Widths and Profiles of Spectral Lines, Fundamentals of Lasers, Doppler-Limited Laser Spectroscopy, High-Resolution Doppler-Free Laser Spectroscopy,

Femtosecond-Time-Resolved Spectroscopy.

MS3212

Solar energy conversion devices II - Preq. MS3111

Specific details about the bulk, thin film and nanocomposite. The fast growing field of PV devices such as solar cells and solar modules. Design and performance factors of various PV devices will be described and analyzed, including monocrystalline, microcrystalline, amorphous and nanocrystalline cells. The key concepts underlying all device operations along with the plenty of practical information about their design, processing and applications.

MS3224

Physical properties of Materials – Preq. PH2272

Electric properties : Conductivity- Electronic and ionic conduction – Energy band structures- Electronic mobility- Semiconductors- Semiconductor devices – Dielectric materials- Ferroelectricity- piezoelectricity.

Thermal properties: Heat capacity – Thermal expansion – Thermal conductivity- Thermal stresses - Magnetic properties ; Magnetic classification of materials- effect of temperature on magnetic properties- domains and hysteresis.- Superconductivity
Optical properties: Light interactions with solids- Atomic and electronic interactions- Refraction and reflection- Luminescence- photoconductivity- optical fibres in communications.

MS3232

Radiation dosimetry - Preq. PH1121

Basic information on :The interactions between electron- and proton beams with matter - The theoretical principles of dosimetry and dose calculations -The absorbed dose in uniform and non-uniform mediums - Methods used for measuring and calculating energy deposited by ionising radiation in different media. The principles for different dosimeters as ionisation chambers, chemical dosimeters and calorimeters - The relation between the dose in the dosimeter and surrounding material (cavity theory) is dealt with at depth.

MS3242

Corrosion and degradation of materials - Preq. PH1121

Corrosion of metals - Electrochemical consideration- Corrosion rates – Passivity - Environmental effects - Forms of corrosion - Corrosion prevention – Oxidation - Swelling and dissolution - Bond rupture - Weathering.

PH3264

Mathematical Physics III – Preq. PH2262

Complex variables - Applications of complex variables - Tensors - Numerical methods - Group theory - Representation theory -Probability - Statistics

MS4115

Materials Science Lab V- Preq. (none)

Selected experiments in different aspects

PH4163

Detectors and accelerators

Gas Filled Detectors - Liquid Filled Detectors - Proportional Counters - Solid State Detectors - Semiconductor Detectors - Scintillation Detectors and Photodetectors - Position Sensitive Detection and Imaging - Some Important Terminologies and Physics of -Transverse Motion - Synchrotron Motion - Quantities – Accelerators Electron Storage Rings - Special Topics in Beam Physics

MS4171

Ceramics - Preq. MS3141

Ceramic structures : Crystal structures – Silicate ceramics- Carbon- Imperfections in ceramics - Ceramic phase diagrams - Mechanical properties of ceramics- Theoretical considerations of the crystallographic and microstructural aspects of the elastic properties and fracture characteristics of ceramics- Thermal properties of ceramic materials: Heat capacity, heat of fusion, thermal conductivity, and thermal expansion in relation to macroscopic measurements and basic atomic concepts applied to ceramic materials - Preparation and properties of ceramic semiconductors, dielectrics, and magnetic materials.

MS4163

Introduction to nanotechnology - Preq. MS3224

This course will explore the underlying science behind nanotechnology, the tools used to create and characterize nanostructures, and potential applications of such devices. The course will start with a brief review of the physical principles of electric fields and forces, the nature of chemical bonds, the interaction of light with matter, and elastic deformation of solids- Fabrication using top-down and bottom-up methods will be discussed- Nanotechnology methods will be compared with those used in the modern micro-electronics industry – Nanomaterials: the unique size-dependent properties (mechanical, thermal, chemical, optical, electronic, and magnetic) that result from nanoscale structure will be explored in the context of technological application including computation, magnetic storage, sensors, and actuators.

MS4153

Digital Electronics - Preq. MS3252

A study of the binary number system, codes, Boolean algebra, minimization techniques, logic gates, code converters, flip-flops, counters, shift registers and binary arithmetic techniques.

MS4123**Electron Microscopy - Preq. MS3121**

What is characterization using electron microscopy- Electron microscope- Transmission electron microscope-Scanning electron microscope- atomic force microscope – Idea and physics beyond each one of those microscopes.

MS4121**Materials Design - Preq. MS2232**

Material Selection - Strength. Other property considerations - Thermal protection. Automobile valve spring - the hip joint. Material requirements - Materials employed.

MS4131**Micro-processing of Materials - Preq. PH3161**

The physical and chemical principles of modern non-traditional materials manufacturing processes - The relation between the microscopic (atomic-level) mechanisms of these processes and the resultant structure, properties and performance of processed materials - The advantages and disadvantages of each process in a modern manufacturing environment - Introduction to single crystal substrates Diffusion - Thermal oxidation - Ion implantation - Rapid thermal processing - Optical and non-optical lithography - Vacuum science and plasmas- Etching processes - Physical vapor deposition - Chemical vapor deposition - Epitaxial growth

PH4214**Condensed matter physics - Preq. PH4171**

Basic magnetic properties and units in magnetism - Localized magnetism associated with ion cores - Magnetism associated with band electrons - Magnetic dipoles in applied fields -Classes of magnetic materials (transition and rare earth metals) - Exchange interactions in magnetism and hyperfine fields - Pauli paramagnetism and theory - Amorphous and glassy state of matter - Glass formation in chalcogenide systems and the periodic system of elements - Different types of glasses - Some physico chemical properties of some glasses.

MS4216**Materials Science Lab VI – Preq. (none)****Selected experiments in different aspects****MS4254****Microcontrollers and microprocessors - Preq. MS4153**

Microprocessor programming - Address decoding - system timing - parallel, serial, and analog I/O – Memory system design and interfacing - Interrupts & direct memory access DMA - Data entry & display - Analog I/O- Interfacing to static and dynamic RAM; microcontrollers.

MS4232

Essay & research

An article searching in one of different topics in theoretical or experimental materials science chosen by the student and approved by his supervisor.

MS4234

Thin films - Preq. MS4171

Review of crystallography, defects, diffusion and phase transformations. Deposition processing and characterization of thin films and their technological applications - Physical and chemical vapor deposition methods. Thin-film nucleation and growth - Thermal, laser and ion processing - Microstructural development in epitaxial, polycrystalline and amorphous films - Thin-film characterization techniques - Mechanical behavior of thin films - Magnetic properties. Functional responses - Applications in information storage, integrated circuits, sensors and actuators, and optoelectronic devices.

MS4222

Analysis techniques in materials science - Preq. MS3121

X-ray physics- X-ray fluorescence - X-ray safety - Specific X-ray analysis techniques, including single crystal diffraction, the powder diffraction method, use of the X-ray diffractometer, indexing of powder patterns, precision lattice parameter determination, thin film diffraction, phase diagram determination, use of the JCPDS database, and the determination of preferred orientation - IR spectroscopy - Raman spectroscopy -Activation analysis - Other analysis methods.

MS4242

Superconductors - Preq. MS3141

The basic notions, the general electrodynamic and thermodynamic properties of superconductors, fluctuation phenomena in superconductors, the Ginzburg-Landau theory of superconductor surface tension, and Abrikosov's theory of the vortex state in superconductors - technological applications : superconducting magnets, magnetic levitation, Josephson effect, metric standard for voltage unit, application of the Josephson effect for measuring weak magnetic fields, superconducting electromotors, generators and transformers using second-generation wires.

MS4244

Materials in electronics - Preq. MS3141

Magnetic materials : classification according to magnetic properties -Classification according to crystal structure - Ferrites- several types- soft and hard ferrites. Perovskites – Magneto-resistance – Giant magnetoresistance – colossal magnetoresistance materials - Conducting polymers.

PH4264

Nuclear analytical techniques -- Preq. PH4163

**Pulse Signals in Nuclear Electronics - The NIM Standard - Signal Transmission
- Electronics for Pulse Signal Processing - Pulse Height Selection and
Coincidence Technique - Electronic Logic for Experiments - Timing Methods
and Systems - Computer Controlled Electronics: CAMAC - X-Ray Florescence -
Mössbauer XPS - Neutron Activation Analysis - Ion-Beam Spectroscopic
Techniques - Atomic Absorption Spectrometry.**



Program title	Biophysics
Program type	Special
Department(s)	Physics

BP 2110 General biophysics

Empirical studies on the living cell, the flexibility of a living cell, the wife of live material of the cell, the cell surface energies, biological effects of some areas, light: energy and the light switch and absorption, the physical foundations of operations impacts vital therapeutic effects laboratory, electromagnetic waves And the spectra of areas vital to measure resistance, the effects of low frequency, microwave radiation, laser radiation, UV radiation, acoustic phenomena are connotation of biophysical units used in acoustic, acoustic generators, considerations of the physical audio-ray absorption.

BP2112 Bioelectric phenomena

Requirements: PH1223.

Electric phenomena in nerve and muscle membrane potentials, Hodgkin-Huxley equations, volume conductor problem, applications to electrocardiography, electroencephalography, plethysmography.

BP2113 Experimental biophysics I

12 different physics experiments covering different branches

PH2121

Waves - Preq. PH1223

Simple harmonic ad damped harmonic motions - Energy of simple harmonic motion - Simple harmonic vibrations in electric system

The vector representation of the simple harmonic motion - Damping coefficient – Ballistic galvanometer - The Q - factor for damping harmonic

motion in electric circuit - The effect of the force on vibration - Isolation of vibration - Q- factor as amplifying coefficient - The forced oscillator – Coupled oscillators - Inductance coupling of electrical oscillators, Coupled oscillations of a loaded string - Waves on transmission lines- ideal transmission line - Waves in more than one dimension- Wave equation in 2-dimension - Reflection of a 2- dimensional wave at rigid boundaries.

PH2125

Classical mechanics - Preq. (none)

Motion in one dimension - Vectors and motion in two dimensions - The laws of motion - Energy, momentum and collisions - Rotational motion and gravity - Rotational equilibrium and rotational dynamics - Applications in biological systems.

PH2181

Introduction to thermodynamics - Preq. PH1123

What is thermodynamics? - Thermal equilibrium and temperature - The Zero law of thermodynamics thermodynamic equilibrium- Empirical and thermodynamic temperature - Equation of state (Equation of state of an ideal gas P-V-) - P-V-T surface for an ideal gas equation of state for real gas -P-V-T surface for a real gas and equation of a state of other than P-V-T system (real gases). partial derivatives. First law of thermodynamics - Entropy and the second law of thermodynamics.

PH2141

Acoustics - Preq. PH1123

Mechanical waves: physical properties, the properties of the center-proliferation, the spread of the models sound like, sound waves interact with biological tissue (Reflection - fragmentation - refraction - coral - overlap - Suction), the sound intensity in the tissue, the appointment of interesting voice echoed in the tissues, Applications of ultrasound in medical imaging using ultrasound.

PH2183

Electromagnetism I - Preq. PH1224

Revision of scalars, vector quantities- Scalar and vector fields. The three coordinate systems used in the course - Coulomb's law in vector notation - The electric field- Line ,surface and volume charge densities - Electrostatic field of different charge distributions -Faraday's experiment of the two spheres - Electric flux density- Gauss' law - First Maxwell equation under static conditions.

PH2161

Mathematical physics I – Preq. PH1224

Matrices and vector spaces - Normal modes - Vector calculus - Line, surface and volume integrals - Fourier series - Integral transforms - First-order ordinary differential equations - Higher-order ordinary differential equations

PH2222

Physical optics – Preq. PH1224

Light wave and interference- The superposition of waves - Interference of two beams of light – Interference involving multiple reflection - Young's Experiment - Newton's fringes - Fresnel's Biprism - Michelson interferometer - Fabry- Perot interferometer - Diffraction- Fresnel diffraction - Cornu spiral - Diffraction at a circular hole and at a circular barrier – Semi-harmonic regions- Diffraction grating - Fhernhover diffraction- intensity of diffraction grating - Step diffraction gratin - Polarization: Absorption and polarization of light - Polarization by diffraction , refraction and double refraction - Polarization using calcite crystal - Nickol prism, Polarization and dispersion of light - Circular and elliptical polarization, Rotation of polarizing plane in solids- liquid and vapors.

PH2242

Analytical Mechnacios – Preq. PH2141

The motion a mass point in two dimensions (Kepler's laws) -The motion a mass point in three dimensions - Dynamics of the system of particles - Collision of particles

D'Almbert's principal and Lagrangian Formalism - Classification of mechanical systems - The principal of least action - Hamilton's canonical equations of motion - Velocity and acceleration of particles relative to the moving and fixed coordinate system.

PH2284

Electromagnetism II – Preq. PH2183

Work done to move a charge in an electric field, potential and potential difference in vector notation- Potential gradient and the electric field of a dipole - Current and continuity equation - Magnetic field laws - 2nd Maxwell equations -3rd Maxwell equations - Magnetic flux, 4th Maxwell equation under static conditions.

PH2262

Mathematical physics II - – Preq. PH2161

Series solutions of ordinary differential equations - Eigenfunction methods for differential equations - Special functions - Quantum operators - Partial differential equations: general and particular solutions - Partial differential equations: separation of variables and other methods - Calculus of variations -Integral equations

PH2272

Modern physics - Preq. PH1224

Special Theory of Relativity - Galilean transformation speed of light - Michelson-Morley experiment - Einstein's postulates - Simultaneity, time dilation space contraction, invariant intervals, rest frames - Proper time, proper length - Lorentz transformation - Doppler effect.

BP2214 Experimental biophysics II

12 different physics experiments covering different branches

BP3112 Molecular Biophysics (1)

Requirements: BP2110.

Linking particles smaller than large, the model and similar places which do not depend on each other, represent: the example of places affected by the nearest place, I represent: random walk theory and the calculation of the average dimensions of living flexible polymers. Distributions of molecular knowledge and most likely, mechanical enzymes. Kopolimr Ketrolit living polymers. Insulation properties of polymers living

BP3115 Experimental biophysics III

12 different biophysics experiments covering different branches

PH3131

Quantum Mechanics I – Preq. PH2262

Historical review - Operators, Eigen value Equation - State function, expectation values - Time development of state function - Particle in a box, Dirac notation - Hermitian operators - Adjoint properties - Superposition principle - Commutator relations - Time development, conservation theorems and Parity - Harmonic oscillator - Unbound states, Barrier problems – Tunneling - Ramsauer effect - Hydrogen atom.

PH3132

Energy Physics – Preq. PH1123

Energy and Society - Physical basis for energy - Fossil Fuels - Electric energy - Electric Power Plants and the environment - Automobiles and the environment - Thermodynamic principles - Atmospheric problems - Nuclear Power and Solar energy - Other energy systems - Nuclear breeder and nuclear fusion reactors - Energy conservation.

PH3141

Atomic physics - Preq. PH2272

Waves and Particle - De Broglie hypothesis- Velocity of De Broglie waves associated with a particle and its relation to the velocity of light - wave and group velocities and particle velocity and the mathematical relations between them - Schrödinger equation for a single particle - Photons: Particle-like properties of radiation – the photoelectric effect - Compton effect – Equation of Compton shift -pair production and pair annihilation - Atomic structure : Thomson atomic model- Rutherford atomic model - Bohr's

atomic model – the atomic spectrum- Sommerfeld's atomic model - Quantum atomic model – the four quantum numbers – Zeeman effect - Atomic spectra - Spectroscopy- Spectrum analysis –Different types of spectra: continuous – characteristic - Atomic spectral lines – absorption spectrum – spectrometer - X- Rays and X- ray production - continuous and characteristic x-ray – Ionization and Excitation of the spectra.

PH3151

Electrical circuits - Preq. PH1224

Simple circuits- Nodal analysis – Mesh analysis – Linearity and superposition - Thévenin and Norton theorems – Source transformations – General nodal and loop analysis – Inductance and capacitance: duality – Simple RL and simple RC circuits- The RLC circuit – Transient and steady state – Sinusoidal forcing function – Phasor admittance – frequency response – average power and RMS – two-port networks.

BP3154 Biophysics of the Nervous System

Requirements: BP2110

Introduction, composition and function of the nervous system, physics is vital for nerve cells, is a cell membrane, to move the chemical, electrical, a collection of nerve signals, switch the power, chemical, physics is vital for ion channels, types, methods of measuring activity Appliances, neurological, comprehensive theory Appliances, sensory, Neural networks, learning and memory devices used in measuring the electrical activity of nerve cells. Registration outside the cells, cells within the registration, control signals, poles, Alchocrh measurements methods, the analysis results.

BP3156 Biomechanics

Requirements: BP2110

Study the mechanics of vital bones, the meaning of equivalent Streamlining flexibility of solid objects, the wife of liquids, feature flexibility and viscosity of biological materials, different models of flexible materials sticky, sticky properties of flexible materials, test mechanical properties of flexible sticky material properties, blood flow, blood examination of her spouse, examination properties Streamlining of the large receptacles small receptacles.

PH3171

Electrodynamics I – Preq. PH2252

Curvilinear coordinates- The Dirac Delta Function – The theory of vector field – Electrostatics: Coulomb's law –Electric field – Electrostatic potential - Solution of electrostatic problem (special techniques) -Laplace's Equation – The Method of images - Electric fields in Matter – Polarization– Electric Displacement - Linear Dielectrics - The steady magnetic field – magnetic flux – the scalar and vector magnetic potentials - Magnetic forces – the nature of magnetic materials - Magnetization and permeability.

BP3216 Experimental biophysics IV

12 different biophysics experiments covering different branches

PH3222

Laser Physics - Preq. PH3141

Invention of lasers – general properties and applications - Types of coherence , coherence length and coherence types , spectral purity and their determination - Quantum transition between atomic energy levels : Einstein relations and the ratio between spontaneous and stimulated emission - Normal distribution of atoms in different energy states and the case of population inversion - Optical feedback and optical resonator – conditions of stability - Power gain and threshold conditions - Laser pumping and creation of population inversion - Laser models : 2-3-4 level laser systems - Laser output : line shape broadening - Axial and transverse modes and their examinations and control - Power rate , gain oscillations , power output interrelations and gain saturation - Modifying laser output : mode selection , Q – switching and mode locking - Types of lasers : gas and solid lasers.

PH3232

Quantum mechanics II – Preq. PH3131

Elementary matrix - The energy representation - Angular momentum- the Pauli spin matrices - Scattering in 3 dimensions - Partial waves- s- wave Phase shift. scattering at low energies - The wave function and normal state of H- atom - Time – independent, non degenerate perturbation - Theory – the perturbed Harmonic oscillator - The normal Helium atom - The variational integral and its properties- The normal state of the Helium atom.

BP3257 Health biophysics

Preq: BP2110

Ionizing radiation: international bodies and international organizations interested technicians and measurement of ionizing radiation. Dosimetry standards. Room ionization (open in the open air) standard. Measuring the radiation absorbed dose, kinetic energy flowing in the center Kerma. Gamma radiation of the qualitative. Account absorbed doses of radioactive elements within the body of a beta or gamma radiation. The basic rules for the prevention of ionizing radiation, a personnel in the field of radiation and the general public. Instrumentation doses personal scale enclave, the film badge, the measure doses Aluminid gases. Non-ionizing radiation: deal with tissue lasers, laser sources and types, safety rules and the risks of lasers, vital to the effects lasers, laser measurement methods, standards protective, risk assessment and classification of lasers, some uses of lasers in medicine, chemistry and biosciences

BP3258 Simulated the Electronic of the Biological systems

Prequ: BP3151

Loudspeaker operations, e-services single-entry: the whole effort, the AC adapter to the effort, differentiation and integration services, integration and differentiation complex. Chambers bilateral entry: offering services, Mkamil difference, continued effort. The non-linear: Comparative organizations, microphone in the electronic operations simulation system, and the weight Bedspring accounts asymmetric, differential equations, simulated heartbeat, a heartbeat candidate, the candidate of vibration, noise measure, the backbone of simulated control the pace, resistance detector Alglovany skin

BP3260 Signal analysis and processing in Biosystems

Requirements: BP3154

Nature of biomedical signals. Correlation. Impulse response. Frequency response. Continuoustime signal modeling. Discrete-time signal modeling. Noise removal and signal compensation. Stochastic signals modeling.

BP3261 Medical Physics)

Requirements: BP2110

Physical and chemical interactions of ionizing radiations and their biological effects, structural imaging (magnetic resonance imaging, ultrasound, computed tomography and optical microscopy); nuclear medicine, therapeutic applications of radiation.

PH3282

Introduction to solid state physics – Preq. PH1123

The crystal -The unit cell and 14 Bravais Lattices - The seven crystal systems – Symmetry elements -Inversion axes - The reciprocal lattice - Brillouin zones –Space groups - Interatomic forces in solids - X- rays types and its production - Types of photographs - Absorption of X- ray and Bragg's law- Uses of X-rays.

PH3292

Radiation physics - Preq. PH1121

Interaction of Radiation with Matter - Ionization, Moeller Scattering, Bhabha Scattering, Electron-Positron Annihilation, Bremsstrahlung, Cherenkov Radiation - Elastic Scattering, Inelastic Scattering, Transmutation, Radiative Capture , Fission, Total Cross Section, Passage of Neutrons through Matter -Radiation Dosimetry - Radiation-Protection Criteria and -Chemical and Biological Effects of Radiation External Radiation Protection - Internal Dosimetry and -Exposure Limits Radiation Protection

PH3272

Electrodynamics II - Preq. PH3171

The magnetic circuit- potential energy and forces on magnetic materials - Time-varying fields (Faraday's law – displacement current) - Maxwell's equations in point form and in integral form – the related potentials - Wave motion in free space and in perfect dielectrics - Plane waves in lossy dielectrics – the poynting vector and power consideration - Propagation in good conductors : skin effect - Reflection of uniform plane waves - The transmission- line equations -Waveguide and antenna fundamentals.

PH4103 AstrobiologyI
Requirements: PH1202

Origin and distribution of the biologically important chemical elements -Conditions in the early Solar System -Earliest evidence for life on Earth- Biological Basics -Key biological molecules (amino acids, proteins, nucleic acids, etc); classification of life (kingdoms; domains); basic structure of prokaryotic and eukaryotic cells; genetic code. Pre-biological chemical evolution and the origin of life -History of life on Earth: Summary of major evolutionary innovations since early appearance of life; evolution of eukaryotic cells -- evidence for endosymbiosis; Cambrian explosion; essential time frame for major evolutionary innovations; astrobiological implications. Requirements for life: is Earth uniquely habitable? Plate tectonics and the carbon cycle; role of a large Moon, etc.

PH4113
Physical Electronics - Preq. PH3151

Electronic properties of semiconductors - Semiconductor materials, free electron energy spectrum, semiconductor band structure, Fermi distribution, doping to produce charge carriers - Semiconductor junctions - Recombination, p-n junction, reverse bias, breakdown - Semiconductor electronic devices - Junction field effect transistor, MOS field effect transistor, bipolar junction transistor.

BP4117 Experimental biophysics V

12 different biophysics experiments covering different branches

PH4193
Materials science I - Preq. PH3261

Atomic Structure - Atomic Bonding in solids - Imperfections in Solids - Mechanical Properties - Failure: Fundamentals of Fracture - Fatigue Testing - Crack Propagation - Steel : Manufacture - Iron-Carbon Phase Diagram - Introduction to ceramics -Introduction to polymers - Introduction to composites.

PH4163
Detectors and accelerators – Preq. PH3292

Gas Filled Detectors - Liquid Filled Detectors - Proportional Counters - Solid State Detectors - Semiconductor Detectors - Scintillation Detectors and Photodetectors - Position Sensitive Detection and Imaging - Some Important Terminologies and

**Physics of -Transverse Motion - Synchrotron Motion - Quantities – Accelerators
Electron Storage Rings - Special Topics in Beam Physics**

BP4171 Radiation Treatment Planning

Requirements: BP3257.

Units dosimetry, and the absorbed dose of. Factors affecting the distribution curves of equal doses of tissue equivalent, equivalent types of tissue, radiation fields square, circular equivalent of the rectangular fields, the relative percentages dose and scatter back, the proportion of (a) dose in the same tissue in the air, the proportion of the dose to tissues in the same fabric equivalent. Inhinaat impact of the patient's body surface to map the distribution of dose and the method of equal treatment in practice or credited, the impact of the heterogeneity of the center on the map of the distribution equal doses. Clove hitch potential candidates for high-dose package. Map Almenthaniat equal doses of radiation fields many of the (bilateral and trilateral), a combination of manual radiation fields. To the fields of radiation dose treatment at the expense of proven source after using the skin surface dose relative percentages. The expense of prescription therapeutic dose to the patient. Account with proven therapeutic dose after the source axis of rotation using a dose in the same tissue in the air. The link between radiation dose and dose relative percentages relative to the tissue in the air.

BP4172 Biophysics and Cell Membranes

Requirements: BP2110.

The importance of biological membrane, the protection of the cell, optional contact with the center, the storage of materials inside compartments within the cell, transition System Eng chemical, biological membrane acquaintance. The molecular structure of biological membranes: a model of liquid Almoszek dynamic model of the membrane bio-manufacturing laboratory modeling of biological tissues, fat single film on the surface of water, air, Allibozzomat, fat black film. The membrane permeability transition: the impact of both the temperature effect on the effort nicknamed permeability, membrane channels in cell permeability. Allibozzomat Khamlat of drugs and genes

BP4174 Biomaterial

Requirements: BP3261

The materials used in the alternative: metals, ceramics, polymers, Profile Joasm and chemical structure: the electrical characteristics of the materials vital alternative: a study of electrical properties in the form in (relations Alaketrostetecip - molecular ionization - and the relationship of the local area and Klacejus Mossite - the theory of fixed isolation and molecular weight). General theory of relaxation. Different ways of measuring the electrical properties (such as fixed unarmed - and other types of resistance) of alternative materials. Mechanical properties of materials vital alternative basic properties of the materials used to measure hardness, fracture, fatigue, stress corrosion with the properties of the materials used in alternative materials. Response and body tissues after the replacement of the joints and organs, the interaction of bone with its alternative study how to form the roof line between

the natural bone material and install a replacement, the cause of the collapse of the stabilization alternative. Applications for metals as an alternative body interactions with metals, ceramics and polymers.

BP4275 Essay & research

An article upon of different topics in theoretical or experimental biophysics chosen by the student and approved by his supervisor.

BP4178 Environmental biophysics(1).

Requirements: BP3257.

The definition of environmental pollution, the types of environmental contaminants (chemical and radiation), the location of pollution (air - land - contaminated surfaces and water), environmental contamination by radiation, types of sources of radiation, ionizing and non ionizing pollution from chimneys nuclear reactors, radioactive sources are open liquid and solid materials Radioactive natural radiation risks in mining and production of oil products, non-ionizing radiation sources, types, divided according to wavelength, sources of electromagnetic waves in nature, the broadcasting antennas and radio and television stations and mobile communications, high-tension electric lines, home electrical wiring, electrical devices, Computer equipment, electronic games. . . And others, aerosol. Definition, a function of size distribution, size and distribution characteristics, atmospheric aerosol, eroded vision, vehicles absorption factor in the atmosphere, light diffraction, absorption of light, the molecule dynamics of aerosol properties, the movement of gases in the vacuum, turning to mass, temperature and aerosol molecules in the course of proliferation Free.

BP4180 Radiobiology I

Requirements: BP2110.

Types of radiation, electromagnetic radiation, radiation detection, radiation units, radiation hazard, effect of radiation on water, effect of radiation on proteins, effect of radiation on lipids, effect of radiation on enzymes, effect of radiation on DNA.

BP4204 AstrobiologyII

Requirements: BP4103

Prospects for life on Mars: Evidence for surface water in the past; climate change; Viking results; possible sub-surface life; Martian palaeontology; future exploration. Prospects for life elsewhere in the Solar System: Europa: Evidence for sub-ice ocean; possible hydrothermal vents; future exploration; Other possibilities (briefly - - Jupiter? Titan?); panspermia. Extrasolar planets: Discovery of planets around other stars; summary of discoveries to-date; limitations of the current methods; future direct imaging of extrasolar terrestrial planets (Darwin, TPF); spectroscopic search for bio-signatures in the atmospheres of extrasolar planets. Extraterrestrial

intelligence: Prospects for intelligent life in the Universe; Drake Equation; SETI; Fermi Paradox.

BP4213 Molecular Biophysics(1)

Requirements: BP3112

Review of the structure of proteins, nucleic acids, carbohydrates, lipids, and the forces and interactions maintaining their structures in solution; thermodynamics and kinetics of protein folding; polymer chain statistics and helix-coil transitions in biopolymers; biopolymer dynamics; structural methods in biology: X-ray crystallography, NMR and fluorescence spectroscopy, electron and probe microscopy; single-molecule methods

PH4214

Condensed matter physics - Preq. PH3261

Basic magnetic properties and units in magnetism - Localized magnetism associated with ion cores - Magnetism associated with band electrons - Magnetic dipoles in applied fields - Classes of magnetic materials (transition and rare earth metals) - Exchange interactions in magnetism and hyperfine fields - Pauli paramagnetism and theory - Amorphous and glassy state of matter - Glass formation in chalcogenide systems and the periodic system of elements - Different types of glasses - Some physico chemical properties of some glasses.

BP4218 Experimental biophysic VI

12 different biophysics experiments covering different branches

PH4264

Nuclear analytical techniques -- Preq. PH4163

Pulse Signals in Nuclear Electronics - The NIM Standard - Signal Transmission - Electronics for Pulse Signal Processing - Pulse Height Selection and Coincidence Technique - Electronic Logic for Experiments - Timing Methods and Systems - Computer Controlled Electronics: CAMAC - X-Ray Florescence - Mössbauer XPS - Neutron Activation Analysis - Ion-Beam Spectroscopic Techniques - Atomic Absorption Spectrometry.

BP4275 Essay & research

An article upon of different topics in theoretical or experimental biophysics chosen by the student and approved by his supervisor.

BP4281 Radiobiology II (

Requirements: BP4180.

This course provides the background to understand both the basis of radiation treatment for cancer and the use of radiobiological models in the evaluation and optimization of radiotherapy: Review of fundamentals – clonogenic assays, cellular

response to radiation, the effect of dose rate, radiation quality (LET), cell-cycle effects, the influence of oxygen, the linear quadratic (LQ) formula and its limitations, the 5 Rs of Radiotherapy, the principles of fractionation and specific considerations in LDR and HDR brachytherapy - the basis and use of radiobiological models (TCP, NTCP, EUD) in both the evaluation and optimization of radiotherapy treatment plans.

BP4282 Medical & Biophysical Measurements

Requirements: BP3259.

Aspects of medical imaging : the physical basis of a medical as well as ways of medical imaging. Main topics: using traditional film cameras, monitors, breast imaging, imaging neighborhood using X-ray, his image and the governance tools, digital imaging and digital detectors, a CT scan, nuclear magnetic resonance. Means the separation of biomolecules: Chapter chromatography (vertical separation chromatography and regular high-performance, chapter-based absorbents chromatography, ion exchange, permeability and separation is the center gas chromatography and liquid chromatography and separation of a high-class). Chapter electrophoresis (separation of proteins and DNA), chapter by proliferation and sedimentation, the basics of X-ray diffraction of samples of biological, nuclear magnetic resonance, mass spectral measurement and bilateral electrical measurement (to measure electrical insulation and a fixed time relax and determination bipolar).

BP 4283 Environmental Biophysics(2)

Requirements: BP4178.

The definition of the environment and the exchange of small capacity, mass and movement of traffic, the equivalent of the ocean bio-contact, temperature: the nature of air temperature and soil, change the vertical air temperature, temperature and biological evolution, the meaning of time warming. Water vapor: the conditions of saturation and saturation of the molecular gas, estimate the density of water vapor in the air. Rights and the Environment: Survey and the rate of metabolism and evaporation of the human body residing in the cold environment, residing in the warm environment, the impact of temperature on the percentage of humidity. Pollutants in the environment by toxic pollution of the environment of toxic gases, toxic contamination of the environment.

BP4284 Bioinformatics

Requirements: BP2110 .

Topics covered include: central dogma and introduction to macromolecular sequences; sequencing methods and physical mapping of genomes; genome data and databases; algorithms for gene finding; statistical methods; pattern recognition; local sequence homology and scoring (BLAST tools); phylogenetic analysis and molecular evolution; tree building methods; RNA structure methods; protein structure and analysis; protein sequence comparison and Dayhoff matrices; Gribskov-Eisenberg profiles; 3d-1d profiles and their construction; homology modeling and scoring of homology models; amphipaticity and hydrophobicity

analysis and membrane structure; structure modeling with PDFs; hidden homology in proteins using Markov models and hidden homology from structural criteria.

**BP4285 Communication and Control Biophysics
Requirements: BP3154.**

**During the electrical properties of tissues and cells, the basics of physical efforts
electrical vital: Voltage stable cell responses generate a vital tissues, electrodes
minute: uses and applications.**



B.Sc. Chemistry

Program title **Chemistry**

Program type **Special**

Department(s) **Chemistry**

Chemical Thermodynamics: **Code: CH2101 (2+1) Pre-request: CH1202**

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Kinetic Theory of Gases **Code: CH 2103 (1) Prerequisite: CH 1101**

This course gives insights on molecular effusion, imperfect gases, collision between molecules, viscosity of gases and kinetic theory of gas viscosity, thermal conductivity of gases, Avogadro's number, molecular dimensions and barometric formula, Boltzmann and Maxwell distribution laws, velocity distribution in three dimensions, equilibration of energy, entropy and probability.

Crystallography and x-rays **Code: PH2191 (2)**

This course concerns with origin, generation sources and types of detectors X-rays, diffraction of X-rays (Bragg's law, lattice plans and indices), symmetry operation and space groups, crystal systems and symmetry elements, point groups and non-primitive lattice, calculation of structure factors and Fourier syntheses.

Principles of Analytical Chemistry Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Elements Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Principles of organic chemistry (1) Code: CH2109, (2+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided.

Principles of organic chemistry (2) Code: CH2111, (2) Pre-request: CH1202

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Chemical Kinetics Code: CH2202 (2) Prerequisite: CH2101

This course explains the concepts of chemical kinetics, reaction rate, molecularity and reaction order, factors affecting reaction rates, integrated rate equations (first, second, third and pseudo-order reactions), effect of temperature on reaction rate and Arrhenius equation, activation energy, applications to simple and complex reactions, collision and transition state theories, concepts and theories of catalysis as well as its types and applications.

Chemistry of Transition Elements Code: CH2204 (2) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is

placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Instrumental Analysis (1) Code: CH2206 (2+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Phase Rule Code: CH 2208 (2) Prerequisite: CH 1202

The course discusses the basic concepts and derivation of phase rule, one-component system (water system, carbon dioxide system, sulfur system), two-components systems, liquid-liquid and liquid-vapor equilibria (completely miscible, partially miscible and immiscible liquids), solid-liquid equilibria and eutectic systems, congruent, peritectic and solid solutions, three components systems and salting out.

Nuclear Chemistry Code: CH 2210 (1) Prerequisite: CH 1202

This course will provide the fundamentals of nuclear chemistry including; nuclear structure, nuclear models (Fermi gas, liquid drop and nuclear shell models), isotopes (effects, separation and properties). Radioactivity and radioactive decay (modes, kinetics and mechanisms), nuclear reactions (fission and fusion) and isotopes chemistry, differences between nuclear fission and fusion are studied. Applications of radioactive decay in dating and radioactive materials/isotopes in radio-labeling, processing and environmental issues are given.

Stereochemistry Code: CH 2212 (2) Prerequisite: CH 2109

The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis.

Organic chemistry (3) Code: CH 2214 (2+1) Prerequisite: CH 2109

This is a study of the properties and reactivity of carbon compounds containing more than one functional e.g. dienes, unsaturated alcohols, unsaturated carbonyl compounds and acids, compounds containing active methylene groups, in addition to the chemistry of saturated and unsaturated cyclic and acyclic compounds.

Organic chemistry (4) Code: CH 2216 (2+1) Prerequisite: CH 2111

This course provide a study of mechanistic aspects of organic reactions including the rate and kinetic concepts, use of isotopes with emphasize on the nucleophilic substitution reactions of aliphatic compounds, elimination reactions (including stereoselectivity and orientation), addition reactions, reactivity of aromatic

compounds towards electrophilic and nucleophilic reactions, in addition to some examples of rearrangement reaction.

Quantum Chemistry **Code: CH 3101 (2) Prerequisite: CH 1202**

This is introductory quantum chemistry with an emphasis on the fundamentals of quantum mechanics, potential well, hydrogen atom, many-electron atoms, Hartree-Fock approximation, diatomic molecules, neutral molecules, application of quantum mechanics to solve problems in chemistry, investigation of electronic structures of atoms, molecules, compounds, and explanation of reaction mechanism, spectroscopy and molecular structures.

Surface Chemistry and Catalysis **Code: CH 3103 (2) Prerequisite: CH 2202**

Introduction to surface and colloid chemistry with emphasize on types and properties of interfaces (liquid-gas, liquid-liquid, gas-solid and solid-liquid), adsorption of gases and adsorption from solution, properties and types of colloid including classification and preparation, electrical aspects of surface chemistry and stability of colloid, emulsions and micellar solutions, applications in biological and technological processes. Theories of catalysis, homogeneous and heterogeneous catalysis as well as enzyme catalyzed reactions are discussed.

Electrochemistry (1) **Code: CH 3105 (2+1) Prerequisite: CH 2204**

This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernst equation and standard electrode potential, activity series, concentration cells, types of electrodes (gas-electrodes, metal/metal oxide-electrodes, amalgam-electrodes and glass-electrode), batteries and accumulators, fuel cells (principles, modes of action and types).

Photochemistry **Code: CH 3107 (1) Prerequisite: CH 2202**

This course discusses the electronic transitions and selection rules, electronically excited states, photophysical and photochemical pathways following electronic excitation, fluorescence lifetime and quantum yield, types of fluorescence, fluorescence quenching, electronic states of molecular oxygen, kinetic rate constants of excited state processes, photochemical reaction and photosensitization.

Instrumental analysis (2) **Code: CH 3109 (2+1) Prerequisite: CH2206**

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Chemistry of heterocyclic compounds Code: CH 3111 (2+1) Prerequisite: CH2214
This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of heteroatoms N, O and S, and condensed systems containing such rings.

Physical organic chemistry Code: CH 3113 (1+1) Prerequisite: CH2214
This course provides a study of chemical structure and reactivity correlation, Hammett equation including the physical significance of σ - and ρ -values as well as applications, limitation and deviation of Hammett plots, neighboring group participation in nucleophilic and displacement reactions, in addition to studying the chemistry of reactive intermediates, precyclic reactions and aromaticity.

Petroleum chemistry and petrochemicals Code: CH 3115 (1) Prerequisite: CH2109, CH2111
This course provides general idea about the importance, occurrence and origin of petroleum, composition and specifications of crude petroleum and its products as well as some physical aspects concerning petroleum fuels, manufacturing processes, oil refinery and separation processes, production of motor and jet fuels, cracking, reforming, isomerisation, refining and treating processing, petrochemical industries and petrochemistry in everyday life.

Molecular spectroscopy Code: CH 3202 (2) Prerequisite: CH 3101
This course provides discussion for electromagnetic radiations and interactions between light and matter, theoretical bases of resonance spectroscopy, rotational spectra of diatomic molecules, IR- spectroscopy, vibration of diatomic vibrating rotary, Raman spectroscopy, electronic absorption spectroscopy of atoms, diatomic and polyatomic molecules as well as applications of spectroscopy to structural investigations.

Molecular reaction dynamics Code: CH3204 (1) Prerequisite: CH 2202
This course will provide understanding of chemical reactions at the molecular level, origin of Arrhenius equation and potential – energy surfaces, kinetics theory of collisions and statistical mechanics of chemical equilibrium. thermodynamical formulation of reaction rates and classification of complex reactions. Autocatalytic reactions, influence of pressure on rates in solutions and deduction of reaction mechanisms, collision dynamics, and dynamics in the condensed phase as well as dynamics of gas–surface reactions.

Electrochemistry (2) Code: CH 3206 (2+1) Prerequisite: CH 3105
This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernst-Planck equation, Faradic and non Faradic processes, the ideal and non ideal polarized electrodes, electrical double layer, factors affecting rates of electrode reactions, over potential polarization, mass

transfer, Butler-Volmer and Tafel equations, more complex electrode reactions, Depolarography and cyclic voltammetry (theory and applications), basis of electrochemical corrosion (theory, polarization resistance and calculation of the corrosion rate).

Solid State Chemistry **Code: CH3208 (1) Prerequisite: CH 1101**

This course provides the bases of crystallography, polymorphism in solids, defects in solids, the exciton concept, intermediate states of solids, amorphous materials, liquid crystals, nanomaterials, band theory of electronic structure, semiconductors, photovoltaic devices and techniques in solid state chemistry.

Coordination Chemistry **Code: CH 3210 (2+1) Prerequisite: CH 2204**

This course explains nomenclature of coordination compounds, structure, bonding, properties, and reactivity of coordination compounds. Topics include theories of metal-ligand bonding (crystal field theory and molecular orbital theory), electronic spectra, detection and structural determination of complexes, isomerism among inorganic complexes and stability of complexes, biological and industrial applications of coordination compounds.

Organometallic Chemistry **Code: CH 3212 (2) Prerequisite: CH 2204**

The course focuses on the nature, bonding, structure and reactivity of organometallic compounds including; alkyl and alkene complexes as well as complexes containing delocalized cyclic systems. Attention is also given to the synthesis and applications of organometallic compounds in industrial, biological and organic syntheses.

Organic spectroscopy **Code: CH 3214 (2+1) Prerequisite: CH 2206, CH2216**

This is a study of modern spectroscopic techniques used in the determination of molecular structure with emphasize on the interpretation of spectra including nuclear magnetic resonance, ultraviolet, infrared and mass spectroscopy.

Chemistry of natural products **Code: CH 3216 (2+1) Prerequisite: CH 2212**

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Practical physical chemistry (1)

Code: CH4101 (2), Prerequisite CH2202, CH3109, CH3206

This course is designed to reinforce the application of theoretical physical concepts into an experimental framework. Several experiments will cover different physical chemistry topics ranging from kinetics, thermodynamics, and surface chemistry to electrochemistry and spectroscopy as well as measuring of molecular parameters. Analysis of collected experimental data includes statistical error analysis and

estimation of uncertainties, writing reports, oral presentation, students will have the chance to work in groups to acquire skills of team.

Practical organic chemistry (1) Code: CH4103 (2), Prerequisite CH2109

This serves as a laboratory course with emphasis on the techniques associated with the synthesis, isolation, purification and identification of organic compounds by physical properties, IR and NMR spectral analyses.

Polymer chemistry Code: CH4105 (1), Prerequisite CH2109

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Biochemistry (1) Code: CH4107 (1), Prerequisite CH3216

This course covers the chemistry and functions of the constituents of living cells including carbohydrates, proteins, lipids, nucleic acids, vitamins, enzymes and coenzymes, enzymatic catalysis, metabolism of carbohydrates, proteins, lipids and nucleic acids with special attention to interrelationships in metabolic rates of these important constituents of living cells.

Essay & Research Code: CH4109 (2)

This course is designed to give students the chance to work on a special project to demonstrate their critical scientific thinking skills by reviewing literature, designing experiment, writing report in the format of mini-review or journal paper, and presenting a poster in verbal scientific language.

Statistical thermodynamics Code: CH4111 (1) Prerequisite: CH 2101

This course will provide an introduction to the probabilistic nature of physical chemistry, calculation of partition functions for simplified models of actual systems, derivation of thermodynamic quantities in terms of partition functions and applications to relevant systems.

Laser chemistry Code: CH4113 (1) Prerequisite: CH 3107

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry of glass and ceramics Code: CH4115 (1) Prerequisite: CH 3208

This is an introduction to materials science and concerns with ceramic raw materials, their beneficiation and characterization, crystal structure of ceramics and

glasses, structural defects and types of ceramics and glasses as well as their fabrication technology, properties of ceramic and glass materials (mechanical, thermal, electrical, optical, magnetic and chemical), ceramic composites and cements.

Bioinorganic Chemistry **Code: CH 4117 (2) Prerequisite: CH 2204**

This course will provide an introduction and overview of metals in biology with emphasize on the structure, reactivity and reactions of biological molecules (metalloproteins, enzymes, hemoglobin, myoglobin, hemerythrin and cytochromes) from an inorganic prospective. The importance of these is discussed in regard to drug design and understanding of diseases resulting from mutations.

Chemistry of pesticides **Code: CH 4119 (1) Prerequisite: CH 2111, CH2109**

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Textile chemistry **Code: CH 4121 (1) Prerequisite: CH 3216**

This course provide the fundamentals of textile fibers including fiber structure, properties, identification, classification (cellulose, cotton flax, hemp jute-man-made, rayon acetate and triacetate protein, wool and silk mineral fibers) man made fibers, processing of textiles (purification and preliminary singeing, designing, scouring, bleaching and mercerizing dyeing) and kinds of forces by which dye molecules are bound to the fiber.

Industrial chemistry **Code: CH4123 (2) Prerequisite: CH3109, CH2204, CH3115**

This will provide an overview of the chemical, biochemical and pharmaceutical industries, the principal processes, scale-up of laboratory methods, modeling of processes, economic factors, automation, data management, quality assurance, safety and project development. The course surveys areas as metallurgy, production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied

Selected topics in organic chemistry **Code: CH 4125 (2) Prerequisite: CH2216**

This is a study of advanced topics in organic chemistry such as stereochemistry, conformational analysis, nonbenzenoid, aromaticity, molecular orbital theory, and organic reaction mechanisms, applications of these concepts to the structure and reactivity of biomolecules such as peptides and proteins, nucleic acids, and carbohydrates. A course in a specific area of organic chemistry such as structure

determination in organic chemistry, or current research subject not covered in regularly scheduled courses presented to fit the interests of advanced students.

Water treatment Code: CH4127 (1) Prerequisite: CH2105, CH3109

This will provide an overview on the sources of water (ground water, upland lakes, rivers, canals and low land reservoirs, rainwater, atmospheric water, desalination of sea-water), importance of water in life, water cycle, types of water to be treated as well as the types of contaminants to be treated and methods of water treatment including; ultraviolet light, filtration, water softening, reverse osmosis, ultra-filtration, deionization and powdered activated carbon treatment.

Practical physical chemistry (2) Code: CH4202 (2), Prerequisite CH4101

This course is continuation of CH4101.

Practical organic chemistry (2) Code: CH4204 (2), Prerequisite CH4103

Synthesis and identification of various organic compounds.

Instrumental Analysis (3) Code: CH 4206 (2) Prerequisite: CH 3109

This course discuss in details the theoretical bases, validity, design and applications of the electrochemical techniques in chemical analysis such as potentiometry and ion-selective electrodes, polarographic and voltammetric techniques, amperometric titrations, coulometry, electrogravimetry and conductometric methods.

Dyes chemistry Code: CH 4208 (1) Prerequisite: CH 2111, CH2109

This course offers correlation of color and chemical constitution, synthetic routes for popular dyes of important types, electronic mechanisms for reactive dyes, chemistry of dye interactions with light, washing and other in-use influences, economic and environmental considerations, classification of dyes (nitroso, nitro, azo, triarylmethane, xanthane, vat, indigo, anthraquinone and reactive dyes), mechanisms of dyeing, basis of modern techniques for color specification, measurement, control, applications of color science to textiles, plastics, and color reproduction.

Physical chemistry of polymers Code: CH 4212 (2) Prerequisite: CH 4105

This course studies the methods of molecular weight determination (chemical, physical and molecular weight distribution), the effect of chemical structure (molecular shape, backbone structure, polarity, presence of bulky substituents and cross linking) on physical properties of polymers (chain flexibility, crystallinity, solubility, mechanical properties and thermal behavior). In addition some techniques for polymer processing are going to be discussed along with their technological applications.

Computational Chemistry Code: CH4214 (1) Prerequisite: CH3101

Molecular modeling including quantum mechanics and molecular mechanics methods; molecular dynamics, simulation methods, computer handling of chemical

structures; substructure and similarity methods, qualitative and quantitative structure-activity; structure-based drug design; artificial intelligence methods.

Inorganic reactions mechanism **Code: CH4216 (2) Prerequisite: CH3210**

The course provides an introduction to inorganic reaction mechanisms, with emphasis on kinetics and mechanism of substitution reactions of square planar metal complexes, cis and trans effects, trans influence, substitution of octahedral metal complexes, solvolysis reactions, electron transfer reactions, outer sphere reactions, cross reactions and inner sphere reactions.

Supramolecular chemistry **Code: CH4218 (1) Prerequisite: CH3212, CH4105**

This course is an introduction to supramolecular chemistry with emphasize on definitions, supramolecular interactions, supramolecular design, host-guest chemistry, self-assembly, macrocyclic hosts, cation and anion binding, coordination polymers, supramolecular chemistry, crystal engineering, self-assembled monolayers (SAMs), fullerenes and nanotubes, dendrimers, fibres, gels and polymers, applications of supramolecular chemistry in molecular devices and life.

Advanced analytical chemistry **Code: CH4220 (2) Prerequisite: CH2109, CH3109**

This subject covers technical aspects and applications of major analytical separation methods and spectroscopy for qualitative and quantitative analysis. These methods include high performance liquid chromatography (HPLC), supercritical fluid extraction and chromatography (SFE/SFC), ion chromatography (IC), and capillary electrophoresis (CE). The spectroscopic methods include atomic absorption spectroscopy (AAS) and atomic emission spectroscopy (AES), inductively-coupled plasma spectroscopy (ICP), ICP coupled with mass spectrometry (ICP-MS). Advances in the analytical methods concerning biosensors and fast techniques are also discussed.

Applied polymer science **Code: CH4222 (2) Prerequisite: CH4105,**

This course emphasizes on the synthesis, properties and industrial processes of products of poly(olefins), poly(vinyl chloride), poly(vinyl acetate), poly(urethanes), epoxies, silicones, styrene copolymers used as textile finishes, nonwoven binders, fabric coatings, composites, adhesives, foams, carpet backing adhesives.

Environmental Chemistry **Code: CH 4224 (1) Prerequisite: CH3109**

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given.

Forensic and criminal chemistry **Code: CH4226 (1) Prerequisite: CH3109**

This course is an introduction to the use of science and the scientific method in law and criminal justice, with detailed examination of the techniques of forensic

chemistry including organic, inorganic, and instrumental analysis. Topics include gunshot residue, drugs and toxicology, paint, arson and explosives, and biochemical methods such as electrophoresis, quality assurance, courtroom testimony, laboratory accreditation, and analyst certification will be discussed.

Analytical biochemistry

Code: CH4228 (1) Prerequisite: CH4107

Introduction to biostudies including characterization and quantitative analysis of biomolecules by using various analytical methods including biosensor, electrophoresis, mass spectrometry, fluoro immunoassays, stripping voltametry, blood gas analysis, cell counting, automatic analyzers.

Chemistry of nucleic acids

Code: CH4230 (1) Prerequisite: CH3216, CH4107

The course examines the bioorganic chemistry of nucleic acids, including DNA and RNA structures, molecular recognition, and mechanistic analyses of covalent modification of nucleic acids. Topics include synthetic methods for the construction of DNA and RNA; separation techniques; recognition of duplex DNA by peptide analogs, proteins, and oligonucleotide-directed triple helical formation, RNA structure and RNA as catalysts.

Solutions chemistry

Code: CH4232 (1) Prerequisite: CH1202, CH2202

This course describes the quantitative approach of physical chemistry in liquid solutions with emphasized on the role of solvent effect. The topics include studies of the dielectric, spectroscopic, thermodynamic, transport or relaxation properties of both electrolytes and nonelectrolytes in liquid solutions.



Program title **Biochemistry**

Program type **Special**

Department(s) **Chemistry**

Chemical Thermodynamics: **Code: CH2141 (2) Pre-request: CH1202**

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Principles of Analytical Chemistry **Code: CH2105, (1+1) Pre-request: CH1202**

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Elements **Code: CH2107 (2) Prerequisite: CH1101**

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Principles of organic chemistry (1) Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided.

Principles of organic chemistry (2) Code: CH2111, (2) Pre-request: CH1202

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Organic chemistry (3) Code: CH 2214 (2+1) Prerequisite: CH 2109

This is a study of the properties and reactivity of carbon compounds containing more than one functional e.g. dienes, unsaturated alcohols, unsaturated carbonyl compounds and acids, compounds containing active methylene groups, in addition to the chemistry of saturated and unsaturated cyclic and acyclic compounds.

Chemical Kinetics Code: CH2240 (1+1) Prerequisite: CH2141

This course explains the concepts of chemical kinetics, reaction rate, molecularity and reaction order, factors affecting reaction rates, integrated rate equations (first, second, third and pseudo-order reactions), effect of temperature on reaction rate and Arrhenius equation, activation energy, applications to simple and complex reactions, collision and transition state theories, concepts and theories of catalysis as well as its types and applications.

Kinetic Theory of Gases Code: CH 2242 (1) Prerequisite: CH 1101

This course gives insights on molecular effusion, imperfect gases, collision between molecules, viscosity of gases and kinetic theory of gas viscosity, thermal conductivity of gases, Avogadro's number, molecular dimensions and barometric formula, Boltzmann and Maxwell distribution laws, velocity distribution in three dimensions, equilibration of energy, entropy and probability.

Instrumental Analysis (1) Code: CH2244 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Stereochemistry Code: CH 2246 (1) Prerequisite: CH 2109

The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis

Principal of Biochemistry (1)

Code: BC2202 (2) Prerequisite: CH2111, CH2109

Carbohydrate classification, derivatives and reactions, Lipid classification biological membrane and lipoprotein

Principal of Biochemistry (2)

Code: BC2204 (2+1) Prerequisite CH2111, CH2109.

Introduction to acids, bases and buffers, Amino acids and proteins: classification and characteristics, nucleic acids, chemical structure of nitrogen bases, Chemical and 3-D structures of DNA.

Surface Chemistry and Catalysis Code: CH 3143 (1) Prerequisite: CH 2240

Introduction to surface and colloid chemistry with emphasize on types and properties of interfaces (liquid-gas, liquid-liquid, gas-solid and solid-liquid), adsorption of gases and adsorption from solution, properties and types of colloid including classification and preparation, electrical aspects of surface chemistry and stability of colloid, emulsions and micellar solutions, applications in biological and technological processes. Theories of catalysis, homogeneous and heterogeneous catalysis as well as enzyme catalyzed reactions are discussed.

Electrochemistry (1) Code: CH 3145 (1) Prerequisite: CH 1202

This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernst equation and standard electrode potential, activity series, concentration cells, types of electrodes (gas-electrodes, metal/metal oxide-electrodes, amalgam-electrodes and glass-electrode), batteries and accumulators, fuel cells (principles, modes of action and types).

Chemistry of Transition Elements Code: CH3147 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Instrumental analysis (2) Code: CH 3149 (1+1) Prerequisite: CH2244

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column,

ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Heterocyclic Chemistry Code: CH 3153 (1+1) Prerequisite: CH2246

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings.

Carbohydrates and lipids metabolism

Code: BC3101 Credit (2+1): Prerequisite BC2202, BC2204

Digestion and absorption of carbohydrate. Catabolism of carbohydrate : glycolysis, TCA cycle, pentose phosphate pathway, glycogenolysis. Anabolism of carbohydrate Glucogenesis, glycogenesis. Metabolism of fructose, galactose, lactose. Digestion of lipids. Catabolism of Fatty acids: Fatty acid oxidation. Anabolism of fatty acids: fatty acids synthesis.

Amino acids and protein metabolism

Code: BC3103 (2+1): Prerequisite BC2202, BC2204

Introduction to metabolism Protein turnover. Catabolism of the carbon skeletons of amino acids. Biosynthesis of non-essential amino acids Biosynthesis of amino acid derived compounds Protein synthesis. Urea cycle, physiologically active amine (seratonine, histamine)

Nucleic acids metabolism

Code: BC3105 (1+1): Prerequisite: BC2202, BC2204

Chemistry of nucleosides and nucleotides. Metabolism of purines and pyrimidines, nucleosides and nucleotides; Abnormalities in nucleic acid metabolism; Xeroderma pigmentation and skin cancer.

Vitamins and inorganic metabolism

Code: BC3107 (2): Prerequisite BC2202, BC2204

Definition, importance and classification of vitamins. Fat soluble vitamin, Chemistry, absorption, occurrence, physiological roles, deficiency. Water soluble vitamin (C, B- complexes) Chemistry, absorption, occurrence, physiological roles, deficiency. Heterocyclic. Water and inorganic elements as sodium, potassium, calcium,, iron, phosphorus and trace elements metabolism.

Coordination Chemistry **Code: CH 3246 (1) Prerequisite: CH 3147**

This course explains nomenclature of coordination compounds, structure, bonding, properties, and reactivity of coordination compounds. Topics include theories of metal-ligand bonding (crystal field theory and molecular orbital theory), electronic spectra, detection and structural determination of complexes, isomerism among inorganic complexes and stability of complexes, biological and industrial applications of coordination compounds.

Natural products **Code: CH 3250 (1+1) Prerequisite: CH 2246**

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D...) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Instrumental Analysis (3) **Code: CH 3252 (2) Prerequisite: CH 3149**

This course discuss in details the theoretical bases, validity, design and applications of the electrochemical techniques in chemical analysis such as potentiometry and ion-selective electrodes, polarographic and voltammetric techniques, amperometric titrations, coulometry, electrogravimetry and conductometric methods.

Enzymology (1) **Code: BC3202 Credit (2+1) Prerequisite BC3101, BC3103**

Definition of enzymes, importance, classification. Kinetics of enzymes: activation energy, Km value, types of inhibition, Reaction with more than one substrate. RNA enzymes.

Body fluids and biological functions *Code: BC3204 (2) Prerequisite BC3103*

Compositions and functions of blood, blood volume, haemopoiesis, haemostasis, abnormal haemoglobins. Heart and circulation Essentials of the physiology of respiration, metabolic rate, respiratory acidosis and alkalosis. Digestive sections; their compositions, functions and control mechanisms of the Alimentary canal. Fluid compartments of the body. Functions of the kidney and urine formation, thirst mechanisms. Water, electrolyte and acid regulation. Buffer mechanisms. Clearance studies.

Hormones **Code: BC3206 (2) Prerequisite: BC3103**

Definition of Hormones. Classification of hormones. Hypothalamus hormones. Pituitary (anterior and posterior) Hormones. Thyroid Hormones, Parathyroid Hormones. Adrenal (cortex and medulla) Hormones. Steroid Hormones and pineal hormones. Pancreatic hormones.

Molecular Biology **Code: BC3208 (2) Prerequisite: BC3105**
Occurrence of Nucleic acid and nucleoproteins. DNA, RNA Structures. Nature of genetic information and storage of genetic information. Transcription and translation. Regulation of gene expression. DNA mutation

Practical biochemistry (1) **Code: BC3210 (2) Prerequisite: BC2202, BC2204**

Biological separation **Code: BC3212 (1) Prerequisite BC3103**
Determination of macromolecules. Separation of macromolecules by different methods chromatography, electrophoresis, Ultracentrifugation. Molecular weight determination.

ST 3202: Biostatistics

This course is designed to introduce the student to data analytic and applied statistical methods commonly used in industrial and scientific applications. The module will focus on computer-aided data analysis using comparisons between batches, analysis of variance, regression and correlation. The module will also deal with estimation and hypothesis testing, multivariate analysis, and nonparametric techniques. Approximations and errors (accuracy and precision; errors; blunders, formulation error, and data uncertainty).

Practical biochemistry (2) **Code: BC4101 Credit (2) Prerequisite BC3210**

Genetic engineering **Code: BC4103 (2) Prerequisite BC3208**
Introduction, Tools of cloning: Cloning vectors Restriction enzymes DNA Ligase and Kinases Hosting bacterial cells Basic steps of gene cloning: Vector and insert preparation-ligation-transformation-screening. Types of Cloning Library construction Genomic library cDNA library Chromosomal library Production of recombinant proteins by cloning Mutagenesis Transgenic animals Transgenic crops Cloning of mammals Gene silencing

Clinical Biochemistry **Code: BC4105 (1) Prerequisite BC3204. BC3206**
Biochemical mechanisms for controlling different pathways under different physiological and nutritional conditions and the importance of diseases arising from defects in these pathways. Particular emphasis will be placed upon the aetiology, symptoms and treatment of diseases such as Type I and II diabetes mellitus; atherosclerosis and other lipid disorders and inborn errors of carbohydrate and amino metabolism.

Immunology **Code: BC4107 (2) Prerequisite BC3103**
Introduction to immunology, Immunogen and antigen, antibody structure and classes, Complement and its biological function, Immunological cell system, Immunological cell system, Organs of immune response, Hypersensitivity, Autoimmunity, Antigen antibodies interactions, Monoclonal antibodies

Neurochemistry **Code: BC4111 Credit (2) Prerequisite BC3206**
Control of water balance, control of body temperature, control of feeding behaviour. Neurohypophysis, Neurohormones, brain hormones. Neuroendocrine pathology.

Enzymology (2) **Code: BC4113 (1) Prerequisite: BC3202**
Enzyme Specificity. Mechanism of enzyme specificity: Tryptophane, proteases and other examples. Allosteric enzymes. Regulation of enzymes. Isoenzymes. Immobilization of enzymes

Drug metabolism **Code: BC4115 Credit (1) Prerequisite BC3101, BC3103**
Pharmatokinetics of drugs: absorption, distribution, metabolism, storage and excretion. Phase I and phase II reactions. The role of mixed functionof cytochrome P450 in drugs metabolism. Other factors effect to the drugs.

Biological oxidation **Code: BC4117 (1) Prerequisite BC3101**
Types of energy, its conversion and transfer in biosystem. Energy transducers. Laws governg energy transfer and utilization. Anatomy of mitochondria. Molecular structure of ATPase synthase. Mitochondrial disfunction and disease.

Biotechnology (1) **Code: BC4119 (2) Prerequisite BC3206**
The chemostat and its application in industrial fermentations alcoholic, amino acids, antibiotics, and other secondary metabolites. Primary and secondary metabolism

Toxicology **Code: BC4121 Credit (1) Prerequisite BC3204**
Basis concepts in toxicology, history and branches , dose –response curves, statistically defined expression in toxicology, classification of toxicants and their mode of action, mutagens, and carcinogen, phytotoxins, zootoxin and environmental toxicants.

Biological membrane **Code: BC4123 Credit (1) Prerequisite BC3204**
Biochemical structure of membrane; comparison between animal and plant membrane; gap junction, mechanism of transportation of micro and macromolecule transport.

Physical biochemistry **Code: BC4125 Credit (1) Prerequisite BC3212**
Physical properties of acid and base buffer. Physical chemistry of protein and amino acids. Blood buffering action. Biological membranes. Determination of macromolecules.

Practical Biochemistry (3) **Code: BC4202 Credit (2) Prerequisite BC4101**

Cancer biology **Code: BC4204Credit (2) Prerequisite BC3206**

Definition, Nature of cancer, some terms frequently applied in cancer. Cancer metabolism. Cell cycle and apoptosis. Host tumor-relationship. Diagnosis and treatment of cancer

Genetic engineering and gene therapy Code: BC4206Credit (2) Prerequisite BC4103

Understanding of cell proliferation and differentiation, analysis, metamorphosis, and communication between cells will also be developed. Production of hormones as insulin by gene manipulation. Treatment by gene therapy.

Biotechnology (2) Code: BC4210Credit (2) Prerequisite BC4103

The course explores the applications of biotechnology, its products and processes. It examines the mechanisms through which biotechnology is commercialised, such as university-industry links, spin-off firms and corporate alliances. The role of regulatory and ethical debates in the development of biotechnology is also explored.

Bioinformatics Code: BC4212Credit (2) Prerequisite BC4103

The course includes: application of computer in nucleic acid and protein sequences, analysis of mass protein fragments.

Disturbance metabolism Code: BC4214Credit (1) Prerequisite BC4105

Regulation of Carbohydrate, Lipid and protein. Hormonal action of metabolic control. Regulation of metabolism in starvation and obesity.

Conversion and dangerous nutrition

Code: BC4216Credit (1) Prerequisite BC4105

An overview of nutrition, food choice and diet planning diets, diet and health, functional foods, antioxidants, food drugs interactions, genetically modified food.

Signal transduction Code: BC4218Credit (2) Prerequisite BC3206

The roles of membrane in signaling pathways, including the activities of a Kinase. Examines the nature and conservation of families of multivalent protein binding modules, which combine to create many discrete signaling pathways. Adds a new discussion of signaling in plants and bacteria, with comparison to mammalian signaling pathways.

Microbial biochemistry Code: BC4220Credit (1) Prerequisite BC4119

Short review of microbial physiology and genetics; a review of general pathways, control and application industrial processes; Continuous culture methods; principles and applications; The chemostat and its application in industrial fermentations. Primary and secondary metabolism

Environmental biochemistry **Code: BC4222Credit (1) Prerequisite BC4121**
Effects of trace element and pollution. carcinogen, phytotoxins, zootoxin and environmental toxicants. Food drug interactions. Relation between cancer and pollution.

Tissue chemistry **Code: BC4224Credit (1) Prerequisite BC3204**
Mechanism of Collagen , elistin, fibrin and fibronectin proteoglycans in extracellular matrix. Role of bone as mineralized connective tissue. Many metabolic and genetic disorders involve bone. . muscle transductionactin and myosin as the major protein of muscle. Actin based regulation occurs in straiated muscles

BP 4292 Radiobiology (1)

Types of radiation, electromagnetic radiation, radiation detection, radiation units, radiation hazard, effect of radiation on water, effect of radiation on proteins, effect of radiation on lipids, effect of radiation on enzymes, effect of radiation on DNA.



B.Sc. Chemistry / Biochemistry

Program title **Chemistry / Biochemistry**

Program type **General Degree**

Department(s) **Chemistry**

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Chemistry of Main Group Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Principles of organic chemistry (2)

Code: CH2111, (2) Pre-request: CH1202

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Chemical Thermodynamics:

Code: CH2141 (2) Pre-request: CH1202

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided.

Organic chemistry (3)

Code: CH 2214 (2+1) Prerequisite: CH 2143

This is a study of the properties and reactivity of carbon compounds containing more than one functional e.g. dienes, unsaturated alcohols, unsaturated carbonyl compounds and acids, compounds containing active methylene groups, in addition to the chemistry of saturated and unsaturated cyclic and acyclic compounds.

Chemical Kinetics

Code: CH2240 (1+1) Prerequisite: CH 2141

This course explains the concepts of chemical kinetics, reaction rate, molecularity and reaction order, factors affecting reaction rates, integrated rate equations (first, second, third and pseudo-order reactions), effect of temperature on reaction rate and Arrhenius equation, activation energy, applications to simple and complex reactions, collision and transition state theories, concepts and theories of catalysis as well as its types and applications.

Kinetic Theory of Gases

Code: CH 2242 (1) Prerequisite: CH 1101

This course gives insights on molecular effusion, imperfect gases, collision between molecules, viscosity of gases and kinetic theory of gas viscosity, thermal conductivity of gases, Avogadro's number, molecular dimensions and barometric formula, Boltzmann and Maxwell distribution laws, velocity distribution in three dimensions, equilibration of energy, entropy and probability.

Instrumental Analysis (1)

Code: CH2244 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption

spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Stereochemistry

Code: CH 2246 (1) Prerequisite: CH 2143

The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis

Principal of Biochemistry (1)

Code: BC2202 (2+0) Prerequisite CH2111, CH2109

Carbohydrate classification, derivatives and reactions, Lipid classification biological membrane and lipoprotein

Principal of Biochemistry (2)

Code: BC2204 (2+1) Prerequisite CH2111, CH2109.

Introduction to acids, bases and buffers, Amino acids and proteins: classification and characteristics, nucleic acids, chemical structure of nitrogen bases, Chemical and 3-D structures of DNA.

Quantum Chemistry

Code: CH 3141 (1) Prerequisite: CH 1202

This is introductory quantum chemistry with an emphasis on the fundamentals of quantum mechanics, potential well, hydrogen atom, many-electron atoms, Hartree-Fock approximation, diatomic molecules, neutral molecules, application of quantum mechanics to solve problems in chemistry, investigation of electronic structures of atoms, molecules, compounds, and explanation of reaction mechanism, spectroscopy and molecular structures.

Surface Chemistry and Catalysis

Code: CH 3143 (1) Prerequisite: CH 2240

Introduction to surface and colloid chemistry with emphasize on types and properties of interfaces (liquid-gas, liquid-liquid, gas-solid and solid-liquid), adsorption of gases and adsorption from solution, properties and types of colloid including classification and preparation, electrical aspects of surface chemistry and stability of colloid, emulsions and micellar solutions, applications in biological and technological processes. Theories of catalysis, homogeneous and heterogeneous catalysis as well as enzyme catalyzed reactions are discussed.

Electrochemistry (1)

Code: CH 3145 (1) Prerequisite: CH 1202

This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernst

equation and standard electrode potential, activity series, concentration cells, types of electrodes (gas-electrodes, metal/metal oxide-electrodes, amalgam-electrodes and glass-electrode), batteries and accumulators, fuel cells (principles, modes of action and types).

Chemistry of Transition Elements

Code: CH3147 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Instrumental analysis (2)

Code: CH 3149 (1+1) Prerequisite: CH2244

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Physical organic chemistry

Code: CH 3151 (1) Prerequisite: CH2111, CH2143

This course provide a study of chemical structure and reactivity correlation, Hammett equation including the physical significance of σ - and ρ -values as well as applications, limitation and deviation of Hammett plots, neighboring group participation in nucleophilic and displacement reactions, in addition to studying the chemistry of reactive intermediates, precyclic reactions and aromaticity.

Heterocyclic Chemistry

Code: CH 3153 (1+1) Prerequisite: CH 2143

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings

Carbohydrates and lipids metabolism

Code: BC3101 Credit (2+1): Prerequisite BC2202, BC2204

Digestion and absorption of carbohydrate. Catabolism of carbohydrate : gcolysis, TCA cycle, pentose phosphate pathway, glycogenolysis. Anabolism of

carbohydrate Glucogenesis, glycogenesis. Metabolism of fructose, galactose, lactose. Digestion of lipids. Catabolism of Fatty acids: Fatty acid oxidation. Anabolism of fatty acids: fatty acids synthesis.

Amino acids and protein metabolism

Code: BC3103 Credit (2+1): Prerequisite BC2202, BC2204

Introduction to metabolism Protein turnover. Catabolism of the carbon skeletons of amino acids. Biosynthesis of non-essential amino acids Biosynthesis of amino acid derived compounds Protein synthesis. Urea cycle, physiologically active amine (seratonine, histamine)

Nucleic acids metabolism

Code: BC3109 (1): Prerequisite BC2202, BC2204

Chemistry of nucleosides and nucleotides. Metabolism of purines and pyrimidines, nucleosides and nucleotides; Abnormalities in nucleic acid metabolism; Xeroderma pigmentation and skin cancer.

Vitamins and inorganic metabolism

Code: BC3111 (1): Prerequisite BC2202, BC2204

Definition, importance and classification of vitamins. Fat soluble vitamin, Chemistry, absorption, occurrence, physiological roles, deficiency. Water soluble vitamin (C, B- complexes) Chemistry, absorption, occurrence, physiological roles, deficiency. Heterocyclic. Water and inorganic elements as sodium, potassium, calcium, iron, phosphorus and trace elements metabolism.

Molecular spectroscopy

Code: CH 3240 (1) Prerequisite: CH 3141

This course provides discussion for electromagnetic radiations and interactions between light and matter, theoretical bases of resonance spectroscopy, rotational spectra of diatomic molecules, IR- spectroscopy, vibration of diatomic vibrating rotary, Raman spectroscopy, electronic absorption spectroscopy of atoms, diatomic and polyatomic molecules as well as applications of spectroscopy to structural investigations.

Electrochemistry (2)

Code: CH 3242 (1+1) Prerequisite: CH 3145

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernst-Planck equation, Faradic and non Faradic processes, the ideal and non ideal polarized electrodes, electrical double layer, factors affecting rates of electrode reactions, over potential polarization, mass transfer, Butler-Volmer and Tafel equations, more complex electrode reactions, Dc-polarography and cyclic voltammetry (theory and applications), basis of

electrochemical corrosion (theory, polarization resistance and calculation of the corrosion rate).

Photochemistry

Code: CH 3244 (1) Prerequisite: CH 2240

This course discusses the electronic transitions and selection rules, electronically excited states, photophysical and photochemical pathways following electronic excitation, fluorescence lifetime and quantum yield, types of fluorescence, fluorescence quenching, electronic states of molecular oxygen, kinetic rate constants of excited state processes, photochemical reaction and photosensitization.

Coordination Chemistry

Code: CH 3246 (1) Prerequisite: CH 3147

This course explains nomenclature of coordination compounds, structure, bonding, properties, and reactivity of coordination compounds. Topics include theories of metal-ligand bonding (crystal field theory and molecular orbital theory), electronic spectra, detection and structural determination of complexes, isomerism among inorganic complexes and stability of complexes, biological and industrial applications of coordination compounds.

Organic spectroscopy

Code: CH 3248 (2) Prerequisite: CH 3149

This is a study of modern spectroscopic techniques used in the determination of molecular structure with emphasize on the interpretation of spectra including nuclear magnetic resonance, ultraviolet, infrared and mass spectroscopy.

Natural products

Code: CH 3250 (1+1) Prerequisite: CH 2246

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Enzymology (1)

Code: BC3202 Credit (2+1): Prerequisite BC3101, BC3103

Definition of enzymes, importance, classification. Kinetics of enzymes: activation energy, Km value, types of inhibition, Reaction with more than one substrate. RNA enzymes.

Body fluids and biological functions

Code: BC3204 Credit (2): Prerequisite BC3103

Compositions and functions of blood, blood volume, haemopoiesis, haemostasis, abnormal haemoglobins. Heart and circulation Essentials of the physiology of respiration, metabolic rate, respiratory acidosis and alkalosis. Digestive sections; their compositions, functions and control mechanisms of the Alimentary canal. Fluid compartments of the body. Functions of the kidney and urine formation, thirst mechanisms. Water, electrolyte and acid regulation. Buffer mechanisms. Clearance studies.

Hormones

Code: BC3206 Credit (2): Prerequisite BC3103.

Definition of Hormones. Classification of hormones. Hypothalamus hormones. Pituitary (anterior and posterior) Hormones. Thyroid Hormones, Parathyroid Hormones. Adrenal (cortex and medulla)Hormones. Steroid Hormones and pineal hormones. Pancreatic hormones

Molecular Biology

Code: BC3208 Credit (2): Prerequisite BC3109.

Occurrence of Nucleic acid and nucleoproteins. DNA, RNA Structures. Nature of genetic information and storage of genetic information. Transcription and translation. Regulation of gene expression. DNA mutation.

Practical biochemistry (1)

Code: BC4141 Credit (2): Prerequisite (BC2202, BC2204).

Petroleum chemistry and petrochemicals

Code: CH 4145 (1) Prerequisite: CH2143

This course provides general idea about the importance, occurrence and origin of petroleum, composition and specifications of crude petroleum and its products as well as some physical aspects concerning petroleum fuels, manufacturing processes, oil refinery and separation processes, production of motor and jet fuels, cracking, reforming, isomerisation, refining and treating processing, petrochemical industries and petrochemistry in everyday life.

Biological separation

Code: BC4147 Credit (1): Prerequisite (BC3143).

Determination of macromolecules. Separation of macromolecules by different methods chromatography, electrophoresis, Ultracentrifugation. Molecular weight determination.

Clinical Biochemistry

Code: BC4105 Credit (1): Prerequisite (BC3204, BC3206).

Biochemical mechanisms for controlling different pathways under different physiological and nutritional conditions and the importance of diseases arising from defects in these pathways. Particular emphasis will be placed upon the etiology, symptoms and treatment of diseases such as Type I and II diabetes mellitus; arteriosclerosis and other lipid disorders and inborn errors of carbohydrate and amino metabolism.

Immunology

Code: BC4107 Credit (2): Prerequisite (BC3103).

Introduction to immunology, Immunogen and antigen, antibody structure and classes, Complement and its biological function, Immunological cell system, Immunological cell system, Organs of immune response, Hypersensitivity, Autoimmunity, Antigen antibodies interactions, Monoclonal antibodies.

Enzymology (2)

Code: BC4113 Credit (1): Prerequisite (BC3202).

Enzyme Specificity. Mechanism of enzyme specificity: Tryptophane, proteases and other examples. Allosteric enzymes. Regulation of enzymes. Isoenzymes. Immobilization of enzymes

Biological oxidation

Code: BC4117 Credit (1): Prerequisite (BC3101).

Types of energy, its conversion and transfer in biosystem. Energy transducers. Laws govern energy transfer and utilization. Anatomy of mitochondria. Molecular structure of ATPase synthase. Mitochondria dysfunction and disease.

Practical organic chemistry

Code: CH4141 (2), Prerequisite CH2143

This serves as a laboratory course with emphasis on the techniques associated with the synthesis, isolation, purification and identification of organic compounds by physical properties, IR and NMR spectral analyses.

Essay & Research

Code: CH4163 (1)

This course is designed to give students the chance to work on a special project to demonstrate their critical scientific thinking skills by reviewing literature, designing experiment, writing report in the format of mini-review or journal paper, and presenting a poster in verbal scientific language.

Statistical thermodynamics

Code: CH4111 (1) Prerequisite: CH 2141

This course will provide an introduction to the probabilistic nature of physical chemistry, calculation of partition functions for simplified models of actual systems, derivation of thermodynamic quantities in terms of partition functions and applications to relevant systems.

Laser chemistry

Code: CH4113 (1) Prerequisite: CH 3244

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry of pesticides

Code: CH 4119 (1) Prerequisite: CH 2143

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Textile chemistry

Code: CH 4121 (1) Prerequisite: CH 3250

This course provide the fundamentals of textile fibers including fiber structure, properties, identification, classification (cellulose, cotton flax, hemp jute-man-made, rayon acetate and triacetate protein, wool and silk mineral fibers) man made fibers, processing of textiles (purification and preliminary singeing, designing, scouring, bleaching and mercerizing dyeing) and kinds of forces by which dye molecules are bound to the fiber.

Solid State Chemistry

Code: CH4143 (1) Prerequisite: CH 1101

This course provides the bases of crystallography, polymorphism in solids, defects in solids, the exciton concept, intermediate states of solids, amorphous materials, liquid crystals, nanomaterials, band theory of electronic structure, semiconductors, photovoltaic devices and techniques in solid state chemistry.

Analytical biochemistry

Code: CH4149 (1) Prerequisite: CH3149

Introduction to biostudies including characterization and quantitative analysis of biomolecules by using various analytical methods including biosensor, electrophoresis, mass spectrometry, fluoro immunoassays, stripping voltametry, blood gas analysis, cell counting, automatic analyzers.

Industrial chemistry

Code: CH4155 (1) Prerequisite: CH3147

This will provide an overview of the chemical, biochemical and pharmaceutical industries, the principal processes, scale-up of laboratory methods, modeling of

processes, economic factors, automation, data management, quality assurance, safety and project development. The course surveys areas as metallurgy, production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Bioinorganic Chemistry

Code: CH 4159 (1) Prerequisite: CH 3246

This course will provide an introduction and overview of metals in biology with emphasize on the structure, reactivity and reactions of biological molecules (metalloproteins, enzymes, hemoglobin, myoglobin, hemerythrin and cytochromes) from an inorganic prospective. The importance of these is discussed in regard to drug design and understanding of diseases resulting from mutations

Dyes chemistry

Code: CH 4208 (1) Prerequisite: CH 2111

This course offers correlation of color and chemical constitution, synthetic routes for popular dyes of important types, electronic mechanisms for reactive dyes, chemistry of dye interactions with light, washing and other in-use influences, economic and environmental considerations, classification of dyes (nitroso, nitro, azo, triarylmethane, xanthane, vat, indigo, anthraquinone and reactive dyes), mechanisms of dyeing, basis of modern techniques for color specification, measurement, control, applications of color science to textiles, plastics, and color reproduction.

Supramolecular chemistry

Code: CH4218 (1) Prerequisite: CH3246, CH4143

This course is an introduction to supramolecular chemistry with emphasize on definitions, supramolecular interactions, supramolecular design, host-guest chemistry, self-assembly, macrocyclic hosts, cation and anion binding, coordination polymers, supramolecular chemistry, crystal engineering, self-assembled monolayers (SAMs), fullerenes and nanotubes, dendrimers, fibres, gels and polymers, applications of supramolecular chemistry in molecular devices and life.

Environmental Chemistry

Code: CH 4224 (1)

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given.

Practical biochemistry (2)

Code: BC4240 Credit (2): Prerequisite (BC4141)

Genetic engineering

Code: BC4246 Credit (2)___Prerequisite (BC3208

Introduction, Tools of cloning: Cloning vectors Restriction enzymes DNA Ligase and Kinases Hosting bacterial cells Basic steps of gene cloning: Vector and insert preparation-ligation-transformation-screening. Understanding of cell proliferation and differentiation, analysis, metamorphosis, and communication between cells will also be developed. Production of hormones as insulin by gene manipulation. Treatment by gene therapy.

Practical physical chemistry

Code: CH4240 (2), Prerequisite CH2240, CH3149

This course is designed to reinforce the application of theoretical physical concepts into an experimental framework. Several experiments will cover different physical chemistry topics ranging from kinetics, thermodynamics, and surface chemistry to electrochemistry and spectroscopy as well as measuring of molecular parameters. Analysis of collected experimental data includes statistical error analysis and estimation of uncertainties, writing reports, oral presentation, students will have the chance to work in groups to acquire skills of team.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Selected applications of polymers

Code: CH4246 (1) Prerequisite CH4143

This course emphasizes on the synthesis, properties and industrial processes of products of poly(olefins), poly(vinyl chloride), poly(vinyl acetate), poly(urethanes), epoxies, silicones, styrene copolymers used as textile finishes, nonwoven binders, fabric coatings, composites, adhesives, foams, carpet backing adhesives.

Advanced analytical chemistry

Code: CH4250 (1) Prerequisite: CH3149

This subject covers technical aspects and applications of major analytical separation methods and spectroscopy for qualitative and quantitative analysis. These methods include high performance liquid chromatography (HPLC), supercritical fluid extraction and chromatography (SFE/SFC), ion chromatography (IC), and capillary electrophoresis (CE). The spectroscopic methods include atomic absorption spectroscopy (AAS) and atomic emission spectroscopy (AES), inductively-coupled plasma spectroscopy (ICP), ICP coupled with mass spectrometry (ICP-MS).

Advances in the analytical methods concerning biosensors and fast techniques are also discussed.

Physical chemistry of polymers

Code: CH 4252 (14) Prerequisite CH2143

This course studies the methods of molecular weight determination (chemical, physical and molecular weight distribution), the effect of chemical structure (molecular shape, backbone structure, polarity, presence of bulky substituents and cross linking) on physical properties of polymers (chain flexibility, crystallinity, solubility, mechanical properties and thermal behavior). In addition some techniques for polymer processing are going to be discussed along with their technological applications

Cancer biology

Code: BC4204 Credit (2): Prerequisite (BC3206).

Definition, Nature of cancer, some terms frequently applied in cancer. Cancer metabolism. Cell cycle and apoptosis. Host tumor-relationship. Diagnosis and treatment of cancer.

Disturbed metabolism

Code: BC4214 Credit (1): Prerequisite (BC4105).

Regulation of Carbohydrate, Lipid and protein. Hormonal action of metabolic control. Regulation of metabolism in starvation and obesity.

Introduction of Biotechnology

Code: BC4244 Credit (1)

The chemostat and its application in industrial fermentations alcoholic, amino acids, antibiotics, and other secondary metabolites. Primary and secondary metabolism.

Chemotherapy

Code: BC4252 Credit (2): Prerequisite (BC3204).

Methods of separation and identifications of drugs. Biosynthesis of alkaloids, phenolics and terpenes. The commercial and medical important of natural product. Mechanism treatment of cancer.

Drug metabolism

Code: BC4254 Credit (1): Prerequisite (BC3103).

Pharmacokinetics of drugs: absorption, distribution, metabolism, storage and excretion. Phase I and phase II reactions. The role of mixed function of cytochrome P450 in drugs metabolism. Other factors effect to the drugs.



Program title Chemistry /Botany

Program type General Degree

Department(s) Chemistry and Botany

Chemical Thermodynamics:

Code: CH2141 (2) Pre-request: CH1202

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Principles of organic chemistry (2)

Code: CH2111, (2) Pre-request: CH1202

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Chemical Kinetics

Code: CH2240 (1+1) Prerequisite: CH2141

This course explains the concepts of chemical kinetics, reaction rate, molecularity and reaction order, factors affecting reaction rates, integrated rate equations (first, second, third and pseudo-order reactions), effect of temperature on reaction rate and Arrhenius equation, activation energy, applications to simple and complex reactions, collision and transition state theories, concepts and theories of catalysis as well as its types and applications.

Kinetic Theory of Gases

Code: CH 2242 (1) Prerequisite: CH 1101

This course gives insights on molecular effusion, imperfect gases, collision between molecules, viscosity of gases and kinetic theory of gas viscosity, thermal conductivity of gases, Avogadro's number, molecular dimensions and barometric formula, Boltzmann and Maxwell distribution laws, velocity distribution in three dimensions, equilibration of energy, entropy and probability.

Instrumental Analysis (1)

Code: CH2244 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Organic chemistry (3)

Code: CH 2214 (2+1) Prerequisite: CH 2143

This is a study of the properties and reactivity of carbon compounds containing more than one functional e.g. dienes, unsaturated alcohols, unsaturated carbonyl compounds and acids, compounds containing active methylene groups, in addition to the chemistry of saturated and unsaturated cyclic and acyclic compounds

Stereochemistry

Code: CH 2246 (1) Prerequisite: CH 2143

The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis.

Quantum Chemistry

Code: CH 3141 (1) Prerequisite: CH 1202

This is introductory quantum chemistry with an emphasis on the fundamentals of quantum mechanics, potential well, hydrogen atom, many-electron atoms, Hartree-Fock approximation, diatomic molecules, neutral molecules, application of quantum mechanics to solve problems in chemistry, investigation of electronic structures of atoms, molecules, compounds, and explanation of reaction mechanism, spectroscopy and molecular structures.

Surface Chemistry and Catalysis

Code: CH 3143 (1) Prerequisite: CH 2240

Introduction to surface and colloid chemistry with emphasize on types and properties of interfaces (liquid-gas, liquid-liquid, gas-solid and solid-liquid), adsorption of gases and adsorption from solution, properties and types of colloid including classification and preparation, electrical aspects of surface chemistry and stability of colloid, emulsions and micellar solutions, applications in biological and technological processes. Theories of catalysis, homogeneous and heterogeneous catalysis as well as enzyme catalyzed reactions are discussed.

Electrochemistry (1)

Code: CH 3145 (1) Prerequisite: CH 1202

This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernst

equation and standard electrode potential, activity series, concentration cells, types of electrodes (gas-electrodes, metal/metal oxide-electrodes, amalgam-electrodes and glass-electrode), batteries and accumulators, fuel cells (principles, modes of action and types).

Chemistry of Transition Elements

Code: CH3147 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Instrumental analysis (2)

Code: CH 3149 (1+1) Prerequisite: CH2244

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Physical organic chemistry

Code: CH 3151 (1) Prerequisite: CH2143

This course provide a study of chemical structure and reactivity correlation, Hammett equation including the physical significance of σ - and ρ -values as well as applications, limitation and deviation of Hammett plots, neighboring group participation in nucleophilic and displacement reactions, in addition to studying the chemistry of reactive intermediates, precyclic reactions and aromaticity.

Heterocyclic chemistry

Code: CH 3153 (1+1) Prerequisite: CH2143

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings.

Molecular spectroscopy

Code:CH 3240 (1) Prerequisite: CH 3141

This course provides discussion for electromagnetic radiations and interactions between light and matter, theoretical bases of resonance spectroscopy, rotational spectra of diatomic molecules, IR- spectroscopy, vibration of diatomic vibrating rotary, Raman spectroscopy, electronic absorption spectroscopy of atoms, diatomic

and polyatomic molecules as well as applications of spectroscopy to structural investigations.

Electrochemistry (2)

Code: CH 3242 (1+1) Prerequisite: CH 3145

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernst-Planck equation, Faradic and non Faradic processes, the ideal and non ideal polarized electrodes, electrical double layer, factors affecting rates of electrode reactions, over potential polarization, mass transfer, Butler-Volmer and Tafel equations, more complex electrode reactions, Dc-polarography and cyclic voltammetry (theory and applications), basis of electrochemical corrosion (theory, polarization resistance and calculation of the corrosion rate).

Photochemistry

Code: CH 3244 (1) Prerequisite: CH 2240

This course discusses the electronic transitions and selection rules, electronically excited states, photophysical and photochemical pathways following electronic excitation, fluorescence lifetime and quantum yield, types of fluorescence, fluorescence quenching, electronic states of molecular oxygen, kinetic rate constants of excited state processes, photochemical reaction and photosensitization.

Coordination Chemistry

Code: CH 3246 (1) Prerequisite: CH 3147

This course explains nomenclature of coordination compounds, structure, bonding, properties, and reactivity of coordination compounds. Topics include theories of metal-ligand bonding (crystal field theory and molecular orbital theory), electronic spectra, detection and structural determination of complexes, isomerism among inorganic complexes and stability of complexes, biological and industrial applications of coordination compounds.

Organic spectroscopy

Code: CH 3248 (2) Prerequisite: CH 3149

This is a study of modern spectroscopic techniques used in the determination of molecular structure with emphasize on the interpretation of spectra including nuclear magnetic resonance, ultraviolet, infrared and mass spectroscopy.

Natural products

Code: CH 3250 (1+1) Prerequisite: CH 2246

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Practical organic chemistry (1)

Code: CH4141 (2), Prerequisite CH2143

This serves as a laboratory course with emphasis on the techniques associated with the synthesis, isolation, purification and identification of organic compounds by physical properties, IR and NMR spectral analyses.

Solid State Chemistry

Code: CH4143 (1) Prerequisite: CH 1101

This course provides the bases of crystallography, polymorphism in solids, defects in solids, the exciton concept, intermediate states of solids, amorphous materials, liquid crystals, nanomaterials, band theory of electronic structure, semiconductors, photovoltaic devices and techniques in solid state chemistry.

Bioinorganic Chemistry

Code: CH 4159 (1) Prerequisite: CH 3246

This course will provide an introduction and overview of metals in biology with emphasize on the structure, reactivity and reactions of biological molecules (metalloproteins, enzymes, hemoglobin, myoglobin, hemerythrin and cytochromes) from an inorganic prospective. The importance of these is discussed in regard to drug design and understanding of diseases resulting from mutations.

Statistical thermodynamics

Code: CH4111 (1) Prerequisite: CH 2141

This course will provide an introduction to the probabilistic nature of physical chemistry, calculation of partition functions for simplified models of actual systems, derivation of thermodynamic quantities in terms of partition functions and applications to relevant systems.

Analytical biochemistry

Code: CH4149 (1) Prerequisite: CH3149

Introduction to biostudies including characterization and quantitative analysis of biomolecules by using various analytical methods including biosensor, electrophoresis, mass spectrometry, fluoro immunoassays, stripping volatametry, blood gas analysis, cell counting, automatic analyzers.

Laser chemistry

Code: CH4113 (1) Prerequisite: CH 3244

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry of pesticides

Code: CH 4119 (1) Prerequisite: CH 2143

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Industrial chemistry

Code: CH4155 (1) Prerequisite: CH3147

This will provide an overview of the chemical, biochemical and pharmaceutical industries, the principal processes, scale-up of laboratory methods, modeling of processes, economic factors, automation, data management, quality assurance, safety and project development. The course surveys areas as metallurgy, production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Textile chemistry

Code: CH 4121 (1) Prerequisite: CH 3250

This course provide the fundamentals of textile fibers including fiber structure, properties, identification, classification (cellulose, cotton flax, hemp jute-man-made, rayon acetate and triacetate protein, wool and silk mineral fibers) man made fibers, processing of textiles (purification and preliminary singeing, designing, scouring, bleaching and mercerizing dyeing) and kinds of forces by which dye molecules are bound to the fiber.

Petroleum chemistry and petrochemicals

Code: CH 4145 (1) Prerequisite: CH2143

This course provides general idea about the importance, occurrence and origin of petroleum, composition and specifications of crude petroleum and its products as well as some physical aspects concerning petroleum fuels, manufacturing processes, oil refinery and separation processes, production of motor and jet fuels, cracking, reforming, isomerisation, refining and treating processing, petrochemical industries and petrochemistry in everyday life.

Practical physical chemistry (1)

Code: CH4240 (2), Prerequisite CH2240, CH3149

This course is designed to reinforce the application of theoretical physical concepts into an experimental framework. Several experiments will cover different physical chemistry topics ranging from kinetics, thermodynamics, and surface chemistry to electrochemistry and spectroscopy as well as measuring of molecular parameters. Analysis of collected experimental data includes statistical error analysis and

estimation of uncertainties, writing reports, oral presentation, students will have the chance to work in groups to acquire skills of team.

Dyes chemistry

Code: CH 4208 (1) Prerequisite: CH 2111

This course offers correlation of color and chemical constitution, synthetic routes for popular dyes of important types, electronic mechanisms for reactive dyes, chemistry of dye interactions with light, washing and other in-use influences, economic and environmental considerations, classification of dyes (nitroso, nitro, azo, triarylmethane, xanthane, vat, indigo, anthraquinone and reactive dyes), mechanisms of dyeing, basis of modern techniques for color specification, measurement, control, applications of color science to textiles, plastics, and color reproduction.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Selected applications of polymers

Code: CH4246 (1) Prerequisite CH4143

This course emphasizes on the synthesis, properties and industrial processes of products of poly(olefins), poly(vinyl chloride), poly(vinyl acetate), poly(urethanes), epoxies, silicones, styrene copolymers used as textile finishes, nonwoven binders, fabric coatings, composites, adhesives, foams, carpet backing adhesives.

Environmental Chemistry

Code: CH 4224 (1)

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given.

Advanced analytical chemistry

Code: CH4250 (1) Prerequisite: CH3149

This subject covers technical aspects and applications of major analytical separation methods and spectroscopy for qualitative and quantitative analysis. These methods include high performance liquid chromatography (HPLC), supercritical fluid extraction and chromatography (SFE/SFC), ion chromatography (IC), and capillary

electrophoresis (CE). The spectroscopic methods include atomic absorption spectroscopy (AAS) and atomic emission spectroscopy (AES), inductively-coupled plasma spectroscopy (ICP), ICP coupled with mass spectrometry (ICP-MS). Advances in the analytical methods concerning biosensors and fast techniques are also discussed.

Physical chemistry of polymers

Code: CH 4252 (1) Prerequisite CH4143

This course studies the methods of molecular weight determination (chemical, physical and molecular weight distribution), the effect of chemical structure (molecular shape, backbone structure, polarity, presence of bulky substituents and cross linking) on physical properties of polymers (chain flexibility, crystallinity, solubility, mechanical properties and thermal behavior). In addition some techniques for polymer processing are going to be discussed along with their technological applications.

Supramolecular chemistry

Code: CH4218 (1) Prerequisite: CH3246, CH4143

This course is an introduction to supramolecular chemistry with emphasize on definitions, supramolecular interactions, supramolecular design, host-guest chemistry, self-assembly, macrocyclic hosts, cation and anion binding, coordination polymers, supramolecular chemistry, crystal engineering, self-assembled monolayers (SAMs), fullerenes and nanotubes, dendrimers, fibres, gels and polymers, applications of supramolecular chemistry in molecular devices and life.



Program title Chemistry / Microbiology

Program type General Degree

Department(s) Chemistry and Botany

Chemical Thermodynamics:

Code: CH2141 (2) Pre-request: CH1202

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Group Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Principles of organic chemistry (2)

Code: CH2111, (2) Pre-request: CH1202

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Chemical Kinetics

Code: CH2240 (1+1) Prerequisite: CH2141

This course explains the concepts of chemical kinetics, reaction rate, molecularity and reaction order, factors affecting reaction rates, integrated rate equations (first, second, third and pseudo-order reactions), effect of temperature on reaction rate and Arrhenius equation, activation energy, applications to simple and complex reactions, collision and transition state theories, concepts and theories of catalysis as well as its types and applications.

Kinetic Theory of Gases

Code: CH 2242 (1) Prerequisite: CH 1101

This course gives insights on molecular effusion, imperfect gases, collision between molecules, viscosity of gases and kinetic theory of gas viscosity, thermal conductivity of gases, Avogadro's number, molecular dimensions and barometric formula, Boltzmann and Maxwell distribution laws, velocity distribution in three dimensions, equilibration of energy, entropy and probability.

Instrumental Analysis (1)

Code: CH2244 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Organic chemistry (3)

Code: CH 2214 (2+1) Prerequisite: CH 2143

This is a study of the properties and reactivity of carbon compounds containing more than one functional e.g. dienes, unsaturated alcohols, unsaturated carbonyl compounds and acids, compounds containing active methylene groups, in addition to the chemistry of saturated and unsaturated cyclic and acyclic compounds

Stereochemistry

Code: CH 2246 (1) Prerequisite: CH 2143

The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis.

Quantum Chemistry

Code: CH 3141 (1) Prerequisite: CH 1202

This is introductory quantum chemistry with an emphasis on the fundamentals of quantum mechanics, potential well, hydrogen atom, many-electron atoms, Hartree-Fock approximation, diatomic molecules, neutral molecules, application of quantum mechanics to solve problems in chemistry, investigation of electronic structures of atoms, molecules, compounds, and explanation of reaction mechanism, spectroscopy and molecular structures.

Surface Chemistry and Catalysis

Code: CH 3143 (1) Prerequisite: CH 2240

Introduction to surface and colloid chemistry with emphasize on types and properties of interfaces (liquid-gas, liquid-liquid, gas-solid and solid-liquid), adsorption of gases and adsorption from solution, properties and types of colloid including classification and preparation, electrical aspects of surface chemistry and stability of colloid, emulsions and micellar solutions, applications in biological and technological processes. Theories of catalysis, homogeneous and heterogeneous catalysis as well as enzyme catalyzed reactions are discussed.

Electrochemistry (1)

Code: CH 3145 (1) Prerequisite: CH 1202

This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernst

equation and standard electrode potential, activity series, concentration cells, types of electrodes (gas-electrodes, metal/metal oxide-electrodes, amalgam-electrodes and glass-electrode), batteries and accumulators, fuel cells (principles, modes of action and types).

Chemistry of Transition Elements

Code: CH3147 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Instrumental analysis (2)

Code: CH 3149 (1+1) Prerequisite: CH2244

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Physical organic chemistry

Code: CH 3151 (1) Prerequisite: CH2143

This course provide a study of chemical structure and reactivity correlation, Hammett equation including the physical significance of σ - and ρ -values as well as applications, limitation and deviation of Hammett plots, neighboring group participation in nucleophilic and displacement reactions, in addition to studying the chemistry of reactive intermediates, precyclic reactions and aromaticity.

Heterocyclic chemistry

Code: CH 3153 (1+1) Prerequisite: CH2143

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings.

Molecular spectroscopy

Code: CH 3240 (1) Prerequisite: CH 3141

This course provides discussion for electromagnetic radiations and interactions between light and matter, theoretical bases of resonance spectroscopy, rotational spectra of diatomic molecules, IR- spectroscopy, vibration of diatomic vibrating rotary, Raman spectroscopy, electronic absorption spectroscopy of atoms, diatomic

and polyatomic molecules as well as applications of spectroscopy to structural investigations.

Electrochemistry (2)

Code: CH 3242 (1+1) Prerequisite: CH 3145

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernst-Planck equation, Faradic and non Faradic processes, the ideal and non ideal polarized electrodes, electrical double layer, factors affecting rates of electrode reactions, over potential polarization, mass transfer, Butler-Volmer and Tafel equations, more complex electrode reactions, Dc-polarography and cyclic voltammetry (theory and applications), basis of electrochemical corrosion (theory, polarization resistance and calculation of the corrosion rate).

Photochemistry

Code: CH 3244 (1) Prerequisite: CH 2240

This course discusses the electronic transitions and selection rules, electronically excited states, photophysical and photochemical pathways following electronic excitation, fluorescence lifetime and quantum yield, types of fluorescence, fluorescence quenching, electronic states of molecular oxygen, kinetic rate constants of excited state processes, photochemical reaction and photosensitization.

Coordination Chemistry

Code: CH 3246 (1) Prerequisite: CH 3147

This course explains nomenclature of coordination compounds, structure, bonding, properties, and reactivity of coordination compounds. Topics include theories of metal-ligand bonding (crystal field theory and molecular orbital theory), electronic spectra, detection and structural determination of complexes, isomerism among inorganic complexes and stability of complexes, biological and industrial applications of coordination compounds.

Organic spectroscopy

Code: CH 3248 (2) Prerequisite: CH 3149

This is a study of modern spectroscopic techniques used in the determination of molecular structure with emphasize on the interpretation of spectra including nuclear magnetic resonance, ultraviolet, infrared and mass spectroscopy.

Natural products

Code: CH 3250 (1+1) Prerequisite: CH 2246

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Practical organic chemistry (1)

Code: CH4141 (2), Prerequisite CH2143

This serves as a laboratory course with emphasis on the techniques associated with the synthesis, isolation, purification and identification of organic compounds by physical properties, IR and NMR spectral analyses.

Solid State Chemistry

Code: CH4143 (1) Prerequisite: CH 1101

This course provides the bases of crystallography, polymorphism in solids, defects in solids, the exciton concept, intermediate states of solids, amorphous materials, liquid crystals, nanomaterials, band theory of electronic structure, semiconductors, photovoltaic devices and techniques in solid state chemistry.

Bioinorganic Chemistry

Code: CH 4159 (1) Prerequisite: CH 3246

This course will provide an introduction and overview of metals in biology with emphasize on the structure, reactivity and reactions of biological molecules (metalloproteins, enzymes, hemoglobin, myoglobin, hemerythrin and cytochromes) from an inorganic prospective. The importance of these is discussed in regard to drug design and understanding of diseases resulting from mutations.

Statistical thermodynamics

Code: CH4111 (1) Prerequisite: CH 2141

This course will provide an introduction to the probabilistic nature of physical chemistry, calculation of partition functions for simplified models of actual systems, derivation of thermodynamic quantities in terms of partition functions and applications to relevant systems.

Analytical biochemistry

Code: CH4149 (1) Prerequisite: CH3149

Introduction to biostudies including characterization and quantitative analysis of biomolecules by using various analytical methods including biosensor, electrophoresis, mass spectrometry, fluoro immunoassays, stripping volatametry, blood gas analysis, cell counting, automatic analyzers.

Laser chemistry

Code: CH4113 (1) Prerequisite: CH 3244

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry of pesticides

Code: CH 4119 (1) Prerequisite: CH 2143

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Industrial chemistry

Code: CH4155 (1) Prerequisite: CH3147

This will provide an overview of the chemical, biochemical and pharmaceutical industries, the principal processes, scale-up of laboratory methods, modeling of processes, economic factors, automation, data management, quality assurance, safety and project development. The course surveys areas as metallurgy, production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Textile chemistry

Code: CH 4121 (1) Prerequisite: CH 3250

This course provide the fundamentals of textile fibers including fiber structure, properties, identification, classification (cellulose, cotton flax, hemp jute-man-made, rayon acetate and triacetate protein, wool and silk mineral fibers) man made fibers, processing of textiles (purification and preliminary singeing, designing, scouring, bleaching and mercerizing dyeing) and kinds of forces by which dye molecules are bound to the fiber.

Petroleum chemistry and petrochemicals

Code: CH 4145 (1) Prerequisite: CH2143

This course provides general idea about the importance, occurrence and origin of petroleum, composition and specifications of crude petroleum and its products as well as some physical aspects concerning petroleum fuels, manufacturing processes, oil refinery and separation processes, production of motor and jet fuels, cracking, reforming, isomerisation, refining and treating processing, petrochemical industries and petrochemistry in everyday life.

Forensic and criminal chemistry

Code: CH4161 (1) Prerequisite: CH3149

This course is an introduction to the use of science and the scientific method in law and criminal justice, with detailed examination of the techniques of forensic chemistry including organic, inorganic, and instrumental analysis. Topics include gunshot residue, drugs and toxicology, paint, arson and explosives, and biochemical methods such as electrophoresis, quality assurance, courtroom testimony, laboratory accreditation, and analyst certification will be discussed.

Practical physical chemistry (1)

Code: CH4240 (2), Prerequisite CH2240, CH3149

This course is designed to reinforce the application of theoretical physical concepts into an experimental framework. Several experiments will cover different physical chemistry topics ranging from kinetics, thermodynamics, and surface chemistry to electrochemistry and spectroscopy as well as measuring of molecular parameters. Analysis of collected experimental data includes statistical error analysis and estimation of uncertainties, writing reports, oral presentation, students will have the chance to work in groups to acquire skills of team.

Dyes chemistry

Code: CH 4208 (1) Prerequisite: CH 2111

This course offers correlation of color and chemical constitution, synthetic routes for popular dyes of important types, electronic mechanisms for reactive dyes, chemistry of dye interactions with light, washing and other in-use influences, economic and environmental considerations, classification of dyes (nitroso, nitro, azo, triarylmethane, xanthane, vat, indigo, anthraquinone and reactive dyes), mechanisms of dyeing, basis of modern techniques for color specification, measurement, control, applications of color science to textiles, plastics, and color reproduction.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Selected applications of polymers

Code: CH4246 (1) Prerequisite: CH4143

This course emphasizes on the synthesis, properties and industrial processes of products of poly(olefins), poly(vinyl chloride), poly(vinyl acetate), poly(urethanes), epoxies, silicones, styrene copolymers used as textile finishes, nonwoven binders, fabric coatings, composites, adhesives, foams, carpet backing adhesives.

Environmental Chemistry

Code: CH 4224 (1)

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and

pesticides are discussed. The different techniques used in pollution analysis are given.

Advanced analytical chemistry

Code: CH4250 (1) Prerequisite: CH3149

This subject covers technical aspects and applications of major analytical separation methods and spectroscopy for qualitative and quantitative analysis. These methods include high performance liquid chromatography (HPLC), supercritical fluid extraction and chromatography (SFE/SFC), ion chromatography (IC), and capillary electrophoresis (CE). The spectroscopic methods include atomic absorption spectroscopy (AAS) and atomic emission spectroscopy (AES), inductively-coupled plasma spectroscopy (ICP), ICP coupled with mass spectrometry (ICP-MS). Advances in the analytical methods concerning biosensors and fast techniques are also discussed.

Physical chemistry of polymers

Code: CH 4252 (1) Prerequisite: CH4143

This course studies the methods of molecular weight determination (chemical, physical and molecular weight distribution), the effect of chemical structure (molecular shape, backbone structure, polarity, presence of bulky substituents and cross linking) on physical properties of polymers (chain flexibility, crystallinity, solubility, mechanical properties and thermal behavior). In addition some techniques for polymer processing are going to be discussed along with their technological applications.

Organic reaction mechanism

Code: CH4254 (1) Prerequisite : CH2143

The course concerns with the method determining the mechanism by the use of isotopes and spectroscopic methods. The study of the effect of structure on reactivity. The detailed study of the mechanism of different types of reactions as ionic substitution, elimination, addition and rearrangement reactions.

Supramolecular chemistry

Code: CH4218 (1) Prerequisite: CH3246, CH4143

This course is an introduction to supramolecular chemistry with emphasize on definitions, supramolecular interactions, supramolecular design, host-guest chemistry, self-assembly, macrocyclic hosts, cation and anion binding, coordination polymers, supramolecular chemistry, crystal engineering, self-assembled monolayers (SAMs), fullerenes and nanotubes, dendrimers, fibres, gels and polymers, applications of supramolecular chemistry in molecular devices and life.



Program title Chemistry / Zoology

Program type General Degree

Department(s) Chemistry and Zoology

Chemical Thermodynamics:

Code: CH2141 (2) Pre-request: CH1202

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Group Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Principles of organic chemistry (2)

Code: CH2111, (2) Pre-request: CH1202

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Chemical Kinetics

Code: CH2240 (1+1) Prerequisite: CH2141

This course explains the concepts of chemical kinetics, reaction rate, molecularity and reaction order, factors affecting reaction rates, integrated rate equations (first, second, third and pseudo-order reactions), effect of temperature on reaction rate and Arrhenius equation, activation energy, applications to simple and complex reactions, collision and transition state theories, concepts and theories of catalysis as well as its types and applications.

Kinetic Theory of Gases

Code: CH 2242 (1) Prerequisite: CH 1101

This course gives insights on molecular effusion, imperfect gases, collision between molecules, viscosity of gases and kinetic theory of gas viscosity, thermal conductivity of gases, Avogadro's number, molecular dimensions and barometric formula, Boltzmann and Maxwell distribution laws, velocity distribution in three dimensions, equilibration of energy, entropy and probability.

Instrumental Analysis (1)

Code: CH2244 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Organic chemistry (3)

Code: CH 2214 (2+1) Prerequisite: CH 2143

This is a study of the properties and reactivity of carbon compounds containing more than one functional e.g. dienes, unsaturated alcohols, unsaturated carbonyl compounds and acids, compounds containing active methylene groups, in addition to the chemistry of saturated and unsaturated cyclic and acyclic compounds

Stereochemistry

Code: CH 2246 (1) Prerequisite: CH 2143

The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis.

Quantum Chemistry

Code: CH 3141 (1) Prerequisite: CH 1202

This is introductory quantum chemistry with an emphasis on the fundamentals of quantum mechanics, potential well, hydrogen atom, many-electron atoms, Hartree-Fock approximation, diatomic molecules, neutral molecules, application of quantum mechanics to solve problems in chemistry, investigation of electronic structures of atoms, molecules, compounds, and explanation of reaction mechanism, spectroscopy and molecular structures.

Surface Chemistry and Catalysis

Code: CH 3143 (1) Prerequisite: CH 2240

Introduction to surface and colloid chemistry with emphasize on types and properties of interfaces (liquid-gas, liquid-liquid, gas-solid and solid-liquid), adsorption of gases and adsorption from solution, properties and types of colloid including classification and preparation, electrical aspects of surface chemistry and stability of colloid, emulsions and miceller solutions, applications in biological and technological processes. Theories of catalysis, homogeneous and heterogeneous catalysis as well as enzyme catalyzed reactions are discussed.

Electrochemistry (1)

Code: CH 3145 (1) Prerequisite: CH 1202

This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernst

equation and standard electrode potential, activity series, concentration cells, types of electrodes (gas-electrodes, metal/metal oxide-electrodes, amalgam-electrodes and glass-electrode), batteries and accumulators, fuel cells (principles, modes of action and types).

Chemistry of Transition Elements

Code: CH3147 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Instrumental analysis (2)

Code: CH 3149 (1+1) Prerequisite: CH2244

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Physical organic chemistry

Code: CH 3151 (1) Prerequisite: CH2143

This course provide a study of chemical structure and reactivity correlation, Hammett equation including the physical significance of σ - and ρ -values as well as applications, limitation and deviation of Hammett plots, neighboring group participation in nucleophilic and displacement reactions, in addition to studying the chemistry of reactive intermediates, precyclic reactions and aromaticity.

Heterocyclic chemistry

Code: CH 3153 (1+1) Prerequisite: CH2143

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings.

Molecular spectroscopy

Code:CH 3240 (1) Prerequisite: CH 3141

This course provides discussion for electromagnetic radiations and interactions between light and matter, theoretical bases of resonance spectroscopy, rotational spectra of diatomic molecules, IR- spectroscopy, vibration of diatomic vibrating rotary, Raman spectroscopy, electronic absorption spectroscopy of atoms, diatomic

and polyatomic molecules as well as applications of spectroscopy to structural investigations.

Electrochemistry (2)

Code: CH 3242 (1+1) Prerequisite: CH 3145

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernst-Planck equation, Faradic and non Faradic processes, the ideal and non ideal polarized electrodes, electrical double layer, factors affecting rates of electrode reactions, over potential polarization, mass transfer, Butler-Volmer and Tafel equations, more complex electrode reactions, Dc-polarography and cyclic voltammetry (theory and applications), basis of electrochemical corrosion (theory, polarization resistance and calculation of the corrosion rate).

Photochemistry

Code: CH 3244 (1) Prerequisite: CH 2240

This course discusses the electronic transitions and selection rules, electronically excited states, photophysical and photochemical pathways following electronic excitation, fluorescence lifetime and quantum yield, types of fluorescence, fluorescence quenching, electronic states of molecular oxygen, kinetic rate constants of excited state processes, photochemical reaction and photosensitization.

Coordination Chemistry

Code: CH 3246 (1) Prerequisite: CH 3147

This course explains nomenclature of coordination compounds, structure, bonding, properties, and reactivity of coordination compounds. Topics include theories of metal-ligand bonding (crystal field theory and molecular orbital theory), electronic spectra, detection and structural determination of complexes, isomerism among inorganic complexes and stability of complexes, biological and industrial applications of coordination compounds.

Organic spectroscopy

Code: CH 3248 (2) Prerequisite: CH 3149

This is a study of modern spectroscopic techniques used in the determination of molecular structure with emphasize on the interpretation of spectra including nuclear magnetic resonance, ultraviolet, infrared and mass spectroscopy.

Natural products

Code: CH 3250 (1+1) Prerequisite: CH 2246

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Practical organic chemistry (1)

Code: CH4141 (2), Prerequisite CH2143

This serves as a laboratory course with emphasis on the techniques associated with the synthesis, isolation, purification and identification of organic compounds by physical properties, IR and NMR spectral analyses.

Solid State Chemistry

Code: CH4143 (1) Prerequisite: CH 1101

This course provides the bases of crystallography, polymorphism in solids, defects in solids, the exciton concept, intermediate states of solids, amorphous materials, liquid crystals, nanomaterials, band theory of electronic structure, semiconductors, photovoltaic devices and techniques in solid state chemistry.

Bioinorganic Chemistry

Code: CH 4159 (1) Prerequisite: CH 3246

This course will provide an introduction and overview of metals in biology with emphasize on the structure, reactivity and reactions of biological molecules (metalloproteins, enzymes, hemoglobin, myoglobin, hemerythrin and cytochromes) from an inorganic prospective. The importance of these is discussed in regard to drug design and understanding of diseases resulting from mutations.

Statistical thermodynamics

Code: CH4111 (1) Prerequisite: CH 2141

This course will provide an introduction to the probabilistic nature of physical chemistry, calculation of partition functions for simplified models of actual systems, derivation of thermodynamic quantities in terms of partition functions and applications to relevant systems.

Analytical biochemistry

Code: CH4149 (1) Prerequisite: CH3149

Introduction to biostudies including characterization and quantitative analysis of biomolecules by using various analytical methods including biosensor, electrophoresis, mass spectrometry, fluoro immunoassays, stripping volatametry, blood gas analysis, cell counting, automatic analyzers.

Laser chemistry

Code: CH4113 (1) Prerequisite: CH 3244

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry of pesticides

Code: CH 4119 (1) Prerequisite: CH 2143

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Industrial chemistry

Code: CH4155 (1) Prerequisite: CH3147

This will provide an overview of the chemical, biochemical and pharmaceutical industries, the principal processes, scale-up of laboratory methods, modeling of processes, economic factors, automation, data management, quality assurance, safety and project development. The course surveys areas as metallurgy, production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Textile chemistry

Code: CH 4121 (1) Prerequisite: CH 3250

This course provide the fundamentals of textile fibers including fiber structure, properties, identification, classification (cellulose, cotton flax, hemp jute-man-made, rayon acetate and triacetate protein, wool and silk mineral fibers) man made fibers, processing of textiles (purification and preliminary singeing, designing, scouring, bleaching and mercerizing dyeing) and kinds of forces by which dye molecules are bound to the fiber.

Petroleum chemistry and petrochemicals

Code: CH 4145 (1) Prerequisite: CH2143

This course provides general idea about the importance, occurrence and origin of petroleum, composition and specifications of crude petroleum and its products as well as some physical aspects concerning petroleum fuels, manufacturing processes, oil refinery and separation processes, production of motor and jet fuels, cracking, reforming, isomerisation, refining and treating processing, petrochemical industries and petrochemistry in everyday life.

Forensic and criminal chemistry

Code: CH4161 (1) Prerequisite: CH3149

This course is an introduction to the use of science and the scientific method in law and criminal justice, with detailed examination of the techniques of forensic chemistry including organic, inorganic, and instrumental analysis. Topics include gunshot residue, drugs and toxicology, paint, arson and explosives, and biochemical

methods such as electrophoresis, quality assurance, courtroom testimony, laboratory accreditation, and analyst certification will be discussed.

Practical physical chemistry (1)

Code: CH4240 (2), Prerequisite CH2240, CH3149

This course is designed to reinforce the application of theoretical physical concepts into an experimental framework. Several experiments will cover different physical chemistry topics ranging from kinetics, thermodynamics, and surface chemistry to electrochemistry and spectroscopy as well as measuring of molecular parameters. Analysis of collected experimental data includes statistical error analysis and estimation of uncertainties, writing reports, oral presentation, students will have the chance to work in groups to acquire skills of team.

Dyes chemistry

Code: CH 4208 (1) Prerequisite: CH 2111

This course offers correlation of color and chemical constitution, synthetic routes for popular dyes of important types, electronic mechanisms for reactive dyes, chemistry of dye interactions with light, washing and other in-use influences, economic and environmental considerations, classification of dyes (nitroso, nitro, azo, triarylmethane, xanthane, vat, indigo, anthraquinone and reactive dyes), mechanisms of dyeing, basis of modern techniques for color specification, measurement, control, applications of color science to textiles, plastics, and color reproduction.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Selected applications of polymers

Code: CH4246 (1) Prerequisite CH4143

This course emphasizes on the synthesis, properties and industrial processes of products of poly(olefins), poly(vinyl chloride), poly(vinyl acetate), poly(urethanes), epoxies, silicones, styrene copolymers used as textile finishes, nonwoven binders, fabric coatings, composites, adhesives, foams, carpet backing adhesives.

Environmental Chemistry

Code: CH 4224 (1)

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given.

Advanced analytical chemistry

Code: CH4250 (1) Prerequisite: CH3149

This subject covers technical aspects and applications of major analytical separation methods and spectroscopy for qualitative and quantitative analysis. These methods include high performance liquid chromatography (HPLC), supercritical fluid extraction and chromatography (SFE/SFC), ion chromatography (IC), and capillary electrophoresis (CE). The spectroscopic methods include atomic absorption spectroscopy (AAS) and atomic emission spectroscopy (AES), inductively-coupled plasma spectroscopy (ICP), ICP coupled with mass spectrometry (ICP-MS). Advances in the analytical methods concerning biosensors and fast techniques are also discussed.

Physical chemistry of polymers

Code: CH 4252 (1) Prerequisite CH4143

This course studies the methods of molecular weight determination (chemical, physical and molecular weight distribution), the effect of chemical structure (molecular shape, backbone structure, polarity, presence of bulky substituents and cross linking) on physical properties of polymers (chain flexibility, crystallinity, solubility, mechanical properties and thermal behavior). In addition some techniques for polymer processing are going to be discussed along with their technological applications.

Organic reaction mechanism

Code: CH4254 (1) Prerequisite : CH2143

The course concerns with the method determining the mechanism by the use of isotopes and spectroscopic methods. The study of the effect of structure on reactivity. The detailed study of the mechanism of different types of reactions as ionic substitution, elimination, addition and rearrangement reactions.

Supramolecular chemistry

Code: CH4218 (1) Prerequisite: CH3246, CH4143

This course is an introduction to supramolecular chemistry with emphasize on definitions, supramolecular interactions, supramolecular design, host-guest chemistry, self-assembly, macrocyclic hosts, cation and anion binding, coordination polymers, supramolecular chemistry, crystal engineering, self-assembled monolayers (SAMs), fullerenes and nanotubes, dendrimers, fibres, gels and polymers, applications of supramolecular chemistry in molecular devices and life.



Program title Chemistry / Entmology

Program type General Degree

Department(s) Chemistry and Zoology

Chemical Thermodynamics:

Code: CH2141 (2) Pre-request: CH1202

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Principles of organic chemistry (2)

Code: CH2111, (2) Pre-request: CH1202

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Chemical Kinetics

Code: CH2240 (1+1) Prerequisite: CH2141

This course explains the concepts of chemical kinetics, reaction rate, molecularity and reaction order, factors affecting reaction rates, integrated rate equations (first, second, third and pseudo-order reactions), effect of temperature on reaction rate and Arrhenius equation, activation energy, applications to simple and complex reactions, collision and transition state theories, concepts and theories of catalysis as well as its types and applications.

Kinetic Theory of Gases

Code: CH 2242 (1) Prerequisite: CH 1101

This course gives insights on molecular effusion, imperfect gases, collision between molecules, viscosity of gases and kinetic theory of gas viscosity, thermal conductivity of gases, Avogadro's number, molecular dimensions and barometric formula, Boltzmann and Maxwell distribution laws, velocity distribution in three dimensions, equilibration of energy, entropy and probability.

Instrumental Analysis (1)

Code: CH2244 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter,

basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Organic chemistry (3)

Code: CH 2214 (2+1) Prerequisite: CH 2143

This is a study of the properties and reactivity of carbon compounds containing more than one functional e.g. dienes, unsaturated alcohols, unsaturated carbonyl compounds and acids, compounds containing active methylene groups, in addition to the chemistry of saturated and unsaturated cyclic and acyclic compounds

Stereochemistry

Code: CH 2246 (1) Prerequisite: CH 2143

The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis.

Quantum Chemistry

Code: CH 3141 (1) Prerequisite: CH 1202

This is introductory quantum chemistry with an emphasis on the fundamentals of quantum mechanics, potential well, hydrogen atom, many-electron atoms, Hartree-Fock approximation, diatomic molecules, neutral molecules, application of quantum mechanics to solve problems in chemistry, investigation of electronic structures of atoms, molecules, compounds, and explanation of reaction mechanism, spectroscopy and molecular structures.

Surface Chemistry and Catalysis

Code: CH 3143 (1) Prerequisite: CH 2240

Introduction to surface and colloid chemistry with emphasize on types and properties of interfaces (liquid-gas, liquid-liquid, gas-solid and solid-liquid), adsorption of gases and adsorption from solution, properties and types of colloid including classification and preparation, electrical aspects of surface chemistry and stability of colloid, emulsions and micellar solutions, applications in biological and technological processes. Theories of catalysis, homogeneous and heterogeneous catalysis as well as enzyme catalyzed reactions are discussed.

Electrochemistry (1)

Code: CH 3145 (1) Prerequisite: CH 1202

This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernst equation and standard electrode potential, activity series, concentration cells, types of electrodes (gas-electrodes, metal/metal oxide-electrodes, amalgam-electrodes and

glass-electrode), batteries and accumulators, fuel cells (principles, modes of action and types).

Chemistry of Transition Elements

Code: CH3147 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Instrumental analysis (2)

Code: CH 3149 (1+1) Prerequisite: CH2244

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Physical organic chemistry

Code: CH 3151 (1) Prerequisite: CH2143

This course provide a study of chemical structure and reactivity correlation, Hammett equation including the physical significance of σ - and ρ -values as well as applications, limitation and deviation of Hammett plots, neighboring group participation in nucleophilic and displacement reactions, in addition to studying the chemistry of reactive intermediates, precyclic reactions and aromaticity.

Heterocyclic chemistry

Code: CH 3153 (1+1) Prerequisite: CH2143

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings.

Molecular spectroscopy

Code: CH 3240 (1) Prerequisite: CH 3141

This course provides discussion for electromagnetic radiations and interactions between light and matter, theoretical bases of resonance spectroscopy, rotational spectra of diatomic molecules, IR- spectroscopy, vibration of diatomic vibrating rotary, Raman spectroscopy, electronic absorption spectroscopy of atoms, diatomic and polyatomic molecules as well as applications of spectroscopy to structural investigations.

Electrochemistry (2)

Code: CH 3242 (1+1) Prerequisite: CH 3145

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernst-Planck equation, Faradic and non Faradic processes, the ideal and non ideal polarized electrodes, electrical double layer, factors affecting rates of electrode reactions, over potential polarization, mass transfer, Butler-Volmer and Tafel equations, more complex electrode reactions, Dc-polarography and cyclic votammetry (theory and applications), basis of electrochemical corrosion (theory, polarization resistance and calculation of the corrosion rate).

Photochemistry

Code: CH 3244 (1) Prerequisite: CH 2240

This course discusses the electronic transitions and selection rules, electronically excited states, photophysical and photochemical pathways following electronic excitation, fluorescence lifetime and quantum yield, types of fluorescence, fluorescence quenching, electronic states of molecular oxygen, kinetic rate constants of excited state processes, photochemical reaction and photosensitization.

Coordination Chemistry

Code: CH 3246 (1) Prerequisite: CH 3147

This course explains nomenclature of coordination compounds, structure, bonding, properties, and reactivity of coordination compounds. Topics include theories of metal-ligand bonding (crystal field theory and molecular orbital theory), electronic spectra, detection and structural determination of complexes, isomerism among inorganic complexes and stability of complexes, biological and industrial applications of coordination compounds.

Organic spectroscopy

Code: CH 3248 (2) Prerequisite: CH 3149

This is a study of modern spectroscopic techniques used in the determination of molecular structure with emphasize on the interpretation of spectra including nuclear magnetic resonance, ultraviolet, infrared and mass spectroscopy.

Natural products

Code: CH 3250 (1+1) Prerequisite: CH 2246

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Practical organic chemistry (1)

Code: CH4141 (2), Prerequisite CH2143

This serves as a laboratory course with emphasis on the techniques associated with the synthesis, isolation, purification and identification of organic compounds by physical properties, IR and NMR spectral analyses.

Solid State Chemistry

Code: CH4143 (1) Prerequisite: CH 1101

This course provides the bases of crystallography, polymorphism in solids, defects in solids, the exciton concept, intermediate states of solids, amorphous materials, liquid crystals, nanomaterials, band theory of electronic structure, semiconductors, photovoltaic devices and techniques in solid state chemistry.

Bioinorganic Chemistry

Code: CH 4159 (1) Prerequisite: CH 3246

This course will provide an introduction and overview of metals in biology with emphasize on the structure, reactivity and reactions of biological molecules (metalloproteins, enzymes, hemoglobin, myoglobin, hemerythrin and cytochromes) from an inorganic prospective. The importance of these is discussed in regard to drug design and understanding of diseases resulting from mutations.

Statistical thermodynamics

Code: CH4111 (1) Prerequisite: CH 2141

This course will provide an introduction to the probabilistic nature of physical chemistry, calculation of partition functions for simplified models of actual systems, derivation of thermodynamic quantities in terms of partition functions and applications to relevant systems.

Analytical biochemistry

Code: CH4149 (1) Prerequisite: CH3149

Introduction to biostudies including characterization and quantitative analysis of biomolecules by using various analytical methods including biosensor, electrophoresis, mass spectrometry, fluoro immunoassays, stripping volatametry, blood gas analysis, cell counting, automatic analyzers.

Laser chemistry

Code: CH4113 (1) Prerequisite: CH 3244

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry of pesticides

Code: CH 4119 (1) Prerequisite: CH 2143

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Industrial chemistry

Code: CH4155 (1) Prerequisite: CH3147

This will provide an overview of the chemical, biochemical and pharmaceutical industries, the principal processes, scale-up of laboratory methods, modeling of processes, economic factors, automation, data management, quality assurance, safety and project development. The course surveys areas as metallurgy, production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Textile chemistry

Code: CH 4121 (1) Prerequisite: CH 3250

This course provide the fundamentals of textile fibers including fiber structure, properties, identification, classification (cellulose, cotton flax, hemp jute-man-made, rayon acetate and triacetate protein, wool and silk mineral fibers) man made fibers, processing of textiles (purification and preliminary singeing, designing, scouring, bleaching and mercerizing dyeing) and kinds of forces by which dye molecules are bound to the fiber.

Forensic and criminal chemistry

Code: CH4161 (1) Prerequisite: CH3149

This course is an introduction to the use of science and the scientific method in law and criminal justice, with detailed examination of the techniques of forensic chemistry including organic, inorganic, and instrumental analysis. Topics include gunshot residue, drugs and toxicology, paint, arson and explosives, and biochemical methods such as electrophoresis, quality assurance, courtroom testimony, laboratory accreditation, and analyst certification will be discussed.

Practical physical chemistry (1)

Code: CH4240 (2), Prerequisite CH2240, CH3149

This course is designed to reinforce the application of theoretical physical concepts into an experimental framework. Several experiments will cover different physical chemistry topics ranging from kinetics, thermodynamics, and surface chemistry to electrochemistry and spectroscopy as well as measuring of molecular parameters.

Analysis of collected experimental data includes statistical error analysis and estimation of uncertainties, writing reports, oral presentation, students will have the chance to work in groups to acquire skills of team.

Dyes chemistry

Code: CH 4208 (1) Prerequisite: CH 2111

This course offers correlation of color and chemical constitution, synthetic routes for popular dyes of important types, electronic mechanisms for reactive dyes, chemistry of dye interactions with light, washing and other in-use influences, economic and environmental considerations, classification of dyes (nitroso, nitro, azo, triarylmethane, xanthane, vat, indigo, anthraquinone and reactive dyes), mechanisms of dyeing, basis of modern techniques for color specification, measurement, control, applications of color science to textiles, plastics, and color reproduction.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Selected applications of polymers

Code: CH4246 (1) Prerequisite CH4143

This course emphasizes on the synthesis, properties and industrial processes of products of poly(olefins), poly(vinyl chloride), poly(vinyl acetate), poly(urethanes), epoxies, silicones, styrene copolymers used as textile finishes, nonwoven binders, fabric coatings, composites, adhesives, foams, carpet backing adhesives.

Environmental Chemistry

Code: CH 4224 (1)

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given.

Advanced analytical chemistry

Code: CH4250 (1) Prerequisite: CH3149

This subject covers technical aspects and applications of major analytical separation methods and spectroscopy for qualitative and quantitative analysis. These methods include high performance liquid chromatography (HPLC), supercritical fluid

extraction and chromatography (SFE/SFC), ion chromatography (IC), and capillary electrophoresis (CE). The spectroscopic methods include atomic absorption spectroscopy (AAS) and atomic emission spectroscopy (AES), inductively-coupled plasma spectroscopy (ICP), ICP coupled with mass spectrometry (ICP-MS). Advances in the analytical methods concerning biosensors and fast techniques are also discussed.

Physical chemistry of polymers

Code: CH 4252 (1) Prerequisite CH4143

This course studies the methods of molecular weight determination (chemical, physical and molecular weight distribution), the effect of chemical structure (molecular shape, backbone structure, polarity, presence of bulky substituents and cross linking) on physical properties of polymers (chain flexibility, crystallinity, solubility, mechanical properties and thermal behavior). In addition some techniques for polymer processing are going to be discussed along with their technological applications.

Organic reaction mechanism

Code: CH4254 (1) Prerequisite : CH2143

The course concerns with the method determining the mechanism by the use of isotopes and spectroscopic methods. The study of the effect of structure on reactivity. The detailed study of the mechanism of different types of reactions as ionic substitution, elimination, addition and rearrangement reactions.

Supramolecular chemistry

Code: CH4218 (1) Prerequisite: CH3246, CH4143

This course is an introduction to supramolecular chemistry with emphasize on definitions, supramolecular interactions, supramolecular design, host-guest chemistry, self-assembly, macrocyclic hosts, cation and anion binding, coordination polymers, supramolecular chemistry, crystal engineering, self-assembled monolayers (SAMs), fullerenes and nanotubes, dendrimers, fibres, gels and polymers, applications of supramolecular chemistry in molecular devices and life.

Chemistry Courses for other programs

Material Science Program

Instrumental analysis (1)

Code: CH2171 (2+1) Pre-request: CH1202

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Organic chemistry

Code: CH2218 (2+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided.

Instrumental analysis (2)

Code: CH 3119 (1+1) Pre-request: CH1202

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Surface Chemistry and Catalysis

Code: CH 3143 (1) Prerequisite: CH 1202

Introduction to surface and colloid chemistry with emphasize on types and properties of interfaces (liquid-gas, liquid-liquid, gas-solid and solid-liquid), adsorption of gases and adsorption from solution, properties and types of colloid including classification and preparation, electrical aspects of surface chemistry and stability of colloid, emulsions and micellar solutions, applications in biological and technological processes. Theories of catalysis, homogeneous and heterogeneous catalysis as well as enzyme catalyzed reactions are discussed.

Photochemistry

Code: CH 3244 (1) Prerequisite: CH 1202

This course discusses the electronic transitions and selection rules, electronically excited states, photophysical and photochemical pathways following electronic excitation, fluorescence lifetime and quantum yield, types of fluorescence, fluorescence quenching, electronic states of molecular oxygen, kinetic rate constants of excited state processes, photochemical reaction and photosensitization.

Natural products

Code: CH 3250 (1+1) Prerequisite: CH 2218

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Polymer chemistry

Code: CH4105 (1), Prerequisite CH1202

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Solid State Chemistry

Code: CH4143 (1) Prerequisite: CH 1101

This course provides the bases of crystallography, polymorphism in solids, defects in solids, the exciton concept, intermediate states of solids, amorphous materials, liquid crystals, nanomaterials, band theory of electronic structure, semiconductors, photovoltaic devices and techniques in solid state chemistry.

Industrial chemistry

Code: CH4123 (2) Prerequisite: CH3143

This will provide an overview of the chemical, biochemical and pharmaceutical industries, the principal processes, scale-up of laboratory methods, modeling of processes, economic factors, automation, data management, quality assurance, safety and project development. The course surveys areas as metallurgy, production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Applied polymer science

Code: CH4222 (2) Prerequisite: CH4105,

This course emphasizes on the synthesis, properties and industrial processes of products of poly(olefins), poly(vinyl chloride), poly(vinyl acetate), poly(urethanes), epoxies, silicones, styrene copolymers used as textile finishes, nonwoven binders, fabric coatings, composites, adhesives, foams, carpet backing adhesives.

Biophysics Program

Principal of Biochemistry (1)

Code: BC2202 Credit (2) Prerequisite CH1202

Carbohydrate classification, derivatives and reactions, Lipid classification biological membrane and lipoprotein

Geology program

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Group Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Organic chemistry

Code: CH2145, (1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Chemistry of Transition Elements

Code: CH2204 (2) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Nuclear Chemistry

Code: CH 2210 (1) Prerequisite: CH 1202

This course will provide the fundamentals of nuclear chemistry including; nuclear structure, nuclear models (Fermi gas, liquid drop and nuclear shell models), isotopes (effects, separation and properties). Radioactivity and radioactive decay (modes, kinetics and mechanisms), nuclear reactions (fission and fusion) and isotopes chemistry, differences between nuclear fission and fusion are studied. Applications of radioactive decay in dating and radioactive materials/isotopes in radio-labeling, processing and environmental issues are given.

Petroleum chemistry and petrochemicals

Code: CH 4145 (1) Prerequisite: CH1202

This course provides general idea about the importance, occurrence and origin of petroleum, composition and specifications of crude petroleum and its products as well as some physical aspects concerning petroleum fuels, manufacturing processes, oil refinery and separation processes, production of motor and jet fuels, cracking, reforming, isomerisation, refining and treating processing, petrochemical industries and petrochemistry in everyday life.

Laser chemistry

Code: CH4113 (1) Prerequisite: CH 1202

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry/ Geology

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Principles of organic chemistry (2)

Code: CH2111, (2) Pre-request: CH1202

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Chemical Thermodynamics:

Code: CH2141 (2) Pre-request: CH1202

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Organic chemistry (3)

Code: CH 2214 (2+1) Prerequisite: CH 2143

This is a study of the properties and reactivity of carbon compounds containing more than one functional e.g. dienes, unsaturated alcohols, unsaturated carbonyl compounds and acids, compounds containing active methylene groups, in addition to the chemistry of saturated and unsaturated cyclic and acyclic compounds

Chemical Kinetics

Code: CH2240 (1+1) Prerequisite: CH2141

This course explains the concepts of chemical kinetics, reaction rate, molecularity and reaction order, factors affecting reaction rates, integrated rate equations (first, second, third and pseudo-order reactions), effect of temperature on reaction rate and Arrhenius equation, activation energy, applications to simple and complex reactions, collision and transition state theories, concepts and theories of catalysis as well as its types and applications.

Instrumental Analysis (1)

Code: CH2244 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Quantum Chemistry

Code: CH 3141 (1) Prerequisite: CH 1202

This is introductory quantum chemistry with an emphasis on the fundamentals of quantum mechanics, potential well, hydrogen atom, many-electron atoms, Hartree-Fock approximation, diatomic molecules, neutral molecules, application of quantum mechanics to solve problems in chemistry, investigation of electronic structures of atoms, molecules, compounds, and explanation of reaction mechanism, spectroscopy and molecular structures.

Surface Chemistry and Catalysis

Code: CH 3143 (1) Prerequisite: CH 2240

Introduction to surface and colloid chemistry with emphasize on types and properties of interfaces (liquid-gas, liquid-liquid, gas-solid and solid-liquid), adsorption of gases and adsorption from solution, properties and types of colloid including classification and preparation, electrical aspects of surface chemistry and stability of colloid, emulsions and miceller solutions, applications in biological and technological processes. Theories of catalysis, homogeneous and heterogeneous catalysis as well as enzyme catalyzed reactions are discussed.

Electrochemistry (1)

Code: CH 3145 (1) Prerequisite: CH 1202

This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernst equation and standard electrode potential, activity series, concentration cells, types of electrodes (gas-electrodes, metal/metal oxide-electrodes, amalgam-electrodes and glass-electrode), batteries and accumulators, fuel cells (principles, modes of action and types).

Chemistry of Transition Elements

Code: CH3147 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Instrumental analysis (2)

Code: CH 3149 (1+1) Prerequisite: CH2244

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Physical organic chemistry

Code: CH 3151 (1) Prerequisite: CH2143

This course provide a study of chemical structure and reactivity correlation, Hammett equation including the physical significance of σ - and ρ -values as well as applications, limitation and deviation of Hammett plots, neighboring group participation in nucleophilic and displacement reactions, in addition to studying the chemistry of reactive intermediates, precyclic reactions and aromaticity.

Heterocyclic chemistry

Code: CH 3153 (1+1) Prerequisite: CH2143

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings.

Molecular spectroscopy

Code: CH 3240 (1) Prerequisite: CH 3141

This course provides discussion for electromagnetic radiations and interactions between light and matter, theoretical bases of resonance spectroscopy, rotational spectra of diatomic molecules, IR- spectroscopy, vibration of diatomic vibrating rotary, Raman spectroscopy, electronic absorption spectroscopy of atoms, diatomic and polyatomic molecules as well as applications of spectroscopy to structural investigations.

Electrochemistry (2)

Code: CH 3242 (1+1) Prerequisite: CH 3145

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernst-Planck equation, Faradic and non Faradic processes, the ideal and non ideal polarized electrodes, electrical double layer, factors affecting rates of electrode reactions, over potential polarization, mass transfer, Butler-Volmer and Tafel equations, more complex electrode reactions, Dc-polarography and cyclic votammetry (theory and applications), basis of electrochemical corrosion (theory, polarization resistance and calculation of the corrosion rate).

Photochemistry

Code: CH 3244 (1) Prerequisite: CH 2240

This course discusses the electronic transitions and selection rules, electronically excited states, photophysical and photochemical pathways following electronic excitation, fluorescence lifetime and quantum yield, types of fluorescence, fluorescence quenching, electronic states of molecular oxygen, kinetic rate constants of excited state processes, photochemical reaction and photosensitization.

Coordination Chemistry

Code: CH 3246 (1) Prerequisite: CH 3147

This course explains nomenclature of coordination compounds, structure, bonding, properties, and reactivity of coordination compounds. Topics include theories of metal-ligand bonding (crystal field theory and molecular orbital theory), electronic spectra, detection and structural determination of complexes, isomerism among inorganic complexes and stability of complexes, biological and industrial applications of coordination compounds.

Organic spectroscopy

Code: CH 3248 (2) Prerequisite: CH 3149

This is a study of modern spectroscopic techniques used in the determination of molecular structure with emphasize on the interpretation of spectra including nuclear magnetic resonance, ultraviolet, infrared and mass spectroscopy.

Natural products

Code: CH 3250 (1+1) Prerequisite: CH 2214

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological

importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Statistical thermodynamics

Code: CH4111 (1) Prerequisite: CH 2141

This course will provide an introduction to the probabilistic nature of physical chemistry, calculation of partition functions for simplified models of actual systems, derivation of thermodynamic quantities in terms of partition functions and applications to relevant systems.

Laser chemistry

Code: CH4113 (1) Prerequisite: CH 3244

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry of pesticides

Code: CH 4119 (1) Prerequisite: CH2143

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Textile chemistry

Code: CH 4121 (1) Prerequisite: CH 3250

This course provide the fundamentals of textile fibers including fiber structure, properties, identification, classification (cellulose, cotton flax, hemp jute-man-made, rayon acetate and triacetate protein, wool and silk mineral fibers) man made fibers, processing of textiles (purification and preliminary singeing, designing, scouring, bleaching and mercerizing dyeing) and kinds of forces by which dye molecules are bound to the fiber.

Practical organic chemistry (1)

Code: CH4141 (2), Prerequisite CH2143

This serves as a laboratory course with emphasis on the techniques associated with the synthesis, isolation, purification and identification of organic compounds by physical properties, IR and NMR spectral analyses.

Solid State Chemistry

Code: CH4143 (1) Prerequisite: CH 1101

This course provides the bases of crystallography, polymorphism in solids, defects in solids, the exciton concept, intermediate states of solids, amorphous materials, liquid crystals, nanomaterials, band theory of electronic structure, semiconductors, photovoltaic devices and techniques in solid state chemistry.

Petroleum chemistry and petrochemicals

Code: CH 4145 (1) Prerequisite: CH2143

This course provides general idea about the importance, occurrence and origin of petroleum, composition and specifications of crude petroleum and its products as well as some physical aspects concerning petroleum fuels, manufacturing processes, oil refinery and separation processes, production of motor and jet fuels, cracking, reforming, isomerisation, refining and treating processing, petrochemical industries and petrochemistry in everyday life.

Analytical biochemistry

Code: CH4149 (1) Prerequisite: CH3149

Introduction to biostudies including characterization and quantitative analysis of biomolecules by using various analytical methods including biosensor, electrophoresis, mass spectrometry, fluoro immunoassays, stripping voltametry, blood gas analysis, cell counting, automatic analyzers.

Industrial chemistry

Code: CH4155 (1) Prerequisite: CH3147

This will provide an overview of the chemical, biochemical and pharmaceutical industries, the principal processes, scale-up of laboratory methods, modeling of processes, economic factors, automation, data management, quality assurance, safety and project development. The course surveys areas as metallurgy, production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Bioinorganic Chemistry

Code: CH 4159 (1) Prerequisite: CH 3246

This course will provide an introduction and overview of metals in biology with emphasize on the structure, reactivity and reactions of biological molecules (metalloproteins, enzymes, hemoglobin, myoglobin, hemerythrin and cytochromes) from an inorganic prospective. The importance of these is discussed in regard to drug design and understanding of diseases resulting from mutations.

Forensic and criminal chemistry

Code: CH4161 (1) Prerequisite: CH3149

This course is an introduction to the use of science and the scientific method in law and criminal justice, with detailed examination of the techniques of forensic

chemistry including organic, inorganic, and instrumental analysis. Topics include gunshot residue, drugs and toxicology, paint, arson and explosives, and biochemical methods such as electrophoresis, quality assurance, courtroom testimony, laboratory accreditation, and analyst certification will be discussed.

Dyes chemistry

Code: CH 4208 (1) Prerequisite: CH 2111

This course offers correlation of color and chemical constitution, synthetic routes for popular dyes of important types, electronic mechanisms for reactive dyes, chemistry of dye interactions with light, washing and other in-use influences, economic and environmental considerations, classification of dyes (nitroso, nitro, azo, triarylmethane, xanthane, vat, indigo, anthraquinone and reactive dyes), mechanisms of dyeing, basis of modern techniques for color specification, measurement, control, applications of color science to textiles, plastics, and color reproduction

Supramolecular chemistry

Code: CH4218 (1) Prerequisite: CH3246, CH4143

This course is an introduction to supramolecular chemistry with emphasize on definitions, supramolecular interactions, supramolecular design, host-guest chemistry, self-assembly, macrocyclic hosts, cation and anion binding, coordination polymers, supramolecular chemistry, crystal engineering, self-assembled monolayers (SAMs), fullerenes and nanotubes, dendrimers, fibres, gels and polymers, applications of supramolecular chemistry in molecular devices and life.

Environmental Chemistry

Code: CH 4224 (1)

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given.

Practical physical chemistry (1)

Code: CH4240 (2), Prerequisite CH2240, CH3149

This course is designed to reinforce the application of theoretical physical concepts into an experimental framework. Several experiments will cover different physical chemistry topics ranging from kinetics, thermodynamics, and surface chemistry to electrochemistry and spectroscopy as well as measuring of molecular parameters. Analysis of collected experimental data includes statistical error analysis and estimation of uncertainties, writing reports, oral presentation, students will have the chance to work in groups to acquire skills of team.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Selected applications of polymers

Code: CH4246 (1) Prerequisite CH2143

This course emphasizes on the synthesis, properties and industrial processes of products of poly(olefins), poly(vinyl chloride), poly(vinyl acetate), poly(urethanes), epoxies, silicones, styrene copolymers used as textile finishes, nonwoven binders, fabric coatings, composites, adhesives, foams, carpet backing adhesives.

Advanced analytical chemistry

Code: CH4250 (1) Prerequisite: CH3149

This subject covers technical aspects and applications of major analytical separation methods and spectroscopy for qualitative and quantitative analysis. These methods include high performance liquid chromatography (HPLC), supercritical fluid extraction and chromatography (SFE/SFC), ion chromatography (IC), and capillary electrophoresis (CE). The spectroscopic methods include atomic absorption spectroscopy (AAS) and atomic emission spectroscopy (AES), inductively-coupled plasma spectroscopy (ICP), ICP coupled with mass spectrometry (ICP-MS). Advances in the analytical methods concerning biosensors and fast techniques are also discussed.

Physical chemistry of polymers

Code: CH 4252 (1) Prerequisite CH4143

This course studies the methods of molecular weight determination (chemical, physical and molecular weight distribution), the effect of chemical structure (molecular shape, backbone structure, polarity, presence of bulky substituents and cross linking) on physical properties of polymers (chain flexibility, crystallinity, solubility, mechanical properties and thermal behavior). In addition some techniques for polymer processing are going to be discussed along with their technological applications.

Organic reaction mechanism

Code: CH4254 (1) Prerequisite : CH2143

The course concerns with the method determining the mechanism by the use of isotopes and spectroscopic methods. The study of the effect of structure on reactivity. The detailed study of the mechanism of different types of reactions as ionic substitution, elimination, addition and rearrangement reactions.

Botany (Special)

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Chemical Thermodynamics:

Code: CH2141 (2) Pre-request: CH1202

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Chemical Kinetics

Code: CH2240 (1+1) Prerequisite: CH2141

This course explains the concepts of chemical kinetics, reaction rate, molecularity and reaction order, factors affecting reaction rates, integrated rate equations (first, second, third and pseudo-order reactions), effect of temperature on reaction rate and Arrhenius equation, activation energy, applications to simple and complex reactions, collision and transition state theories, concepts and theories of catalysis as well as its types and applications.

Organic chemistry (2)

Code: CH3173 (1+1) Pre-request: CH 2143

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Instrumental Analysis

Code: CH3171 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Transition Elements

Code: CH3280 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Chemistry of Heterocyclic compounds

Code: CH 3274 (1+1) Prerequisite: CH 3173

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings.

Natural products

Code: CH 3250 (1+1) Prerequisite: CH 2143

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloquinoline and tropane alkaloids), carotenoids, in

addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D...) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Laser chemistry

Code: CH 3278 (1) Prerequisite: CH 3171

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry of pesticides

Code: CH 4119 (1) Prerequisite: CH 2143

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Instrumental analysis (2)

Code: CH 4171 (1+1) Prerequisite: CH3171

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Environmental Chemistry

Code: CH 4224 (1)

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric

and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given.

Solutions chemistry

Code: CH4232 (1) Prerequisite: CH1202

This course describes the quantitative approach of physical chemistry in liquid solutions with emphasized on the role of solvent effect. The topics include studies of the dielectric, spectroscopic, thermodynamic, transport or relaxation properties of both electrolytes and nonelectrolytes in liquid solutions.

Microbiology (Special)

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Chemical Thermodynamics:

Code: CH2141 (2) Pre-request: CH1202

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron

equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Chemical Kinetics

Code: CH2240 (1+1) Prerequisite: CH2141

This course explains the concepts of chemical kinetics, reaction rate, molecularity and reaction order, factors affecting reaction rates, integrated rate equations (first, second, third and pseudo-order reactions), effect of temperature on reaction rate and Arrhenius equation, activation energy, applications to simple and complex reactions, collision and transition state theories, concepts and theories of catalysis as well as its types and applications.

Principles of organic chemistry (2)

Code: CH2274 (2) Pre-request: CH2143

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Organic chemistry (3)

Code: CH3173 (1+1) Pre-request: CH 2143

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Instrumental Analysis (1)

Code: CH3171 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, UV-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Transition Elements

Code: CH3280 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Chemistry of Heterocyclic compounds

Code: CH 3274 (1+1) Prerequisite: CH 3173

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings.

Natural products

Code: CH 3250 (1+1) Prerequisite: CH 2143

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Laser chemistry

Code: CH 3278 (1) Prerequisite: CH 3171

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry of pesticides

Code: CH 4119 (1) Prerequisite: CH 2143

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Instrumental analysis (2)

Code: CH 4171 Prerequisite: CH3171

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Biochemistry (1)

Code: CH4173 (1), Prerequisite CH1202

This course covers the chemistry and functions of the constituents of living cells including carbohydrates, proteins, lipids, nucleic acids, vitamins, enzymes and coenzymes, enzymatic catalysis, metabolism of carbohydrates, proteins, lipids and nucleic acids with special attention to interrelationships in metabolic rates of these important constituents of living cells.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Environmental Chemistry

Code: CH 4224 (1)

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given.

Solutions chemistry

Code: CH4232 (1) Prerequisite: CH1202

This course describes the quantitative approach of physical chemistry in liquid solutions with emphasized on the role of solvent effect. The topics include studies of the dielectric, spectroscopic, thermodynamic , transport or relaxation properties of both electrolytes and nonelectrolytes in liquid solutions.

Biotechnology

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Instrumental Analysis (1)

Code: CH2244 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Instrumental analysis (2)

Code: CH 3149 (1+1) Prerequisite: CH2244

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in

quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Coordination Chemistry

Code: CH 3246 (1)

This course explains nomenclature of coordination compounds, structure, bonding, properties, and reactivity of coordination compounds. Topics include theories of metal-ligand bonding (crystal field theory and molecular orbital theory), electronic spectra, detection and structural determination of complexes, isomerism among inorganic complexes and stability of complexes, biological and industrial applications of coordination compounds.

Laser chemistry

Code: CH 3278 (1) Prerequisite: CH 3149

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Water treatment

Code: CH4127 (1) Prerequisite: CH2105

This will provide an overview on the sources of water (ground water, upland lakes, rivers, canals and low land reservoirs, rainwater, atmospheric water, desalination of sea-water), importance of water in life, water cycle, types of water to be treated as well as the types of contaminants to be treated and methods of water treatment including; ultraviolet light, filtration, water softening, reverse osmosis, ultra-filtration, deionization and powdered activated carbon treatment.

Bioinorganic Chemistry

Code: CH 4159 (1) Prerequisite: CH 3246

This course will provide an introduction and overview of metals in biology with emphasize on the structure, reactivity and reactions of biological molecules (metalloproteins, enzymes, hemoglobin, myoglobin, hemerythrin and cytochromes) from an inorganic prospective. The importance of these is discussed in regard to drug design and understanding of diseases resulting from mutations.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and

molecular structure of polymers as well as additives that improve the properties of plastics.

Environmental Chemistry

Code: CH 4224 (1)

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given.

Entmology (Special)

Chemical Thermodynamics:

Code: CH2141 (2) Pre-request: CH1202

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chemistry of Main Group Elements

Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Instrumental Analysis (1)

Code: CH2244 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Instrumental analysis (2)

Code: CH 3149 (1+1) Prerequisite: CH2244

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

Organic chemistry (2)

Code: CH 3173 (1+1) Prerequisite: CH 2143

This is a study of the properties and reactivity of carbon compounds containing more than one functional e.g. dienes, unsaturated alcohols, unsaturated carbonyl compounds and acids, compounds containing active methylene groups, in addition to the chemistry of saturated and unsaturated cyclic and acyclic compounds

Transition Elements

Code: CH 3280 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Chemistry of Heterocyclic compounds

Code: CH 3274(1+1) Prerequisite: CH 3173

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings.

Photochemistry

Code: CH 3244 (1) Prerequisite: CH 2244

This course discusses the electronic transitions and selection rules, electronically excited states, photophysical and photochemical pathways following electronic excitation, fluorescence lifetime and quantum yield, types of fluorescence, fluorescence quenching, electronic states of molecular oxygen, kinetic rate constants of excited state processes, photochemical reaction and photosensitization.

Natural products

Code: CH 3250 (1+1) Prerequisite: CH 2246

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Laser chemistry

Code: CH4113 (1) Prerequisite: CH 3244

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

Chemistry of pesticides

Code: CH 4119 (1) Prerequisite: CH 2143

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

Environmental Chemistry

Code: CH 4224 (1)

This is an introductory course in the chemistry of environment. The chemical nature of environmental processes is examined with a major focus on atmospheric and aquatic chemistry, urban pollution, climate change, and acid rain. In addition, the use and environmental fate of heavy metals, chlorinated organic chemicals, and pesticides are discussed. The different techniques used in pollution analysis are given.

Solutions chemistry

Code: CH4232 (1) Prerequisite: CH1202

This course describes the quantitative approach of physical chemistry in liquid solutions with emphasized on the role of solvent effect. The topics include studies of the dielectric, spectroscopic, thermodynamic , transport or relaxation properties of both electrolytes and nonelectrolytes in liquid solutions.

Zoology (Special)

Principles of Analytical Chemistry

Code: CH2105, (1+1) Pre-request: CH1202

This course studies non-instrumental methods of quantitative chemical analysis including volumetric methods which are based on equilibria in aqueous solutions such as; acid-base (including acid/base and buffer systems), redox, precipitation and complex formation reactions, types of errors in chemical analysis, laboratory experiments concerning the application of these methods in chemical determinations and problem solving.

Practical, 3 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

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Code: CH2107 (2) Prerequisite: CH1101

The course discusses the structures and properties of main group elements (s & p-block elements) including; alkali and alkaline earth metals, boron, carbon and nitrogen groups, chalcogenes, halogens and noble gases. Properties of elements based on atomic structure & electronic configurations, trends of properties, basic chemistry of the main group elements, extraction and different uses of these elements, nomenclature of simple inorganic compounds.

Chemical Thermodynamics:

Code: CH2141 (2) Pre-request: CH1202

This course discusses the basic concepts, the applications and limitations of thermodynamics, systems, work and energy, laws of thermodynamics (first, second and third) with applications to systems having chemical changes, fundamental equations, Gibbs free energy and equilibrium in multi-phase systems, Clapeyron equation and phase equilibria with emphasize on the chemical potential and chemical equilibria.

Principles of organic chemistry (1)

Code: CH2143, (1+1) Pre-request: CH1202

The topics covered in this course include nomenclature, structure and reactions of alkanes, alkenes, alkynes, aromatic hydrocarbons, alkyl halides, and alcohols, ethers and thio-compounds.. Classification of organic compounds, bonding and reactions of aliphatic hydrocarbons is provided

Principles of organic chemistry (2)

Code: CH2274 (2) Pre-request: CH2143

The course continues to introduce the more important functional groups present in organic molecules as well as their physical and chemical properties. Topics generally include nomenclature, structure and reactions of aldehydes, ketones, carboxylic

acids, nitrogen compounds and its derivatives. The chemistry of aromatic compounds as well as mono- saccharides is provided.

Instrumental Analysis (1)

Code: CH3171 (1+1) Prerequisite: CH2105

This course concerns with the spectroscopic methods of analysis and discusses the nature of radiations, spectral regions and interactions of radiations with the matter, basic components of spectroscopic instruments, Uv-Visible absorption spectrophotometry and Beer's law, IR-spectrophotometry, molecular luminescence (fluorometry and phosphorimetry), flame photometry, atomic absorption and emission spectroscopy, X-ray techniques, refractometry and polarimetry. The applications of these techniques in qualitative and quantitative determinations are covered.

Organic chemistry (3)

Code: CH 3173 (1+1) Prerequisite: CH 2274

This is a study of the properties and reactivity of carbon compounds containing more than one functional e.g. dienes, unsaturated alcohols, unsaturated carbonyl compounds and acids, compounds containing active methylene groups, in addition to the chemistry of saturated and unsaturated cyclic and acyclic compounds

Transition Elements

Code: CH 3280 (1) Pre-requisite: CH2107

The scope of this course is the general properties and coordination chemistry of transition metals (d & f-block elements) including the definitions, periodic properties based on electronic configuration (valence, common oxidation states, atomic radii, ionization energies and standard oxidation potentials). Emphasis is placed on the chemistry of the transition metals, extraction, industrial and biological importance of transition metals.

Instrumental analysis (2)

Code: CH 3149 (1+1) Prerequisite: CH2244

This is an introduction to chromatographic methods of analysis with emphasize on the principles of different chromatographic techniques (paper, thin-layer, column, ion-exchange, gel permeation, gas and solvent extraction chromatography, electrophoresis and HPLC), applications of chromatographic methods in quantitative and quantitative determinations. Theoretical bases and some applications of the thermal methods of analysis (TGA, DTA, DSC, thermo-mechanical and dynamic mechanical analysis) are included.

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Code: CH 3274(1+1) Prerequisite: CH 3173

This course discusses the general nature of heterocyclic compounds, basic terms and principles in heterocyclic chemistry, synthesis and reactivity of heterocyclic compounds containing 5-, 6- and 7-membered rings with one or more of hetero-atoms N, O and S, and condensed systems containing such rings.

Photochemistry

Code: CH 3244 (1) Prerequisite: CH 1202

This course discusses the electronic transitions and selection rules, electronically excited states, photophysical and photochemical pathways following electronic excitation, fluorescence lifetime and quantum yield, types of fluorescence, fluorescence quenching, electronic states of molecular oxygen, kinetic rate constants of excited state processes, photochemical reaction and photosensitization.

Natural products

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Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products including the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzyloisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D....) and vitamins (vitamin B_{1,2,5,6}, E, K and A).

Laser chemistry

Code: CH4113 (1) Prerequisite: CH 3244

This course will provide the basic theory and concepts behind laser chemistry, covering the operation of lasers, key properties of laser radiations, features of various sources and commonly used techniques as well as the data acquisition methods and applications of laser in industry, environmental studies, biology and medicine.

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Code: CH 4119 (1) Prerequisite: CH 2143

This course discusses rationale behind the development of pesticides, physical and chemical properties as well as their use, modes and site(s) of action in relation to chemical properties, uptake, translocation and metabolism in target and non-target organisms, the principles of assessing pesticide selectivity, development of pesticides in industry and public institutions, formulations of pesticides and use of adjuvant to enhance efficacy, aquatic and terrestrial ecotoxicology in relation to pesticide loads, intentional and not intentional discharge in the environment and risk assessment of the pesticide use.

Biochemistry (1)

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This course covers the chemistry and functions of the constituents of living cells including carbohydrates, proteins, lipids, nucleic acids, vitamins, enzymes and coenzymes, enzymatic catalysis, metabolism of carbohydrates, proteins, lipids and nucleic acids with special attention to interrelationships in metabolic rates of these important constituents of living cells.

Polymer chemistry

Code: CH4244 (1), Prerequisite CH2143

This is introductory course to macromolecules and synthetic polymers including free radical and ionic polymerization, molecular weights distribution, mechanical and viscoelastic properties, polymer structure in relation to utilization, terms and concepts of addition, condensation and ring opening polymerization, synthesis of industrially important polymers, relationship between physical properties and molecular structure of polymers as well as additives that improve the properties of plastics.

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Solutions chemistry

Code: CH4232 (1) Prerequisite: CH1202

This course describes the quantitative approach of physical chemistry in liquid solutions with emphasized on the role of solvent effect. The topics include studies of the dielectric, spectroscopic, thermodynamic, transport or relaxation properties of both electrolytes and nonelectrolytes in liquid solutions.



Programme Title	Geology
Programme Type	Special
Department(s)	Geology

GE 1101 Physical Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Introduction, Theories on the origin of the Universe and the Solar System– The atmosphere, the hydrosphere, the lithosphere and the Earth's interior – The Earth's crust – Plate tectonic and the origin of mountains and oceans – Internal geologic processes and tectonic movements – Structures – Earthquakes and Volcanicity –External geologic processes; Weathering (physical and chemical), wind action, running water (rainfall, rivers and deltas), groundwater and its geologic action, waves and current actions in coastal areas, glacial erosion –. Laboratory studies of topographic and geologic maps.

GE 1103 Historical Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Introduction to the Earth's history, the most important events occurred during the geologic history of the Earth (e.g. orogenic, sedimentologic, biologic climatic, etc.). The origin of the atmosphere and ocean, orbital forcing and its effect on the earth's climate. Earth's age-dating, origin of life on the Earth, the record of life forms (fauna and flora) that evolved throughout the geologic time. Quaternary history of mammals. Extinct fossil groups and vertebrate evolution. Laboratory studies of paleogeographic and geologic maps.

GE 1202 Earth's Material (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 1101

This course covers the nature and properties of the materials which make up the earth and is divided into three parts; "*Crystallography, Mineralogy* and *Petrology*". The first part includes definition of crystallography and crystal formation, and general description of crystal morphology. The second part concerns with the physical and chemical properties of minerals, and classification of minerals. The third part introduces the rock cycle, and the basic concepts of identification, classification and origin of igneous, sedimentary and metamorphic rocks. Laboratory exercises consist of hand specimen description and classification of crystal models, minerals and rocks.

GE 1204 Introduction to Geophysics (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, definition and branches of geophysics. Gravity field of the Earth. Geoid's, GPS and isostasy. Seismic methods and earthquake. Magnetic and paleomagnetic methods. Electric and Geothermal methods. Borehole geophysics. Practical work of some measured geophysical parameters.

GE 2101 Crystallography (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction to Crystallography, Crystal Symmetry and crystallization, Stereographic projection, Intercepts, parameters and indices, Cubic system, Tetragonal system, Hexagonal system, Trigonal system, Orthorhombic system, Monoclinic system, Triclinic system, Crystal aggregates, Crystal chemistry.

GE 2103 Structural Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Crystal chemistry: i- crystal lattice, lattice planes, glide planes, screw axis, fourteen bravais lattice, ii- Coordination, iii- Chemical adaptability and iv- Bonding forces in crystals. Mineral structures : metallic minerals, covalent minerals, molecular minerals and ionic minerals. Practical work includes identification of mineral structures of metallic- homopolar, molecular and ionic minerals.

GE 2105 Optical Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, polarization and polarized microscope, preparation of microscopic thin sections in minerals and rocks, Optics of isotropic minerals and their indicatrix, Measuring the refractive index, Optics of anisotropic minerals: Uniaxial, biaxial and their indicatrix, Optical properties of minerals in planed and between crossed Nichols, Interference colors, Optical orientation and extinction angle, Interference figures. Microscopic examination and description of selected minerals in thin sections.

GE 2107 Principles of Stratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction and basic principles of stratigraphy, Types of bedding, Stratification and layering of rocks, Sea level changes and the sedimentation style, Cyclic successions, Stratigraphic contacts, The use of unconformities in dating geological events, Relative geologic time, Major types of stratigraphic units.

GE 2109 Micropaleontology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, , Biology of foraminifera, Morphological characteristics of foraminiferal tests, structure and arrangements of chambers, overall shape of the tests, aperture, suture, peripheral and umbilical characters, shell wall and surface ornamentation, Taxonomic classification, Ecology and significance of foraminifera Practical work includes methods of preparation and examination of faunal content.

GE 2111 Gemstones (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, The nature of crystals, The beauty of colored gems, The beauty of Phenomenal and ornamental stones, Physical properties of gemstones, Durability, Gemological properties of gemstones, Gem Description, Diamond, Ruby, Sapphire, Beryl, Emerald, Chrysoberyl, Moonstone, Opal, Quartz and Peridot, Topaz, Agate and Turquoise. Cutting of inorganic ones, Organic gemstones, Synthetic and artificial products, Uses of gemology in Egypt and Arab Countries.

GE 2113 Vertebrate Paleontology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, definitions, Subphylum: Vertebrata; Superclass: Pisces and Superclass: Tetrapoda (Amphibia, Reptilia, Aves and Mammalia). Dinosaur paleobiology and the origin of birds. Major mammalian lineages and Primate origins. Importance of Fayoum province in Egypt as a famous locality for vertebrate fossils. Wadi El-Hitan as a world heritage protectorate in Egypt. laboratory exercises include examples of each class.

GE 2115 Field Training (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, traverse types, methods and techniques of geologic surveying, Field equipments (Compass, Alidade, Total Station, GPS), the nature and construction of topographic and geologic maps, Preparation of topographic maps. Laboratory and field training applying geologic traverses and preparation of topographic maps.

GE 2202 Rock-Forming Minerals (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Introduction, Chemistry, Stability, Mineral reaction and Optical properties of the following: Nesosilicates (olivine group, humite group, garnet group, Zircon and Sphene), Sorosilicates (Epidote group, Melilite group), Ring silicates (Beryl, Tourmaline and Cordierite), Sheet silicates (Mica group, Pyrophyllite C, talc, Chlorite, Serpentine), Single chain silicates (Pyroxene group), Double chain silicate (Amphibole group), and Tectosilicates (Feldspar group, Silica minerals and Sodalitefeldspathoite group). Practical work includes identification of the optical properties of the above mentioned minerals.

GE 2204 Igneous Petrology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Introduction, Earth's interior, source of heat and heat transfer, melting and generation of magma, mixing of magma, composition of magma in different tectonic settings, magmatic differentiation in open and closed systems, Bown's reaction series, chemical and mineralogical classifications of some igneous rocks. Laboratory study consists of hand specimens identification and examination.

GE 2206 Metamorphic Petrology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Introduction, Earth's heat and pressure, fluids and their generation, metamorphism and its agents, mineral assemblages and textures, types of metamorphism, tectonics and metamorphism. Laboratory study consists of hand specimens identification and examination

GE 2208 Lithostratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction and stratigraphic laws, General characteristics of sediments, Stratigraphic analysis, Strata configuration and boundaries, Stratigraphic units, Lithostratigraphy, Biostratigraphy, Chronostratigraphy and Geochronology, Breaks in sedimentations, Stratigraphic correlation, Other stratigraphic units, Stratigraphic data presentation

GE 2210 Micropaleontology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2109

Introduction, Test, Morphology, Wall structure and arrangement of some selected microfauna including Nummulites, Operculina, Miogypsina, calcareous algae, calcareous nannoplankton, Pollen and Spores, Conodonts, Radiolaria, and Diatoms. Ecology and significance of microfauna. Practical work includes examination, classification and description of some selected fauna and flora.

GE 2212 Macropaleontology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction and Earth history, Geologic Time Scale, Fossils and fossilization, Significance of fossils, Age determination, Ecology and mode of life, Taxonomy and classification, Phylum Mollusca, Class: Pelecypoda, Class Gastropoda, Class Cephalopoda. Practical work includes examination, classification and description of some selected taxa.

GE 2224 Special Course (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

A course covering selected topics in geology and to be specified by the department committee each year. It may be repeated for credit when course topic varies.

GE 2214 Applied Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction to mineralogy, genesis, occurrence and physico-chemical characteristics of the most important minerals and rocks including: clay minerals, limestones, cement/concrete aggregates, building stone,..... together with their industrial applications, and the process of mineralogy and the factors that determine the quality of the resources and the end-products. Practical work consists of specification of the physico-chemical characteristics of raw materials used in different industries.

GE 2216 Advanced Stratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction; Stratigraphic subdivisions (litho-, bio-, chrono-) and event stratigraphy. Stratigraphic laws, sedimentary environments; coastal environments, shallow marine environments, shelf sediments and processes. Sedimentary facies, facies stacking patterns, sea-level changes, accommodation space, sedimentation rate, shoreline trajectory. Sequence stratigraphy, definition, basics, significance. Sequence stratigraphic elements; key surfaces, parasequence, parasequence sets and stacking patterns, systems tracts. Sequence stratigraphy of coastal and shallow marine environments; case studies. Applications of sequence stratigraphy

GE 2218 Paleoecology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Paleoecological data derived from sedimentology, mineralogy, geochemistry and paleontology. Study of some selected ancient organisms and their environments. Environmental parameters. Populations in paleoecology, Paleobiogeography and climate. The ice age, global warming and sea level rise, aspects of Paleozoic, Cenozoic global climate, Paleoclimatic data from fauna and flora.

GE 2220 Field Training (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Observing and collecting data and samples, using compass, clinometer, hand level, GPS and Total Station, plotting geologic features on a base map, Mapping geologic features on aerial photographs, making a geologic map from aerial photographs, Measuring stratigraphic sections. Laboratory and field training include preparing and interpretation of geologic maps and cross-sections.

GE 3101 Structural Geology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction to structural Geology, Measurements of attitudes of strata and bedding planes, Non-tectonic structures, Stress and Strain, Field Study of Geologic Structures, Types of Unconformities, Folds and their Types, Faults and their Classification, Joints, Cleavage- foliation – lineation , and shear zones. Practical work includes drawing and interpretation of geologic structural maps.

GE 3103 Igneous Petrology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2204

Introduction, definitions and common terms in igneous petrology, distribution of igneous rocks in different tectonic settings, Forms, , Field relations, Structures and Textures, Classification, Petrography, Binary system, Tertiary system, Quaternary system. Laboratory study consists of hand specimens and petrographic examination under the microscope.

GE 3105 Metamorphic Petrology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2206

Introduction, definitions, Metamorphic fabrics, Metamorphic facies and grades, Contact, Dynamic, Ocean floor, Regional and ultrahigh pressure metamorphism, Metaplates, Metabasites, Meta-carbonates and Calc-Silicates, meta-ultramafics, distribution of metamorphic rocks in tectonic settings, Field relations and observations, Phase rules and Mineral transformations. Laboratory study consists of hand specimens and petrographic examination under the microscope.

GE 3107 Sedimentary Petrology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Sedimentary particles, Origin and mode of formation of sedimentary particles, Mineralogical composition of sedimentary particles, Detrital and non-detrital minerals, Textures of sedimentary rocks, Primary structures of sedimentary rocks, Weathering processes, Transportation processes, Sedimentation processes, Depositional environments. Practical work includes identification of mineral grains, grain size analyses and data interpretation, determination of grain shape, roundness and sphericity, and XRD identification of clay minerals.

GE 3109 Macropaleontology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2212

Introduction, Phylum: Bryozoa, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina, Trace fossils and Plants, Paleoecology and paleoenvironment. Practical work includes examination, classification and description of some selected taxa.

GE 3111 Field Geology and Field Studies (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Detailed mapping and sampling, Mapping of Igneous, Sedimentary and Metamorphic Rocks, Unconformities and folds, Stereonets and faults, Cross-sections, Subsurface mapping techniques, Preparing and writing a geologic report. Field training include sampling and interpreting geologic maps, applied geologic problems.

GE 3125 Geophysics (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Definition and branches of geophysics, Gravity field of the Earth, Geoid, GPS and isostasy, Seismic methods and earthquakes, Magnetic and paleomagnetic methods, Electric and geothermal methods, Borehole geophysics, Practical work of some measured geophysical parameters.

GE 3113 Marine Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction, ocean basins, sea floor topography and bathymetry. Ocean water circulation and its driving force, physical and chemical properties of ocean water, Types of continental margins, deep ocean floor, mid-ocean ridges and trenches, continental shelf, slope, and rise, submarine canyons, seamounts, abyssal plain, basin-floor fans. Marine sediments, coastal zone geology and classifications. Sediments of nearshore environments. Sea-level, water depth, climate, hazards. Sea-level and sedimentation. Marine resources, manganese nodules. Marine sediment sampling, description and instruments.

GE 3115 Non-metallic Deposits (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Classification basis of the principal uses in order to lend emphasis to the recent utilization of these resources. Ceramic materials, metallurgical and refractory material: industrial and manufacturing materials: building materials, fertilizer, abrasives. Occurrence, processing, economic and applications of non-metallic minerals: Sand and sandstones, Siliceous raw materials, Clay minerals, Carbonate rocks, Salt minerals, Sulphates, Sulfur, Fluorine minerals, Boron minerals, Volcaniclastic rocks, Graphite and diamond, Feldspars and nepheline syenite, Asbestos, Zirconium. Non-metallic deposits in Egypt.

GE 3117 Rock Mechanics (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction, Geological classification of rocks, Engineering classification of rock masses, Index properties of rocks, stress and strain in rocks, elastic and time-dependent behavior of rocks, state of stress in rock masses, failure mechanisms, Stress-strain relationship in rocks, Measurement of rock stresses and lab testing. Geological and engineering applications.

GE 3119 Palynology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2109

Definition, historical matters, purposes, disadvantages and limitations, the natural history of Palynomorphs, Spores / pollen morphology, Methods of study, Applied Palynology and case studies from Egypt. Practical work focus on studying palynomorphs from the Precambrian to Holocene in Egypt in addition to presenting data quantitatively in the form of figures, percentages or both.

GE 3121 Trace Fossils (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2109

Introduction, Types of trace fossil preservation, Ethological (Behavioral) classification of trace fossils, The characteristics of the eight main groups (Cubichnia, Domichnis, Fugichnia, Equilibrichnia, Repichnia, Pascichnia, Agrichnia, Fodinichnia), Marine ichnofacies classification (Trypanites, Skolithos, Cruziana, Zoophycos and Nereites ichnofacies), Evolution of trace fossils, Geological importance of trace fossils, Applications from Egypt and other countries.

GE 3123 Lab Techniques (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

This course is designed to cover various techniques used in soft and hard rocks. Soft rocks techniques include: grain size analysis, heavy mineral separation, preparation of thin sections and staining techniques, XRD of clay minerals and bulk samples. Hard rocks techniques include preparation of thin and thin polished sections, separation of minerals (electromagnetic and microscopic), major and trace elements (including REE), Isotope analyses.

GE 3202 Tectonic Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3101

General introduction, Outline of available theories, Geosynclinal theory, Earth forces and the kinds of faulting they produce, Boundary zones between crustal plates, constructive, destructive and conservative plate boundaries, Continental drift, Sea-floor spreading, Subduction zones, Transform faults, Global wrench tectonic, Major lithospheric plates of the Earth, Egypt in the framework of global tectonics.

GE 3204 Subsurface Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction, Examination and Application of the techniques employed in subsurface geologic analysis, Theory of open hole logging operations, Analysis of log records, Use of log records to construct various types of subsurface maps, Examinations of well cuttings and cores, Methods of calculating water saturation, Porosity and probable lithologies, Representation and interpretation of subsurface data.

GE 3206 Biostratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2208

Stratigraphic distribution of foraminifera - through Paleozoic, Mesozoic, the K/T boundary, Paleocene-Eocene boundary, Tertiary larger foraminifera and their biostratigraphic importance and Stratigraphic distribution of macrofossils through Paleozoic, Mesozoic, and Cenozoic eras.

GE 3208 Sedimentary Petrology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Classification of sedimentary rocks, Residual deposits and soils, Clastic rocks, Rudaceous rocks Arenaceous rocks, Argillaceous rocks, Limestone and dolostone, Siliceous rocks, Phosphorites, Carbonaceous deposits, Evaporates, Iron bearing rocks. Practical work includes identification, classification and petrographic description of clastic and non-clastic sedimentary rocks.

GE 3210 Engineering Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, Geology and civil engineering, Geological maps and sections, Field and lab investigations of site, geophysical surveys and assessment of different ground conditions, Soil strength, Rock strength, Rock mass strength, Ground subsidence, slope failure and landslides, Landslide hazards and slope stabilization, Rock excavation and tunnels in rocks.

GE 3212 Geology of Ores (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2202

Introduction, Classification of Ore Deposits, Source rocks and mobility of elements, Magmatic Ore Deposits, Metamorphic Ore Deposits, Sedimentary Ore Deposits, Fluids of mineralization, Wall-Rock alteration and interaction, Mineral parageneses and zoning. Distribution of mineral deposits in tectonic environments. Laboratory study consists of hand specimens examination, description and identification.

GE 3226 Geophysics (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3125

Introduction, Geomagnetic field and its elements, Magnetic surveying, Magnetic anomaly separation, Types of gravity corrections and surveying, Gravity anomaly separation and interpretation, Elasticity theory, Seismic waves, Seismic prospecting, Artificial sources of energy, seismic instruments, basic seismic field methods, seismic reflection and refraction, estimation of velocity, thickness and dip of geological horizons, Electrical surveying, measurements and interpretation. Practical application of geophysical measurements and interpretation.

GE 3214 Structural Geology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3101

Introduction to Structural Geology, Objectives, Mechanical Principles, Description of Folds, Field Study of Folds and Office Techniques, Joints, Description and Classification of Faults, Criteria for Faulting, Diapirs and Related Structural Features, Geophysical methods in Structural Geology. Practical work includes construction and interpretation of geologic structural maps.

GE 3216 Quaternary Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Studies of Quaternary environments, Scale and rapidity of climatic and environmental changes in the modern world, Impacts of human activities on global climates, Non-marine fossil, The study of palynomorphs (pollen grains) in sediments, Insect remains. Practical work includes study and sampling of sediment exposures in the Nile Delta and Eastern and Western Deserts. These samples will provide the basis for subsequent lab work for evaluation of the pre-Deltaic and Desert bio-and litho-compositions and environment.

GE 3218 Geology of Africa (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Geography and topography of the African continent, African plateau and continental shelf, The Atlas Mountains and their relation to the Alpine mountain system of southern Europe, The continent's largest rivers and lakes as an important inland transportation system, Recent major earth disturbances, Major petrology and structural frames of the African continent, Pangaea supercontinent formation and breaking apart, Gondwanaland, separation of the Arabia and formation of the Red Sea, formation of the Great Rift Valley and the Cameroon Rift and the associated volcanoes. Exercises include application of the geologic characteristics to interpret the tectonic history.

GE 3220 Volcanology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2204

Introduction, Volcanic landforms and deposits (lava flows, pyroclastics, and derivative sediments) and their relations to the composition and physical properties of magmas and the modes of emplacement, Volcanic hazards and the effects of eruptions on climate and the atmosphere, Volcanic-hosted geothermal systems and mineral resources. Exercises include field trip to the Oligocene and Miocene volcanic eruptions in the Gulf of Suez and the Eastern and Western Deserts, covering studies in volcanology, petrology, hydrothermal alteration, geothermal systems, mapping and sampling of geothermal fluids and gases.

GE 3222 Geoarcheology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, principles and techniques, Pre-historic man (Paleolithic and Neolithic) implements, Water logged sites, tailoring GIS software for archeological application, application of palynology and archeology, geophysical and geochemical analyses of archeological sites, evidence of agriculture, economic utility of archeological sites, Geoarcheological Foundations, case studies from the Nile Delta, Pyramids Plateau and Upper Egypt, Postburial disturbance, archeological sites context, Use of geoarcheology in Egypt

GE 3224 Environmental Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Atmosphere, Lithosphere, Hydrosphere, Biosphere, Environment and human activities, Global warming and sea level rise, Greenhouse effect, Coastal erosion, Shoreline protection, Flash flood hazards and mitigation, Groundwater pollution due to extensive use of fertilizers and insecticides, water-logging problems, Sand dune migration, resources management and Urban growth. Applied examples from Egypt and other countries.

GE 4101 Phanerozoic Geology of Egypt (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE3107

Introduction, location, geography and provinces, structural units and tectonic framework of Egypt, Early Paleozoic rocks in the Gulf of Suez region and southwestern Egypt, Carboniferous and Permian rocks in the Gulf of Suez region, Triassic rocks in Sinai, Jurassic rocks in Egypt, Early Cretaceous rocks, Late Cretaceous rocks in Egypt.

GE 4103 Remote Sensing (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Concept and fundamentals, Principal properties of image, Remote sensing systems, Aerial photographs and photogeology, Types and characteristics of aerial photographs, Geometrical aspects of aerial photo, Relief displacement and vertical exaggeration, Stereovision, Parallax

GE 4105 Geochemistry (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Geochemical classification of elements and rule of their distribution, geochemistry of Earth compared to other planets, geochemistry of igneous rocks, magmatic crystallisation, evolution and tectonic settings, geochemistry of sedimentary rocks and conditions during sedimentation, metasomatism, isotope fractionation during igneous, sedimentary and metamorphic processes, age dating, stable isotope geochemistry, mineral chemistry, analytical techniques of rocks and minerals

GE 4107 Geology of Ores in Egypt (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2202

Introduction, Classification of Ores in Egypt, The Arabian Nubian Shield evolution and genesis of mineralization in Egypt. Ornamental and Building Stones (e.g. Marble, Limestone, Serpentinite, Granite), Metallic and Non-metallic Ores (magmatic, metamorphic and sedimentary), Economic importance and industrial applications of ore deposits in Egypt, Precious and Gem-stones.

GE 4109 Petroleum Geology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, Physical and chemical properties of oil and gas, Occurrence of petroleum, Origin of petroleum deposits, Source energy required for transformation of organic matters into petroleum, Evolution of petroleum (kerogene type and maturation), Subsurface environments, Oil migration.

GE 4111 Hydrogeology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, Occurrence of groundwater, Hydrogeologic cycle and water balance, Groundwater movement, Aquifer tests, Water wells, Rock properties affecting groundwater, Vertical distribution of groundwater, Types of aquifers, Storage coefficient and Springs. Field and lab techniques employed for groundwater studies.

GE 4125 Special Course (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

A course covering selected topics in geology and to be specified by the department committee each year. It may be repeated for credit when course topic varies.

GE 4141 Research and Essay (1 hour weekly = 1Credit hour)

Pre-requisite: -----

Reviewing a research project in geological sciences to be selected by the supervisor, preparing a written essay on it.

GE 4113 Clay Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, basic mineralogy, structure, classification and origin, X-ray analysis, aqueous solubility and ion exchange, roles of clay minerals in global biogeochemical cycling, and natural hazards (swelling clays, slip surfaces of landslides and faults), their importance to civil engineering projects, clay as a natural resource, its impact on human health, nuclear waste repositories. Exercises include X-ray study, interpretation and evaluation, case studies of natural hazards and engineering projects.

GE 4115 Facies Analysis and Depositional Environments (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction; properties of hydrodynamic flow and sedimentation, primary sedimentary structures, Siliciclastic depositional Environments: Fluvial deposits; processes, facies characteristics and facies model, Deltaic deposits; major subdivision and depositional processes, delta plain, delta front and prodelta facies characteristics, Estuarine deposits, estuarine facies characteristics and facies model. Linear shoreline depositional environments; beach and shoreface; subdivision, depositional processes. Facies characteristics and facies model. Carbonate Depositional environments: Peritidal carbonates; facies characteristics and models. Shelf Carbonates.

GE 4117 Ore Dressing (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3212

General information, Definition and history of mineral processing, Mineral properties used in mineral processing, Technical and financial calculations. Sampling, Crushing and crushers, Grinding and mills, critical rotation velocity in mills, Sieving and sieve types, Ore dressing with specific gravity differences; inert media, Ore dressing with heavy medium, Ore dressing with jigging. Ore dressing with specific gravity differences; vibration table Flotation, Ore dressing with magnetic separation, Ore dressing with electrostatic separation, Recycling of metals.

GE 4119 Volcaniclastics (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2204

Introduction, crustal magmatism and volcaniclastic sediments, generation of large-scale magma chambers, dynamics of eruption, emplacement and physical characteristics of pyroclastic flows and lavas, and interpreting volcaniclastic deposits, Tephra and volcaniclastic units in the field. Exercises include field trip to the metavolcanic rocks in the Eastern Desert and mapping of volcanic terrains.

GE 4121 Isotope Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3103

Nuclide systematics, radioactive decay and radiogenic growth, Radiogenic isotope data (mainly Rb-Sr, Sm-Nd, Lu-Hf, U-Th-Pb and Re-Os) used as indicators of rock-forming processes, ore-forming processes and fluid-rock interaction. Stable isotope systematics: Fractionation of stable isotopes in geological processes, Application of light stable isotopes (H, C, O, N, S) to petrogenesis and ore-forming processes, fluid rock interaction, Stable isotope systematics of heavier elements. Noble gas isotope systematics, Geochronology. Exercises include estimating the decay and fractionation of isotopes, age dating and interpreting the geological processes and origin.

GE 4123 Geochemical prospecting (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: ----

Overview of exploration geology, Exploration geochemistry., Exploration geology terminology, Dispersion halos, Geochemical sampling, Geochemical survey, Field analytical methods, laboratory analytical methods, Treatment of geochemical data, geochemical map, Treatment of geochemical data, Geostatistics, Interpretation of geochemical data, statistical interpretation, univariate analysis, Interpretation of geochemical data, multivariate analysis.

GE 4202 Phanerozoic Geology of Egypt (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4101

Introduction, Paleocene rocks, Cretaceous/Tertiary contact in Egypt, distribution of Eocene rocks, Oligocene facies, Miocene in the Gulf of Suez region, Red Sea and north Western Desert, Pliocene rocks in Egypt, Quaternary rocks and Nile Delta deposits.

GE 4204 Photogeology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Principals of remote sensing, Data acquisition and interpretation, Interaction mechanics Images and remote sensing systems, Errors in flying, airphoto cameras and types of films Geometrical aspects of aerial photographs, Relief displacement and vertical exaggeration Stereovision, Photogrammetry.

GE 4206 Precambrian Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Distribution and age of Precambrian rocks, Theories of rock evolution, Classifications of Precambrian rock units in Egypt, Gneiss, migmatite and schist, Ophiolitic rocks, Island-arc metasediment and metavolcanic associations, Granites, Dokhan volcanics, Gabbros, Hamamat sediments, Natash volcanics and ring complexes.

GE 4208 Mining Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Ore Deposits; concept; plate tectonic; volcanoes,; deposition; residual; exploration, Mining methods: open-pit, pit-slopes, underground, bulk UG, mining cycle, complication. Mine workings, claim staking, exploration and drilling methods and drill holes, blasting. Rock sampling, geostatistics, trench/adit mapping. Mineral processing methods; comminuting, floating, smelting, leaching, bio-leaching. Mine waste disposal, Grade and tonnage calculations. Ore reserve classification. Mine and money; contracts, prices, valuation, reserves, costing. Future of mining: economics, automation, bacteria, viruses, future company.

GE 4210 Basin Analysis (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Theory of basin formation, Classification of sedimentary basins according to tectonic environment, The controls on and mechanisms of subsidence and sedimentation, Examples from around the world of typical basin types, Impact basin style and sedimentation on the hydrocarbon habitat and prospectivity, depositional systems and their control on reservoir, source, seal and trap rocks, introduction to seismic facies analysis, sequence stratigraphy, correlation techniques and basin modeling. Exercises include interpretation of seismic and wireline log data for basin analysis.

GE 4212 Hydrogeology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4111

Introduction, groundwater movement, permeability, determination of hydraulic conductivity, groundwater flow rates, groundwater flow directions, Aquifer tests, groundwater quality and chemistry, Isotope hydrology, Groundwater pollution, Surface and subsurface investigations of groundwater, Groundwater modeling, Hydrogeology of Egypt.

GE 4242 Research and Essay (1 hour weekly = 1Credit hour)

Pre-requisite: -----

Reviewing a research project in geological sciences to be selected by the supervisor, preparing a written essay on it.

GE 4216 Remote Sensing (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Visual image interpretation, Elements of image interpretation, Drainage analysis, Recognition of geological structures, Recognitions of rock types, Mapping with aerial photographs, Remote sensing satellites, Digital images, Remote sensing applications.

GE 4218 Petroleum Geology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4109

Chemistry, composition and physical properties of petroleum, origin and migration of hydrocarbons, Geology of petroleum, Occurrence of petroleum, Reservoir rocks, Porosity and permeability, Structure traps, Stratigraphic traps, Combination traps, Barren traps, Gulf of Suez petroleum provinces, Western desert, petroleum provinces, Nile delta petroleum provinces, Sinai petroleum provinces, methods of exploration.

GE 4220 Hydrogeochemistry (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4105

Principles of Aqueous chemistry, Chemical Reactions, Mass transport in Groundwater Flow (Aqueous system), Mass transport in Groundwater Flow (Geology process), Contaminant Hydrogeology, Hydrogeochemistry of Egypt.

GE 4222 Advanced Geochemistry (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4105

Introduction, Geochemistry of sedimentary rocks, Eh, pH and oxygen fugacity during sedimentary processes, Behavior of elements during metamorphism, REE in metamorphic rocks, Metasomatism and behavior of elements, Radiogenic isotope geology, Fractionation of radiogenic isotopes during igneous, sedimentary and metamorphic processes, Estimation of absolute age using radiogenic isotopes, Mineral chemistry and mantle processes.

GE 4224 Organic Geochemistry (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4105

Introduction, Fate of organic matter from its formation through its transformation and destruction during depositional, diagenetic (remineralization) and catagenic (petroleum generation) processes. Stable carbon isotopes, Organic carbon and phosphorus, Organic chemicals of environmental concern, Biomarkers as tracers of past and present productivity, Radiocarbon in organic materials, Organic carbon transport and old carbon in the modern environment, Fate of organic matter over geologic time, Black Carbon. Practical work includes analytical techniques of biomarkers, water and interstitial fluid and petroleum source rocks.

GE 4226 Ore Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3212

Introduction and the components of ore microscope, Preparation of polished sections, Optical properties under polarized light and crossed Nicoles, Hardness, Structural and morphological grains, Microchemical techniques, Growth textures, Solid solutions in native and oxide textures, Solid solutions in sulphides, Replacement and deformational temperatures.

GE 4228 Geographic Information Systems (1 lecture + 3 practical hours weekly = 2 Credit hours)

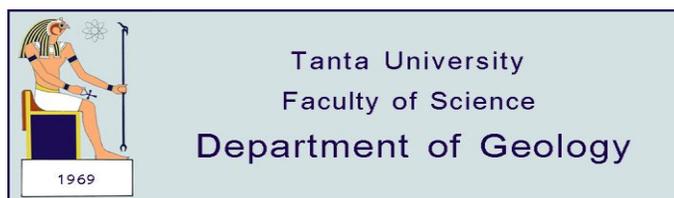
Pre-requisite: ----

Introduction, Tools and techniques of GIS (spatial data capture, management, and analysis), Cartographic output using GIS software, Database design and management including conversion fundamentals, modeling techniques, and strategic planning, Developing a GIS using ArcView GIS software. Applications of GIS (environmental assessment, analysis of natural hazards, site analysis for business and industry, criminal justice, real estate, location analysis, resource management, and land-use planning). Practical study include training in the use of technology and software to in GIS and GIS base map development (scanning, digitizing, and coordinate geometry).

GE 4230 Selected Topics (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: ----

A course covering selected topics in geology and to be specified by the department committee each year. It may be repeated for credit when course topic varies.



Programme Title	Geophysic
Programme Type	Special
Department(s)	Geology

GP 2101 Seismic Waves and Velocities (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Basic concepts and terminologies, Stress, Strain and the elasticity theory, Wave Equation, Nomenclature, Elastic constants and their interrelationships, Types and characteristics of seismic waves, Propagation of Seismic Waves, Seismic velocities in different rock types, Travel Time Curves, Global Earth Models.

GP 2103 Gravity Methods (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Gravity field and principles, Gravity variation, Gravity instruments, Units of gravitational acceleration, Gravity surveying on land, Marine gravity surveying, Air-borne gravity surveying, Gravity data reduction, Bouguer anomaly, Gravity over simple geological bodies, Qualitative and quantitative gravity data interpretation, Methods of depth determination, Applications.

GP 2105 Electrical Methods (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Basic theories of electrical and electromagnetic methods, Electrical properties of rocks and minerals, Telluric and magnetotelluric theories, Model curves, Self potential method and its applications, Induced polarization method and its applications, Instruments, Field arrangements and measurements, Interpretation.

GP 2107 Magnetic Methods (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Main Basics, The geomagnetic field, Geomagnetic Elements, Magnetic Components, Magnetic properties of rocks and minerals, Magnetic susceptibility and its anisotropy, Instruments, Field and lab measurements, Methods of Separation, Magnetic Effects of Different Geometrical Forms, Magnetic Variations and Corrections, Qualitative and Quantitative Interpretation.

GP 2109 Radioactive and Geothermal Methods (1 lecture + 2 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Theories and principles of radioactivity, Radioactive and fission-track dating, Radioactive decay, Radioactivity of rocks and minerals, Age determination using radioisotopes, Instruments, Field operations, Heat within the Earth, Geothermal heat flow, Tectonics and heat flow, Thermal logging, Calculation of simple geotherms, Continental and oceanic heat flow, Geological applications and interpretation.

GE 2105 Optical Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, polarization and polarized microscope, preparation of microscopic thin sections in minerals and rocks, Optics of isotropic minerals and their indicatrix, Measuring the refractive index, Optics of anisotropic minerals: Uniaxial, biaxial and their indicatrix, Optical properties of minerals in planed and between crossed Nichols, Interference colors, Optical orientation and extinction angle, Interference figures. Microscopic examination and description of selected minerals in thin sections.

GE 2107 Principles of Stratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction and basic principles of stratigraphy, Types of bedding, Stratification and layering of rocks, Sea level changes and the sedimentation style, Cyclic successions, Stratigraphic contacts, The use of unconformities in dating geological events, Relative geologic time, Major types of stratigraphic units.

GE 2103 Structural Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Crystal chemistry: i- crystal lattice, lattice planes, glide planes, screw axis, fourteen bravais lattice, ii- Coordination, iii- Chemical adaptability and iv- Bonding forces in crystals. Mineral structures : metallic minerals, covalent minerals, molecular minerals and ionic minerals. Practical work includes identification of mineral structures of metallic- homopolar, molecular and ionic minerals.

GE 2109 Micropaleontology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, , Biology of foraminifera, Morphological characteristics of foraminiferal tests, structure and arrangements of chambers, overall shape of the tests, aperture, suture, peripheral and umbilical characters, shell wall and surface ornamentation, Taxonomic classification, Ecology and significance of foraminifera Practical work includes methods of preparation and examination of faunal content.

GE 2115 Field Training (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, traverse types, methods and techniques of geologic surveying, Field equipments (Compass, Alidade, Total Station, GPS), the nature and construction of topographic and geologic maps, Preparation of topographic maps. Laboratory and field training applying geologic traverses and preparation of topographic maps.

GP 2202 Seismic Methods (1) (2 lectures + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: GP 2101

Introduction and Basics, Elasticity theory, Seismic Techniques, Character of seismic events, Basic field methods, Refraction and reflection of seismic waves, Wave propagation and interaction with geological boundaries, Velocities and rock properties, Velocities of common earth materials, Travel time curves, First arrivals, Determining Earth structure from travel times.

GP 2204 Gravity Methods (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GP 2103

Introduction and basic concepts of gravity methods, gravitational force, the Earth's mass and density, gravitational potential, the normal spheroid and Geoid, densities of rocks, Absolute measurements; pendulum and free falling, relative measurements; stable and unstable gravity meters, Interpretation of gravity data, ambiguity of gravity, Regional and residual anomaly separation and filtering techniques, Frequency-domain filtering, Calculating of the gravity anomalies of simple shape bodies, Applications of gravity and some case studies of gravity measurements.

GP 2206 Electrical Methods (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GP 2105

Introduction, Review of fundamental theories, Time-domain electromagnetic methods and their applications, Frequency-domain electromagnetic methods, Vertical Electrical Sounding (VES), Electrical resistivity data processing and digital linear filtering, Joint application of electrical and electromagnetic methods, Empirical methods of resistivity data interpretation, Computer-aided resistivity data interpretation.

GP 2208 Magnetic Methods (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GP 2107

Historical Review, Main Concepts of Geomagnetic Field, Intensity of magnetization, Variations and Corrections, Types of Magnetic Surveying, Instruments and types of magnetometers, Separation of Magnetic Anomalies, Qualitative and Quantitative Interpretation, Comparison between gravity and magnetic effects for simple geometrical bodies.

GP 2210 Paleomagnetism (2 lectures + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: GP 2107

Introduction and physical basis, Fundamentals of rock and mineral magnetism, Common magnetic minerals and their identification, Data acquisition, Stability tests, Studying climatic changes through magnetic properties of sediments and soils, Sampling and measurements, Magnetic fabric (AMS), Data presentation, Statistical analysis, Geomagnetic applications, Reversals of magnetization, Geological applications.

GE Mineralogy and Petrology (2 lectures + 3 practical hours weekly = 3 Credit hours)

Pre-requisite: GE 1202

Introduction, Physical properties of minerals, Mineral identification, X-ray and crystal structure, Mineral associations, Description of minerals, Rock cycle and types of rocks, Magma composition and magmatic differentiation, Igneous rocks, Sedimentary rocks and their classification, Metamorphic rocks and types of metamorphism.

GE 2202 Rock-Forming Minerals (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Introduction, Chemistry, Stability, Mineral reaction and Optical properties of the following: Nesosilicates (olivine group, humite group, garnet group, Zircon and Sphene), Sorosilicates (Epidote group, Melilite group), Ring silicates (Beryl, Tourmaline and Cordierite), Sheet silicates (Mica group, Pyrophyllite C, talc, Chlorite, Serpentine), Single chain silicates (Pyroxene group), Double chain silicate (Amphibole group), and Tectosilicates (Feldspar group, Silica minerals and Sodalitefeldspathoite group). Practical work includes identification of the optical properties of the above mentioned minerals.

GE 2204 Igneous Petrology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Introduction, Earth's interior, source of heat and heat transfer, melting and generation of magma, mixing of magma, composition of magma in different tectonic settings, magmatic differentiation in open and closed systems, Bowen's reaction series, chemical and mineralogical classifications of some igneous rocks. Laboratory study consists of hand specimens identification and examination.

GE 2206 Metamorphic Petrology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Introduction, Earth's heat and pressure, fluids and their generation, metamorphism and its agents, mineral assemblages and textures, types of metamorphism, tectonics and metamorphism. Laboratory study consists of hand specimens identification and examination

GE 2208 Lithostratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction and stratigraphic laws, General characteristics of sediments, Stratigraphic analysis, Strata configuration and boundaries, Stratigraphic units, Lithostratigraphy, Biostratigraphy, Chronostratigraphy and Geochronology, Breaks in sedimentations, Stratigraphic correlation, Other stratigraphic units, Stratigraphic data presentation

GE 2210 Micropaleontology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2109

Introduction, Test, Morphology, Wall structure and arrangement of some selected microfauna including Nummulites, Operculina, Miogypsina, calcareous algae, calcareous nannoplankton, Pollen and Spores, Conodonts, Radiolaria, and Diatoms, Ecology and significance of microfauna. Practical work includes examination, classification and description of some selected fauna and flora.

GE 2212 Macropaleontology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction and Earth history, Geologic Time Scale, Fossils and fossilization, Significance of fossils, Age determination, Ecology and mode of life, Taxonomy and classification, Phylum Mollusca, Class: Pelecypoda, Class Gastropoda, Class Cephalopoda. Practical work includes examination, classification and description of some selected taxa.

GE 2214 Applied Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction to mineralogy, genesis, occurrence and physico-chemical characteristics of the most important minerals and rocks including: clay minerals, limestones, cement/concrete aggregates, building stone, together with their industrial applications, and the process of mineralogy and the factors that determine the quality of the resources and the end-products. Practical work consists of specification of the physico-chemical characteristics of raw materials used in different industries.

GE 2220 Field Training (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Observing and collecting data and samples, using compass, clinometer, hand level, GPS and Total Station, plotting geologic features on a base map, Mapping geologic features on aerial photographs, making a geologic map from aerial photographs, Measuring stratigraphic sections. Laboratory and field training include preparing and interpretation of geologic maps and cross-sections.

GP 3101 Seismic Methods (2) (2 lectures + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: GP 2202

Introduction, Basic reflection seismic theory: Seismic wave propagation; wave length, frequency, velocity, reflection coefficient, polarity, absorption and resolution, Techniques of exploration seismology, Refraction, diffraction and reflection, Seismic data acquisition on land: Sources, basic field equipments and layout, Seismic data acquisition at sea: Sources, receivers, and instruments, Interpretation of 2-D and 3-D seismic reflection data; Identification of geological structures, Fundamental of geophysical analysis, digital processing methods applied to seismic data.

GP 3103 Electromagnetic Methods (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GP 2208

Introduction, Basic concepts, Electromagnetic properties of rocks, Propagation of electromagnetic waves and their properties, Methods of electromagnetic measurements, Methods of field measurements (surveys), Measurement equipments, Mathematical equations used in electromagnetic methods, Applications in geophysical prospecting, Case studies in Egypt.

GP 3105 Seismic Field Methods (1 lecture + 2 practical hours weekly = 2 Credit hours)

Pre-requisite: GP 2202

Introduction, seismic theory, Geometry of seismic wave paths, Characteristics of seismic events, Comparison of refraction and reflection methods, Reflection field methods: field methods for land surveys, field layouts, field equipment for land surveys, Equipment and methods, measurement of velocity, Inline refraction, Broadside refraction and fan shooting, Marine refraction work.

GP 3107 Seismic Data Processing and Interpretation (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GP2202

Introduction, Fundamental theory and practical applications of time-series analysis, Digital filtering, General processing sequence, Other processing procedures, Types of seismic velocities, Multiples, Interpretation models, Tectonic interpretation of seismic refraction profiles, Structural and tectonic interpretation of seismic reflection profiles.

GP 3109 Petrophysics (2 lecture + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: -----

Introduction, Physical properties of rocks, Porosity, Permeability, Relative permeability, Capillary pressure, Electrical properties of rocks, Mechanical properties of rocks, sonic properties of rocks, Coring and drilling tools, Measurement techniques of different petrophysical parameters, Methods of well-logging interpretation, Applications in mining, oil, and gas industry.

GE 3101 Structural Geology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction to structural Geology, Measurements of attitudes of strata and bedding planes, Non-tectonic structures, Stress and Strain, Field Study of Geologic Structures, Types of Unconformities, Folds and their Types, Faults and their Classification, Joints, Cleavage- foliation – lineation , and shear zones. Practical work includes drawing and interpretation of geologic structural maps.

GE 3107 Sedimentary Petrology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Sedimentary particles, Origin and mode of formation of sedimentary particles, Mineralogical composition of sedimentary particles, Detrital and non-detrital minerals, Textures of sedimentary rocks, Primary structures of sedimentary rocks, Weathering processes, Transportation processes, Sedimentation processes, Depositional environments. Practical work includes identification of mineral grains, grain size analyses and data interpretation, determination of grain shape, roundness and sphericity, and XRD identification of clay minerals.

GE 3109 Macropaleontology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2212

Introduction, Phylum: Bryozoa, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina, Trace fossils and Plants, Paleoecology and paleoenvironment. Practical work includes examination, classification and description of some selected taxa.

GE 3111 Field Geology and Field Studies (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Detailed mapping and sampling, Mapping of Igneous, Sedimentary and Metamorphic Rocks, Unconformities and folds, Stereonets and faults, Cross-sections, Subsurface mapping techniques, Preparing and writing a geologic report. Field training include sampling and interpreting geologic maps, applied geologic problems.

GE 3123 Lab Techniques (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

This course is designed to cover various techniques used in soft and hard rocks. Soft rocks techniques include: grain size analysis, heavy mineral separation, preparation of thin sections and staining techniques, XRD of clay minerals and bulk samples. Hard rocks techniques include preparation of thin and thin polished sections, separation of minerals (electromagnetic and microscopic), major and trace elements (including REE), Isotope analyses.

Semester 2- Obligatory courses

GP 3202 Earthquake Seismology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GP2101

Introduction, Basics in seismology, Various types of seismic waves, Earthquake histories, Main causes of Earthquakes, Magnitude and energy of earthquakes, Earthquake hazards, Earthquake prediction, Earthquake belts and geographic distribution, Seismology and plate tectonics.

GP 3204 Interpretation of Potential Gravity Data (2 lectures + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: GP2204

Introduction, Corrections of gravity measurements, Gravity data processing, Separation methods of gravity anomalies, Qualitative interpretation of gravity data, Quantitative interpretation of gravity data, Methods of depth determination, Bouguer gravity anomalies and plate tectonics.

GP 3206 Electromagnetic Methods (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: 2208

Introduction and theories, Polarity in Rocks, Free magnetic field for low-frequency sources, Classification of artificial energy sources, Instruments, Penetration depth measurements, Methods of electromagnetic measurements within stratigraphic sequences, Investigation of sea floor by electromagnetic methods, Interpretation of electromagnetic data and uses in geophysical prospecting.

GP 3208 Special Course (1 lecture + 2 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

A course covering selected topics in geophysics and to be specified by the department committee each year. May be repeated for credit when course topic varies.

GP 3210 Computer Applications in Geophysics (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GP 2101

Introduction, PC hardware and software, Fortran and C++ programming languages, Digital systems, Flow charts, Format types, "if" and "do" statements, Types of variables, Uni- and bi-directional systems, Gravity software, Magnetic software, Seismic software, Electric software, Well-logging software.

GE 3202 Tectonic Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3101

General introduction, Outline of available theories, Geosynclinal theory, Earth forces and the kinds of faulting they produce, Boundary zones between crustal plates, constructive, destructive and conservative plate boundaries, Continental drift, Sea- floor spreading, Subduction zones, Transform faults, Global wrench tectonic, Major lithospheric plates of the Earth, Egypt in the framework of global tectonics.

GE 3204 Subsurface Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction, Examination and Application of the techniques employed in subsurface geologic analysis, Theory of open whole logging operations, Analysis of log records, Use of log records to construct various types of subsurface maps, Examinations of well cuttings and cores, Methods of calculating water saturation, Porosity and probable lithologies, Representation and interpretation of subsurface data.

GE 3206 Biostratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2208

Stratigraphic distribution of foraminifera - through Paleozoic, Mesozoic, the K/T boundary, Paleocene-Eocene boundary, Tertiary larger foraminifera and their biostratigraphic importance and Stratigraphic distribution of macrofossils through Paleozoic, Mesozoic, and Cenozoic eras.

GE 3208 Sedimentary Petrology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Classification of sedimentary rocks, Residual deposits and soils, Clastic rocks, Rudaceous rocks Arenaceous rocks, Argillaceous rocks, Limestone and dolostone, Siliceous rocks, Phosphorites, Carbonaceous deposits, Evaporates, Iron bearing rocks. Practical work includes identification, classification and petrographic description of clastic and non-clastic sedimentary rocks.

GE 3210 Engineering Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, Geology and civil engineering, Geological maps and sections, Field and lab investigations of site, geophysical surveys and assessment of different ground conditions, Soil strength, Rock strength, Rock mass strength, Ground subsidence, slope failure and landslides, Landslide hazards and slope stabilization, Rock excavation and tunnels in rocks.

GE 3212 Geology of Ores (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2202

Introduction, Classification of Ore Deposits, Source rocks and mobility of elements, Magmatic Ore Deposits, Metamorphic Ore Deposits, Sedimentary Ore Deposits, Fluids of mineralization, Wall-Rock alteration and interaction, Mineral parageneses and zoning. Distribution of mineral deposits in tectonic environments. Laboratory study consists of hand specimens examination, description and identification.

GE 3224 GE 3214 Structural Geology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3101

Introduction to Structural Geology, Objectives, Mechanical Principles, Description of Folds, Field Study of Folds and Office Techniques, Joints, Description and Classification of Faults, Criteria for Faulting, Diapirs and Related Structural Features, Geophysical methods in Structural Geology.

GE 3216 Quaternary Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Studies of Quaternary environments, Scale and rapidity of climatic and environmental changes in the modern world, Impacts of human activities on global climates, Non-marine fossil, The study of palynomorphs (pollen grains) in sediments, Insect remains. Practical work includes study and sampling of sediment exposures in the Nile Delta and Eastern and Western Deserts. These samples will provide the basis for subsequent lab work for evaluation of the pre-Deltaic and Desert bio-and litho-compositions and environment.

GP 4101 Well Logging (2 lectures + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: ----

Introduction, Conditions of well-logging technique, Review of basic concepts, Spontaneous potential log (SP), Resistivity, Natural gamma ray log (GR), Natural gamma ray spectrometry (NGS), Neutron logs, Formation density log (FDC), Sonic logs (BHC), Caliper logs, Thermal decay time (TDT).

GP 4103 Engineering and Environmental Geophysics (2 lectures + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: GE 3101

Introduction, Uses of geophysical prospecting methods in engineering and environmental applications, Gravity prospecting and interpretation, Magnetic prospecting and interpretation, Seismic refraction prospecting and interpretation, Electrical resistivity prospecting and interpretation, Measurements of ground penetrating radar (GPR), Depth and thickness determination of surface layers, Depth determination of caves, archeological sites, and buried geological structures.

GP 4105 Seismic Stratigraphy (2 lectures + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: GP 2101

Introduction, Outlines of seismic techniques, Processing and interpretation of seismic data, Identification of stratigraphic contacts from seismic sections, Dating and correlating stratigraphic contacts, Identification of geological structures from seismic sections, Applications and case studies in Egypt.

GP 4107 Reservoir Correlation and Production (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GP 3109

Introduction, Reservoir correlation, Models of reservoir correlation, Computer models, Uses and applications of reservoir correlation, Procedures used in reservoir correlation, Variations between correlation methods, necessary data used for correlation of some reservoir.

GE 4109 Petroleum Geology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, Physical and chemical properties of oil and gas, Occurrence of petroleum, Origin of petroleum deposits, Source energy required for transformation of organic matters into petroleum, Evolution of petroleum (kerogene type and maturation), Subsurface environments, Oil migration.

GP 4109 Hydrogeology (2 lectures + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: GE 3107

Introduction, Occurrence of groundwater, Hydrogeologic cycle, Groundwater movement, Aquifer tests, Groundwater quality and chemistry, Isotope hydrogeology, Surface and subsurface investigations of groundwater, Water wells, Field and lab techniques employed for groundwater studies, Hydrogeology of Egypt.

GP 4141 Research and Essay (1 hour weekly = 1 Credit hour)

Pre-requisite: ----

Reviewing a research project in geophysical sciences to be selected by the supervisor, preparing a written essay on it.

GE 4103 Remote Sensing (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Concept and fundamentals, Principal properties of image, Remote sensing systems, Aerial photographs and photogeology, Types and characteristics of aerial photographs, Geometrical aspects of aerial photo, Relief displacement and vertical exaggeration, Stereovision, Parallax

GE 4105 Geochemistry (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: ----

Geochemical classification of elements and rule of their distribution, geochemistry of Earth compared to other planets, geochemistry of igneous rocks, magmatic crystallisation, evolution and tectonic settings, geochemistry of sedimentary rocks and conditions during sedimentation, metasomatism, isotope fractionation during igneous, sedimentary and metamorphic processes, age dating, stable isotope geochemistry, mineral chemistry, analytical techniques of rocks and minerals

GE 4107 Geology of Ores in Egypt (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2202

Introduction, Classification of Ores in Egypt, The Arabian Nubian Shield evolution and genesis of mineralization in Egypt. Ornamental and Building Stones (e.g. Marble, Limestone, Serpentine, Granite), Metallic and Non-metallic Ores (magmatic, metamorphic and sedimentary), Economic importance and industrial applications of ore deposits in Egypt, Precious and Gem-stones.

GE 4113 Clay Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, basic mineralogy, structure, classification and origin, X-ray analysis, aqueous solubility and ion exchange, roles of clay minerals in global biogeochemical cycling, and natural hazards (swelling clays, slip surfaces of landslides and faults), their importance to civil engineering projects, clay as a natural resource, its impact on human health, nuclear waste repositories. Exercises include X-ray study, interpretation and evaluation, case studies of natural hazards and engineering projects.

GE 4115 Facies Analysis and Depositional Environments (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, Sedimentary facies and lithologic characteristics, Primary sedimentary structures, Faunal and floral content, Sedimentary models, The model concept, Description of sedimentary models, Genetic classification of sedimentary facies, Sequences and cycles, Depositional non-marine sedimentary environments: deserts, fluvial, lakes, glacial, Transitional sedimentary environments: estuaries, deltas, Shallow and deep marine environments.

GE 4117 Ore Dressing (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3212

General information, Definition and history of mineral processing, Mineral properties used in mineral processing, Technical and financial calculations. Sampling, Crushing and crushers, Grinding and mills, critical rotation velocity in mills, Sieving and sieve types, Ore dressing with specific gravity differences; inert media, Ore dressing with heavy medium, Ore dressing with jigging. Ore dressing with specific gravity differences; vibration table Flotation, Ore dressing with magnetic separation, Ore dressing with electrostatic separation, Recycling of metals.

Semester 2

GP 4202 Soil Mechanics (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GP 3109

Introduction, Fundamental concepts, Products of weathering and soil formation, Properties of soil, Soil classification, Mechanical and physical aspects of soil, Field tests: sand cone test, Vane shear test; S.P.T.

test; Dutch cone test, Lab tests: water content; unit weight; particle size analysis; Atterberg limits; Compaction test; permeability test, consolidation test; direct shear test; unconfined test; triaxial test, Shear strength of soil, Bearing capacity of soils.

GP 4204 Integration of Geophysical Data (2 lectures + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: -----

Introduction, Gravity data interpretation, Magnetic data interpretation, Seismic data interpretation, Electrical and electromagnetic data interpretation, Comparing the potential and other geophysical methods, Geological applications of different geophysical techniques, Comparison of the crustal and upper mantle structures deduced from different geophysical observations, Depth determination with various geophysical techniques.

GP 4206 Mining Geophysics (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GP 3103

Introduction, Geophysical exploration methods: reflection and refraction seismology; Electromagnetic techniques; Radiometric and remote sensing techniques, miscellaneous methods; drill hole logging, Explosives and Blasting, Drilling, Open cut mining methods, Underground mining methods, Mineralization geological environments, Interpretation of geophysical data, Ethical and environmental concern.

GP 4208 Petroleum Evaluation and Economics (2 lectures + 2 practical hours weekly = 3 Credit hours)

Pre-requisite: GE 4109

Introduction, Oil source rocks, Types of reservoirs, Sealing cap rocks, Types of oil traps, Oil migration, Geophysical exploration of oil and gas, The oil and gas industry, Development, Oil and gas production, Transportation, Oil and gas reserves, Techniques of calculating oil reserves, The world oil and gas market and its history, Petroleum law, Egypt in the world of oil and gas market.

GE 4232 Stratigraphy of Egypt (2 lectures + 3 practical hours weekly = 3 Credit hours)

Pre-requisite: GE 3107

Location, geography and main characteristics of provinces, Egypt in the framework of global tectonics, Major structural units of Egypt, Surface and subsurface Paleozoic rocks in Egypt, Triassic, Jurassic and Cretaceous stratigraphy, Cretaceous-Tertiary boundary in Egypt, Eocene stratigraphy, Oligocene volcanicity and Red Sea rifting, Miocene facies and subsurface stratigraphy in the Gulf of Suez region, Quaternary sediments in Egypt and Nile Delta deposits, Economic minerals and ores.

GP 4242 Research and Essay (1 hour weekly = 1 Credit hour)

Pre-requisite: -----

Reviewing a research project in geophysical sciences to be selected by the supervisor, preparing a written essay on it.

GE 4204 Photogeology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Principals of remote sensing, Data acquisition and interpretation, Interaction mechanics Images and remote sensing systems, Errors in flying, airphoto cameras and types of films Geometrical aspects of aerial photographs, Relief displacement and vertical exaggeration Stereovision, Photogrammetry, Visual interpretation.

GE 4206 Precambrian Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Distribution and age of Precambrian rocks, Theories of rock evolution, Classifications of Precambrian rock units in Egypt, Gneiss, migmatite and schist, Ophiolitic rocks, Island-arc metasediment and metavolcanic associations, Granites, Dokhan volcanics, Gabbros, Hamamat sediments, Natash volcanics and ring complexes.

GE 4208 Mining Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Ore Deposits; concept; plate tectonic; volcanoes,; deposition; residual; exploration, Mining methods: open-pit, pit-slopes, underground, bulk UG, mining cycle, complication. Mine workings, claim staking, exploration and drilling methods and drill holes, blasting. Rock sampling, geostatistics, trench/adit mapping. Mineral processing methods; comminuting, floating, smelting, leaching, bio-leaching. Mine waste disposal, Grade and tonnage calculations. Ore reserve classification. Mine and money; contracts, prices, valuation, reserves, costing. Future of mining: economics, automation, bacteria, viruses, future company.

GE 4210 Basin Analysis (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Theory of basin formation, Classification of sedimentary basins according to tectonic environment, The controls on and mechanisms of subsidence and sedimentation, Examples from around the world of typical basin types, Impact basin style and sedimentation on the hydrocarbon habitat and prospectivity, depositional systems and their control on reservoir, source, seal and trap rocks, introduction to seismic facies analysis, sequence stratigraphy, correlation techniques and basin modeling. Exercises include interpretation of seismic and wireline log data for basin analysis.

GE 4218 Petroleum Geology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

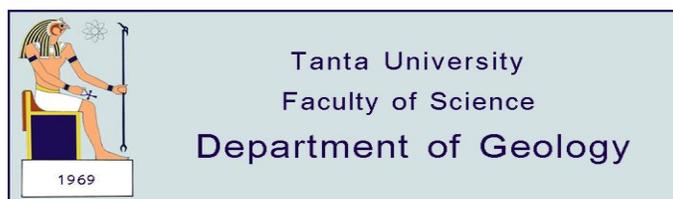
Pre-requisite: GE 4109

Chemistry, composition and physical properties of petroleum, origin and migration of hydrocarbons, Geology of petroleum, Occurrence of petroleum, Reservoir rocks, Porosity and permeability, Structure traps, Stratigraphic traps, Combination traps, Barren traps, Gulf of Suez petroleum provinces, Western desert, petroleum provinces, Nile delta petroleum provinces, Sinai petroleum provinces, methods of exploration.

GE 4228 Geographic Information Systems (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: ----

Introduction, Tools and techniques of GIS (spatial data capture, management, and analysis), Cartographic output using GIS software, Database design and management including conversion fundamentals, modeling techniques, and strategic planning, Developing a GIS using ArcView GIS software. Applications of GIS (environmental assessment, analysis of natural hazards, site analysis for business and industry, criminal justice, real estate, location analysis, resource management, and land-use planning). Practical study include training in the use of technology and software to in GIS and GIS base map development (scanning, digitizing, and coordinate geometry).



Programme Title	Chemistry/Geology
Programme Type	General Degree
Department(s)	Geology and Chemistry

GE 2105 Optical Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, polarization and polarized microscope, preparation of microscopic thin sections in minerals and rocks, Optics of isotropic minerals and their indicatrix, Measuring the refractive index, Optics of anisotropic minerals: Uniaxial, biaxial and their indicatrix, Optical properties of minerals in planed and between crossed Nichols, Interference colors, Optical orientation and extinction angle, Interference figures. Microscopic examination and description of selected minerals in thin sections.

GE 2107 Principles of Stratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction and basic principles of stratigraphy, Types of bedding, Stratification and layering of rocks, Sea level changes and the sedimentation style, Cyclic successions, Stratigraphic contacts, The use of unconformities in dating geological events, Relative geologic time, Major types of stratigraphic units.

GE 2109 Micropaleontology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, , Biology of foraminifera, Morphological characteristics of foraminiferal tests, structure and arrangements of chambers, overall shape of the tests, aperture, suture, peripheral and umbilical characters, shell wall and surface ornamentation, Taxonomic classification, Ecology and significance of foraminifera Practical work includes methods of preparation and examination of faunal content.

GE 2101 Crystallography (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite:

Introduction to Crystallography, Crystal Symmetry and crystallization, Stereographic projection, Intercepts, parameters and indices, Cubic system, Tetragonal system, Hexagonal system, Trigonal system, Orthorhombic system, Monoclinic system, Triclinic system, Crystal aggregates, Crystal chemistry.

GE 2103 Structural Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Crystal chemistry: i- crystal lattice, lattice planes, glide planes, screw axis, fourteen bravais lattice, ii- Coordination, iii- Chemical adaptability and iv- Bonding forces in crystals. Mineral structures : metallic minerals, covalent minerals, molecular minerals and ionic minerals. Practical work includes identification of mineral structures of metallic- homopolar, molecular and ionic minerals.

GE 2111 Gemstones (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, The nature of crystals, The beauty of colored gems, The beauty of Phenomenal and ornamental stones, Physical properties of gemstones, Durability, Gemological properties of gemstones, Gem Description, Diamond, Ruby, Sapphire, Beryl, Emerald, Chrysoberyl, Moonstone, Opal, Quartz and Peridot, Topaz, Agate and Turquoise. Cutting of inorganic ones, Organic gemstones, Synthetic and artificial products, Uses of gemology in Egypt and Arab Countries.

GE 2113 Vertebrate Paleontology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, definitions, Subphylum: Vertebrata; Superclass: Pisces and Superclass: Tetrapoda (Amphibia, Reptila, Aves and Mammalia). Dinosaur paleobiology and the origin of birds. Major mammalian lineages and Primate origins. Importance of Fayoum province in Egypt as a famous locality for vertebrate fossils. Wadi El-Hitan as a world heritage protectorate in Egypt. laboratory exercises include examples of each class.

GE 2115 Field Training (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, traverse types, methods and techniques of geologic surveying, Field equipments (Compass, Alidade, Total Station, GPS), the nature and construction of topographic and geologic maps, Preparation of topographic maps. Laboratory and field training applying geologic traverses and preparation of topographic maps.

GE 2202 Rock-Forming Minerals (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Introduction, Chemistry, Stability, Mineral reaction and Optical properties of the following: Nesosilicates (olivine group, humite group, garnet group, Zircon and Sphene), Sorosilicates (Epidote group, Melilite group), Ring silicates (Beryl, Tourmaline and Cordierite), Sheet silicates (Mica group, Pyrophyllite C, talc, Chlorite, Serpentine), Single chain silicates (Pyroxene group), Double chain silicate (Amphibole group), and Tectosilicates (Feldspar group, Silica minerals and Sodalitefeldspathoite group). Practical work includes identification of the optical properties of the above mentioned minerals.

GE 2204 Igneous Petrology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Introduction, Earth's interior, source of heat and heat transfer, melting and generation of magma, mixing of magma, composition of magma in different tectonic settings, magmatic differentiation in open and closed systems, Bown's reaction series, chemical and mineralogical classifications of some igneous rocks. Laboratory study consists of hand specimens identification and examination.

GE 2206 Metamorphic Petrology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Introduction, Earth's heat and pressure, fluids and their generation, metamorphism and its agents, mineral assemblages and textures, types of metamorphism, tectonics and metamorphism. Laboratory study consists of hand specimens identification and examination

GE 2212 Macropaleontology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction and Earth history, Geologic Time Scale, Fossils and fossilization, Significance of fossils, Age determination, Ecology and mode of life, Taxonomy and classification, Phylum Mollusca, Class: Pelecypoda, Class Gastropoda, Class Cephalopoda. Practical work includes examination, classification and description of some selected taxa.

GE 2208 Lithostratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction and stratigraphic laws, General characteristics of sediments, Stratigraphic analysis, Strata configuration and boundaries, Stratigraphic units, Lithostratigraphy, Biostratigraphy, Chronostratigraphy and Geochronology, Breaks in sedimentations, Stratigraphic correlation, Other stratigraphic units, Stratigraphic data presentation

GE 2210 Micropaleontology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2109

Introduction, Test, Morphology, Wall structure and arrangement of some selected microfauna including Nummulites, Operculina, Miogypsina, calcareous algae, calcareous nannoplankton, Pollen and Spores, Conodonts, Radiolaria, and Diatoms. Ecology and significance of microfauna. Practical work includes examination, classification and description of some selected fauna and flora.

GE 2214 Applied Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction to mineralogy, genesis, occurrence and physico-chemical characteristics of the most important minerals and rocks including: clay minerals, limestones, cement/concrete aggregates, building stone,..... together with their industrial applications, and the process of mineralogy and the factors that determine the quality of the resources and the end-products. Practical work consists of specification of the physico-chemical characteristics of raw materials used in different industries.

GE 2216 Advanced Stratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction; Revising briefly the classic stratigraphic subdivisions particularly litho-, bio-, chrono- and event stratigraphy. Stratigraphic laws, sedimentary environments; coastal environments, shallow marine environments, shelf sediments and processes. Sedimentary facies, facies stacking patterns, sea-level changes, accommodation space, sedimentation rate, shoreline trajectory. Sequence stratigraphy, definition, basics, significance. Sequence stratigraphic elements; key surfaces, parasequence, parasequence sets and stacking patterns, systems tracts. Sequence stratigraphy of coastal and shallow marine environments; case studies. Applications of sequence stratigraphy

GE 2218 Paleoecology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Paleoecological data derived from sedimentology, mineralogy, geochemistry and paleontology. Study of some selected ancient organisms and their environments. Environmental parameters. Populations in paleoecology, Paleobiogeography and climate. The ice age, global warming and sea level rise, aspects of Paleozoic, Cenozoic global climate, Paleoclimatic data from fauna and flora.

GE 2220 Field Training (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Observing and collecting data and samples, using compass, clinometer, hand level, GPS and Total Station, plotting geologic features on a base map, Mapping geologic features on aerial photographs,

making a geologic map from aerial photographs, Measuring stratigraphic sections. Laboratory and field training include preparing and interpreting geologic maps and cross-sections.

GE 2224 Special Course (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

A course covering selected topics in geology and to be specified by the department committee each year. May be repeated for credit when course topic varies.

GE 3101 Structural Geology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction to structural Geology, Measurements of attitudes of strata and bedding planes, Non-tectonic structures, Stress and Strain, Field Study of Geologic Structures, Types of Unconformities, Folds and their Types, Faults and their Classification, Joints, Cleavage- foliation – lineation , and shear zones. Practical work includes drawing and interpretation of geologic structural maps.

GE 3107 Sedimentary Petrology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2105

Sedimentary particles, Origin and mode of formation of sedimentary particles, Mineralogical composition of sedimentary particles, Detrital and non-detrital minerals, Textures of sedimentary rocks, Primary structures of sedimentary rocks, Weathering processes, Transportation processes, Sedimentation processes, Depositional environments. Practical work includes identification of mineral grains, grain size analyses and data interpretation, determination of grain shape, roundness and sphericity, and XRD identification of clay minerals.

GE 3111 Field Geology and Field Studies (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Detailed mapping and sampling, Mapping of Igneous, Sedimentary and Metamorphic Rocks, Unconformities and folds, Stereonets and faults, Cross-sections, Subsurface mapping techniques, Preparing and writing a geologic report. Field training include sampling and interpretation of geologic maps, applied geologic problems.

GE 3103 Igneous Petrology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2204

Introduction, definitions and common terms in igneous petrology, distribution of igneous rocks in different tectonic settings, Forms, , Field relations, Structures and Textures, Classification, Petrography, Binary system, Tertiary system, Quaternary system. Laboratory study consists of hand specimens and petrographic examination under the microscope.

GE 3105 Metamorphic Petrology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2206

Introduction, definitions, Metamorphic fabrics, Metamorphic facies and grades, Contact, Dynamic, Ocean floor, Regional and ultrahigh pressure metamorphism, Metaplates, Metabasites, Meta-carbonates and Calc-Silicates, meta-ultramafics, distribution of metamorphic rocks in tectonic settings, Field relations and observations, Phase rules and Mineral transformations. Laboratory study consists of hand specimens and petrographic examination under the microscope.

GE 3109 Macropaleontology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2212

Introduction, Phylum: Bryozoa, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina,

Trace fossils and Plants, Paleoecology and paleoenvironment. Practical work includes examination, classification and description of some selected taxa.

GE 3113 Marine Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction, ocean basins, sea floor topography and bathymetry. Ocean water circulation and its driving force, physical and chemical properties of ocean water, Types of continental margins, deep ocean floor, mid-ocean ridges and trenches, continental shelf, slope, and rise, submarine canyons, seamounts, abyssal plain, basin-floor fans. Marine sediments, coastal zone geology and classifications. Sediments of nearshore environments. Sea-level, water depth, climate, hazards. Sea-level and sedimentation. Marine resources, manganese nodules. Marine sediment sampling, description and instruments.

GE 3115 Non-metallic Deposits (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Classification basis of the principal uses in order to lend emphasis to the recent utilization of these resources. Ceramic materials, metallurgical and refractory material: industrial and manufacturing materials: building materials, fertilizer, abrasives. Occurrence, processing, economic and applications of non-metallic minerals: Sand and sand stones, Siliceous raw materials, Clay minerals, Carbonate rocks, Salt minerals, Sulphates, Sulfur, Fluorine minerals, Boron minerals, Volcaniclastic rocks, Graphite and diamond, Feldspars and nepheline syenite, Asbestos, Zirconium. Non-metallic deposits in Egypt

GE 3117 Rock Mechanics (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction, Geological classification of rocks, Engineering classification of rock masses, Index properties of rocks, stress and strain in rocks, elastic and time-dependent behavior of rocks, state of stress in rock masses, failure mechanisms, Stress-strain relationship in rocks, Measurement of rock stresses and lab testing. Geological and engineering applications.

GE 3119 Palynology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2109

Defination, historical matters, purposes, disadvantages and limitations, the natural history of Palynomorphs, Spores / pollen morphology, Methods of study, Applied Palynology and case studies from Egypt. Practical work focus on studying palynomorphs from the Precambrian to Holocene in Egypt in addition to presenting data quantitatively in the form of figures, percentages or both.

GE 3121 Trace Fossils (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2109

Introduction, Types of trace fossil preservation, Ethological (Behavioral) classification of trace fossils, The characteristics of the eight main groups (Cubichnia, Domichnis, Fugichnia, Equilibrichnia, Repichnia, Pascichnia, Agrichnia, Fodinichnia), Marine ichnofacies classification (Trypanites, Skolithos, Cruziana, Zoophycos and Nereites ichnofacies), Evolution of trace fossils, Geological importance of trace fossils, Applications from Egypt and other countries.

GE 3123 Lab Techniques (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

This course is designed to cover various techniques used in soft and hard rocks. Soft rocks techniques include: grain size analysis, heavy mineral separation, preparation of thin sections and staining techniques, XRD of clay minerals and bulk samples. Hard rocks techniques include preparation of thin and thin polished sections, separation of minerals (electromagnetic and microscopic), major and trace elements (including REE), Isotope analyses.

GE 3125 Geophysics (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Definition and branches of geophysics, Gravity field of the Earth, Geoid, GPS and isostasy, Seismic methods and earthquake, Magnetic and paleomagnetic methods, Electric and geothermal methods, Borehole geophysics, Practical work of some measured geophysical parameters.

GE 3202 Tectonic Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3101

General introduction, Outline of available theories, Geosynclinal theory, Earth forces and the kinds of faulting they produce, Boundary zones between crustal plates, constructive, destructive and conservative plate boundaries, Continental drift, Sea-floor spreading, Subduction zones, Transform faults, Global wrench tectonic, Major lithospheric plates of the Earth, Egypt in the framework of global tectonics.

GE 3204 Subsurface Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Introduction, Examination and Application of the techniques employed in subsurface geologic analysis, Theory of open hole logging operations, Analysis of log records, Use of log records to construct various types of subsurface maps, Examinations of well cuttings and cores, Methods of calculating water saturation, Porosity and probable lithologies, Representation and interpretation of subsurface data.

GE 3212 Geology of Ores (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2202

Introduction, Classification of Ore Deposits, Source rocks and mobility of elements, Magmatic Ore Deposits, Metamorphic Ore Deposits, Sedimentary Ore Deposits, Fluids of mineralization, Wall-Rock alteration and interaction, Mineral parageneses and zoning. Distribution of mineral deposits in tectonic environments. Laboratory study consists of hand specimens examination, description and identification.

GE 3206 Biostratigraphy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2208

Stratigraphic distribution of foraminifera - through Paleozoic, Mesozoic, the K/T boundary, Paleocene-Eocene boundary, Tertiary larger foraminifera and their biostratigraphic importance and Stratigraphic distribution of macrofossils through Paleozoic, Mesozoic, and Cenozoic eras.

GE 3208 Sedimentary Petrology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Classification of sedimentary rocks, Residual deposits and soils, Clastic rocks, Rudaceous rocks Arenaceous rocks, Argillaceous rocks, Limestone and dolostone, Siliceous rocks, Phosphorites, Carbonaceous deposits, Evaporates, Iron bearing rocks. Practical work includes identification, classification and petrographic description of clastic and non-clastic sedimentary rocks.

GE 3210 Engineering Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, Geology and civil engineering, Geological maps and sections, Field and lab investigations of site, geophysical surveys and assessment of different ground conditions, Soil strength, Rock strength, Rock mass strength, Ground subsidence, slope failure and landslides, Landslide hazards and slope stabilization, Rock excavation and tunnels in rocks.

GE 3214 Structural Geology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3101

Introduction to Structural Geology, Objectives, Mechanical Principles, Description of Folds, Field Study of Folds and Office Techniques, Joints, Description and Classification of Faults, Criteria for Faulting, Diapirs and Related Structural Features, Geophysical methods in Structural Geology. Practical work includes construction and interpretation of geologic structural maps.

GE 3216 Quaternary Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Studies of Quaternary environments, Scale and rapidity of climatic and environmental changes in the modern world, Impacts of human activities on global climates, Non-marine fossil, The study of

palynomorphs (pollen grains) in sediments, Insect remains. Practical work includes study and sampling of sediment exposures in the Nile Delta and Eastern and Western Deserts. These samples will provide the basis for subsequent lab work for evaluation of the pre-Deltaic and Desert bio-and litho-compositions and environment.

GE 3218 Geology of Africa (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Geography and topography of the African continent, African plateau and continental shelf, The Atlas Mountains and their relation to the Alpine mountain system of southern Europe, The continent's largest rivers and lakes as an important inland transportation system, Recent major earth disturbances, Major petrology and structural frames of the African continent, Pangaea supercontinent formation and breaking apart, Gondwanaland, separation of the Arabia and formation of the Red Sea, formation of the Great Rift Valley and the Cameroon Rift and the associated volcanoes. Exercises include application of the geologic characteristics to interpret the tectonic history.

GE 3220 Volcanology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2204

Introduction, Volcanic landforms and deposits (lava flows, pyroclastics, and derivative sediments) and their relations to the composition and physical properties of magmas and the modes of emplacement, Volcanic hazards and the effects of eruptions on climate and the atmosphere, Volcanic-hosted geothermal systems and mineral resources. Exercises include field trip to the Oligocene and Miocene volcanic eruptions in the Gulf of Suez and the Eastern and Western Deserts, covering studies in volcanology, petrology, hydrothermal alteration, geothermal systems, mapping and sampling of geothermal fluids and gases.

GE 3222 Geoaerchology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, principles and techniques, Pre-historic man (Paleolithic and Neolithic) implements, Water logged sites, tailoring GIS software for archeological application, application of palynology and archeology, geophysical and geochemical analyses of archeological sites, evidence of agriculture, economic utility of archeological sites, Geoaerchological Foundations, case studies from the Nile Delta, Pyramids Plateau and Upper Egypt, Postburial disturbance, archeological sites context, Use of geoaerchology in Egypt

GE 3224 Environmental Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: ----

Introduction, Atmosphere, Lithosphere, Hydrosphere, Biosphere, Environment and human activities, Global warming and sea level rise, Greenhouse effect, Coastal erosion, Shoreline protection, Flash flood hazards and mitigation, Groundwater pollution due to extensive use of fertilizers and insecticides, water-logging problems, Sand dune migration, resources management and Urban growth. Applied examples from Egypt and other countries.

GE 4105 Geochemistry (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: ----

Geochemical classification of elements and rule of their distribution, geochemistry of Earth compared to other planets, geochemistry of igneous rocks, magmatic crystallisation, evolution and tectonic settings, geochemistry of sedimentary rocks and conditions during sedimentation, metasomatism, isotope fractionation during igneous, sedimentary and metamorphic processes, age dating, stable isotope geochemistry, mineral chemistry, analytical techniques of rocks and minerals

GE 4109 Petroleum Geology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, Physical and chemical properties of oil and gas, Occurrence of petroleum, Origin of petroleum deposits, Source energy required for transformation of organic matters into petroleum, Evolution of petroleum (kerogene type and maturation), Subsurface environments, Oil migration.

GE 4111 Hydrogeology (1) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Introduction, Occurrence of groundwater, Hydrogeologic cycle and water balance, Groundwater movement, Aquifer tests, Water wells, Rock properties affecting groundwater, Vertical distribution of groundwater, Types of aquifers, Storage coefficient and Springs. Field and lab techniques employed for groundwater studies.

GE 4130 Geology of Egypt (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE3107

Introduction, Structural and tectonic setting, Early Paleozoic rocks, Carboniferous rocks, Triassic rocks in Sinai, Jurassic rocks in Egypt, Early Cretaceous rocks, Late Cretaceous in Egypt, Paleocene rocks and Cretaceous/Tertiary boundary, Eocene and Oligocene in , Egypt, Miocene and Pliocene rocks in Egypt, Quaternary rocks and Nile Delta

GE 4141 Research and Essay (1 hour weekly = 1 Credit hour)

Pre-requisite: -----

Reviewing a research project in geology to be selected by the supervisor, preparing a written essay on it.

GE 4204 Photogeology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Principals of remote sensing, Data acquisition and interpretation, Interaction mechanics Images and remote sensing systems, Errors in flying, air-photo cameras and types of films Geometrical aspects of aerial photographs, Relief displacement and vertical exaggeration Stereovision, Photogrammetry.

GE 4206 Precambrian Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Distribution and age of Precambrian rocks, Theories of rock evolution, Classifications of Precambrian rock units in Egypt, Gneiss, migmatite and schist, Ophiolitic rocks, Island-arc metasediment and metavolcanic associations, Granites, Dokhan volcanics, Gabbros, Hamamat sediments, Natash volcanics and ring complexes.

GE 4208 Mining Geology (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 2107

Ore Deposits; concept; plate tectonic; volcanoes.; deposition; residual; exploration, Mining methods: open-pit, pit-slopes, underground, bulk UG, mining cycle, complication. Mine workings, claim staking, exploration and drilling methods and drill holes, blasting. Rock sampling, geostatistics, trench/adit mapping. Mineral processing methods; comminuting, floating, smelting, leaching, bio-leaching. Mine waste disposal, Grade and tonnage calculations. Ore reserve classification. Mine and money; contracts, prices, valuation, reserves, costing. Future of mining: economics, automation, bacteria, viruses, future company.

GE 4242 Research and Essay (1 hour weekly = 1 Credit hour)

Pre-requisite: -----

Reviewing a research project in geology to be selected by the supervisor, preparing a written essay on it.

GE 4210 Basin Analysis (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3107

Theory of basin formation, Classification of sedimentary basins according to tectonic environment, The controls on and mechanisms of subsidence and sedimentation, Examples from around the world of typical basin types, Impact basin style and sedimentation on the hydrocarbon habitat and prospectivity, depositional systems and their control on reservoir, source, seal and trap rocks, introduction to seismic facies analysis, sequence stratigraphy, correlation techniques and basin modeling. Exercises include interpretation of seismic and wireline log data for basin analysis.

GE 4212 Hydrogeology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4111

Introduction, groundwater movement, permeability, determination of hydraulic conductivity, groundwater flow rates, groundwater flow directions, Aquifer tests, groundwater quality and chemistry, Isotope hydrology, Groundwater pollution, Surface and subsurface investigations of groundwater, Groundwater modeling, Hydrogeology of Egypt.

GE 4216 Remote Sensing (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Visual image interpretation, Elements of image interpretation, Drainage analysis, Recognition of geological structures, Recognitions of rock types, Mapping with aerial photographs, Remote sensing satellites, Digital images, Remote sensing applications.

GE 4218 Petroleum Geology (2) (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4109

Chemistry, composition and physical properties of petroleum, origin and migration of hydrocarbons, Geology of petroleum, Occurrence of petroleum, Reservoir rocks, Porosity and permeability, Structure traps, Stratigraphic traps, Combination traps, Barren traps, Gulf of Suez petroleum provinces, Western desert, petroleum provinces, Nile delta petroleum provinces, Sinai petroleum provinces, methods of exploration.

GE 4220 Hydrogeochemistry (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4105

Principles of Aqueous chemistry, Chemical Reactions, Mass transport in Groundwater Flow (Aqueous system), Mass transport in Groundwater Flow (Geology process), Contaminant Hydrogeology, Hydrogeochemistry of Egypt.

GE 4222 Advanced Geochemistry (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4105

Introduction, Geochemistry of sedimentary rocks, Eh, pH and oxygen fugacity during sedimentary processes, Behavior of elements during metamorphism, REE in metamorphic rocks, Metasomatism and behavior of elements, Radiogenic isotope geology, Fractionation of radiogenic isotopes during igneous, sedimentary and metamorphic processes, Estimation of absolute age using radiogenic isotopes, Mineral chemistry and mantle processes.

GE 4224 Organic Geochemistry (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 4105

Introduction, Fate of organic matter from its formation through its transformation and destruction during depositional, diagenetic (remineralization) and catagenic (petroleum generation) processes. Stable carbon isotopes, Organic carbon and phosphorus, Organic chemicals of environmental concern, Biomarkers as tracers of past and present productivity, Radiocarbon in organic materials, Organic carbon transport and old carbon in the modern environment, Fate of organic matter over geologic time, Black Carbon. Practical work includes analytical techniques of biomarkers, water and interstitial fluid and petroleum source rocks.

GE 4226 Ore Mineralogy (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 3212

Introduction and the components of ore microscope, Preparation of polished sections, Optical properties under polarized light and crossed Nicoles, Hardness, Structural and morphological grains, Microchemical techniques, Growth textures, Solid solutions in native and oxide textures, Solid solutions in sulphides, Replacement and deformational temperatures.

GE 4228 Geographic Information Systems (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

Introduction, Tools and techniques of GIS (spatial data capture, management, and analysis), Cartographic output using GIS software, Database design and management including conversion fundamentals, modeling techniques, and strategic planning, Developing a GIS using ArcView GIS software. Applications of GIS (environmental assessment, analysis of natural hazards, site analysis for business and industry, criminal justice, real estate, location analysis, resource management, and land-use planning). Practical study include training in the use of technology and software to in GIS and GIS base map development (scanning, digitizing, and coordinate geometry).

GE 4230 Selected Topics (1 lecture + 3 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

A course covering selected topics in geology and to be specified by the department committee each year. May be repeated for credit when course topic varies.

COURSES DESCRIPTION FOR

B.Sc. Biology Section

GE 1121 General Geology (1) (1 lecture + 2 practical hours weekly = 2 Credit hours)

Pre-requisite: -----

The origin of the Earth and creation of the Universe, The Earth's interior (composition and structure), materials of the Earth's crust (crystals, minerals and rocks), continents, ocean basins, lithosphere, hydrosphere, biosphere and atmosphere. Internal processes: volcanism, earthquakes, crustal deformation, mountain building and plate tectonics, External processes: weathering, mass wasting, streams, glaciers, groundwater, deserts and coasts. Exercises include topographic and geologic maps.

GE 1222 General Geology (2) (1 lecture+ 2 practical hours weekly = 2 Credit hours)

Pre-requisite: GE 1121

Introduction, Origin, evolution and mass extinction of major life forms with emphasis on stratigraphic record, development of the geologic time scale and paleogeographic features of the Earth. Absolute and Relative Age, Law of superposition, Major life forms in Precambrian, Paleozoic, Mesozoic and Cenozoic Eras. Laboratory studies include stratigraphic sections and identification and description of invertebrate fossils.



Programme Title Botany

Programme Type Special

Department(s) Botany

BO2101: BO1101: General Ecology

This module introduces the students to plant ecology and covers several topics in two parts. The first part deals with the component of the ecosystem, energy flow, food chain, ecological pyramids, bio-geochemical cycles, Temporal Variations (at population and community Level). The second part deals with the ecological factors: (biotic factors, climate, topography, soil) and their effect on plants, plant vegetation and ecosystems. The course will also cover plant indicators, responses of plant behaviors to ecological factors, different field trips to different wild habitats to recognize the components of ecosystems.

BO2103: BO1101: Photosynthesis

The aim of this module is to study with some details the process of photosynthesis with its biochemical pathways. Students will acquire knowledge of the control of flux through photosynthetic pathways, and the ways in which photosynthesis is

adapted to different physiological states. The module will also consider the amazing diversity and sophistication in the ability of cells to synthesize complex molecules from simple precursors, and the ways in which knowledge of this can lead to the ability to manipulate metabolism in plants. Throughout the module, the ways in which individual pathways illustrate the general principles of metabolism will be highlighted. Examples will be taken from a wide range of plant and algal systems.

BO2105: BO1101: General Genetics

This module provides an introduction to the principles of genetics and considers the application of these principles to diverse aspects of biology. The genetic systems of higher organisms and microbes are described, including mechanisms of gene transmission and genetic exchange and mutation. Non-Mendelian genetic systems such as multiple alleles, pseudoalleles, linkage, crossing over and gene mapping, genetics related to sex and polygenes and pleiotropy are additional topics that will be covered in this module. Plant and microbial examples are stressed where appropriate. Applications include fundamental studies in other biological disciplines, such as evolutionary and developmental biology, as well as topics directly concerned with human welfare.

BO2107: BO1101: Cell Biology

The aim of this module is to provide an introduction to the overall structures of prokaryotic and eukaryotic cells; organization and function of biological membranes; compartmentalization of eukaryotic cells and the functions of the major types of organelle; the main elements of the cytoskeleton and their functions; intercellular and intracellular communication

BO2109: BO1202: Non Flowering Plants

The aim of this module is to give the students sufficient knowledge on the non flowering plants including their occurrence, structure, classification and evolutionary relationships describing selected life cycles of the major groups. The major groups include: Bryophyta (Hepaticae, Anthocerteae and Musci), Pteridophyta (Psilophytinae, Lycopodiinae, Equisetinae and Filicinae) and Gymnospermae (Cycadophyta, Ginkgophyta, Coniferophyta and Genetophyta). Special emphasis will be given to the evolution of stele structure in the different non flowering plants.

MB2101: BO1202: Prokaryotic Diversity

This module deals with the occurrence and distribution of prokaryotic organisms and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to bacteria, cyanobacteria and actinomycetes particularly their nutritional requirements, physical conditions required for growth, reproduction and economic importance. This course will also cover viruses and their distinctive characters, their structure, size, multiplication and transmission as well as the human, animal and plant viral diseases.

BO2111: B01202: Soil Ecology

This course deals with soil ecology. One part of this course will deal with the soil environment (soil physical and chemical features, soil water status, soil pH, soil

temperature, soil light). The course will also deal with the soil biota with special emphasis on the interactions between the soil biota and soil features. The course will also cover the ecology of soil nutrient cycles and soil pollution.

BO2202: BO1101: Plant Taxonomy

This module introduces the students to the principles of plant taxonomy and the definitions and terms used in plant taxonomy and systematics, taxonomic categories and taxa definitions and the history and development of plant classifications. The course will give attention to the recent systems of plant classifications and the modern phenetic and cladistic approaches in plant classifications. A major part of this module will deal with the sources of taxonomic information, and the classification of selected families of angiosperms, as classified in Cronquist system with reference to their taxonomic position in the Engler system. The impact of plant geography, breeding system and cytological features on the classification of some groups will be also covered in this course.

BO2204: BO1202: Algae

In one part of this module the students will be introduced to topics covering the occurrence and distribution of algae and their morphological structure, diversity and classification. The course will also cover reproduction in algae (vegetative, asexual and sexual) and life history and alternation of generation giving examples from the different groups of fresh water and marine algae. In a second part of the module will deal with the phylogenetic relationships and evolution of representative algal groups.

BO2206: BO1101: Plant Anatomy

This course covers the fundamental aspects of the structure and functions of the plant cells and tissues. The living and non living cell components will be described and the different types of plants tissues studied in some details. The course will also cover the primary structure of plant body and the normal and anomalous secondary thickening. Some lectures will be devoted to the formation of secondary roots and the abscission of leaves and ecological anatomy.

BO2208: BO2101: Economic Botany

This module deals with the importance of plants as sources of services and goods of economic importance in human life. It should cover fiber and wood plants, dye plants, rubber, gum and resin plants, fatty oil and wax plants, sugar, starch and cellulose plants, medicinal plants, pasture and forage plants and food plants. The uses of products derived from plant sources should also be addressed in this module.

BO2210: BO2101: Crop Plants

This module deals with the classification, evolution and diversity of crop plants and the different uses of these plants in human life. The structure and classification of field crops that may include topics on environment in relation to crop growth and distribution will be also addressed. Some topics should also deal with seed bed preparation, crop rotation, Crop distribution in Egypt and crop improvement.

BO2222, BO2105, Principles of Molecular Genetics

This module gives detailed studies on the molecular aspects of genetics particularly gene structure, expression and regulation in prokaryotes and eukaryotes and describes the detailed mechanisms classic specific cases. This module also covers mutations and will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. Special emphasis will be given to eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing and eukaryotic gene regulation emphasizing transcriptional control and including details of general and specific transcription factors which interact to regulate gene expression in different tissues at different stages.

MB2232: BO1202, Virology

This module aims to introduce students to the detailed biological properties (structure and replication) of viruses particularly those associated with major diseases of man, and plants and provide awareness of the transmission, epidemiology, pathogenesis and control of these virus groups. The module also embraces the basic specific and non-specific host defense mechanisms associated with these infections, the interaction of viruses with these defenses, and the principles concerned with the diagnosis of viral infections by laboratory procedures.

BO3101: BO2131: Plant Growth and Development

This module provides the students with knowledge of the key areas of plant growth and development with emphasis on the role of plant growth regulators on cell division and differentiation. The topics of the course may start with the regions and phases of growth in plant body and the factors affecting growth. Detailed topics may include the chemistry, biosynthesis, translocation, action and role of auxins, gibberellins, cytokinins, ethylene and abscissic acid in plant growth. Additional lectures will be devoted to photoperiodism and vernalization and the molecular biology aspects of seed embryogenesis, dormancy and germination.

BO3103: BO2105: Plant Molecular Biology

This module provides practical knowledge of the key areas of molecular biology, and emphasizes the manner in which the separate disciplines of biochemistry and genetics must be integrated in the laboratory. The module will introduce students to the basic laboratory skills of simple laboratory work and will involve the use of basic laboratory equipment e.g. spectrophotometers and microscopes. The module should also cover more complicated experiments such as gel electrophoresis and PCR. The rules of laboratory safety will be emphasized.

BO3105: BO2105: Plant Cytogenetics and Evolution

This module will illustrate how genetic approaches have been used to understand the mechanisms of eukaryotic cell growth and division. Material to be covered includes the mitotic cell cycle and its control by internal and external signals. Meiosis will be described and its genetic significance illustrated. The molecular

aspects of chromosome structure, organization and chromosomal banding and their use in karyotype analysis are studied. In addition, the consequences of chromosomal variations and their role in evolution and plant breeding will be studied. Examples illustrating this role will be given from different plant groups.

BO3107: BO2206: Plant Secondary Metabolites

This module deals with secondary metabolites of plants. The structure and function of major groups of these natural products will be covered giving some examples from different plant groups such as phenolics, alkaloids, terpenes and other plant secondary metabolites as well as sterols, cholesterol and vitamins particularly vitamin D₃ & D₄, Bile, vitamin B complex, vitamin B1 (thiamine), vitamin B2, vitamin H, biotin, vitamin E group, vitamin K group, vitamin K1 and vitamin A. The role of the secondary metabolites in plants tolerance to environment will be discussed.

BO3109: BO2101: Plant Geography

This course will cover the principles and targets for the study of plant geography, climatic zones and vegetation belts of the world. It will also cover the floristic regions and the major plant communities of the world and the distribution of plant species. Other topics include dispersion of Diasporas and the characters of distributional area and explanation of distributional methods of the endemic plants. Special emphases will be given to domestication of plants and the center of origin of the major crops.

BO3111: BO2103: Plant Enzymology

This module will focus on the types, nomenclature and classification of plant enzymes. The course also covers the structure, kinetics and functions of enzymes. It will also cover topics related to the nature of enzymes, enzyme specificity, mechanisms of enzyme action, separation and purification of enzymes. The following topics will also be dealt with in this course: factor affecting enzymatic reactions, the type of inhibition, regulatory enzymes, multi-enzyme system and prosthetic groups

BO3121: BO2105: Regulation of Gene Expression

This module gives a broad overview of gene expression and regulation in prokaryotes and eukaryotes and look at detailed mechanisms by studying classic specific cases. Special emphasis will be given to eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing and eukaryotic gene regulation emphasizing transcriptional control and including details of general and specific transcription factors which interact to regulate gene expression in different tissues at different stages of plant life.

BO3113: BO3222: Physiology of Algae

This module deals with physiological aspects of algae based on detailed studies on the structure of algal cell components. The structure and function of major

physiological pathways and the different secondary metabolites will be also addressed in this course. The role of the secondary metabolites in algal tolerance to environment will be discussed.

MB3113: BO1202: Applied Microbiology

The aim of this course is to introduce students to areas of microbial biotechnology that are either currently being exploited commercially or that are likely to lead to commercial ventures in the near future. The first part of the course covers the fermentation processes currently utilized in the pharmaceutical and food industries, based on microbial fermentation and illustrates the range of technologies involved in large-scale commercial growth of microorganisms. The second part of the course covers the utilization of gene technology for the production of new products from micro-organisms and micro-algae.

BO3202: BO2206: Plants water relation, and mineral nutrition and translocation

This module will deal with the role of water in plants including the properties of water and aqueous solutions. The course should also address cell-water relations and the absorption of water and factors affecting this process. A major part of the module should deal with the translocation of water to stem and leaves and the transpiration and factors affecting this important process. Stomatal mechanisms and measurements of stomatal apertures and their contribution to plant-water balance and water stress will be major topics of this course.

BO3204: BO2101: Wetland and Desert Ecology

In one part of this module the following topics will be covered: origin and development of deserts, the scientific and practical scope of deserts, structure and function relationships of desert organisms and also the impact of man and desertification, combating desertification desert distribution and uses of desert plants. The course will also cover non- biological resources in arid lands; minerals, energy and water; culture and demography of desert population; properties of Egyptian desert. In a second part of the course the concept and the categories of wetlands will be explained. Plant stratification and succession, diversity, factors controlling the properties of wetland (watering, fertility, disturbances, and competitions, grazing) will also be covered. Other topics include remediation of wetlands, Job's functions, conservation management of wetland, study the situation current of Egyptian's wetland.

BO3206: BO2201: Flora of Egypt

This course will give knowledge about the preparation of plant collection, historical review of Egyptian flora. The characteristics of natural vegetation of Egypt covering recent studies will be explained and the geographic regions and its properties (The Nile region, Deserts, Oases, Mediterranean Sea coast, Red sea coast, Gebel Elba, and Sinai flora) will be described. The students will be asked to make their collections through field trips to some of the Egyptian geographical regions. They will also be encouraged to make collections of the Egyptian cultivated plants, ornamental plants of Orchards and street trees, crop plants (vegetables and fruits),

medicinal plants and learn the methods of plant collections and establishment the Herbarium.

BO3208: BO2202: Medicinal and Aromatic Plants

This module covers broad topics on medicinal plants and their cultivation and the problematic business communication in medicinal and aromatic plants industry. The module will also include comparison of cultivation and wild collection of medicinal and aromatic plants under sustainability aspects; sustainable wild collection of medicinal and aromatic plants, international trade in medicinal and aromatic plants: actors, volumes and commodities, quality control in the production chain of herbal. This course will also cover topics on the functional genomic approaches to study and engineer secondary metabolism in plant cell cultures.

MB3232: BO1202: Mycology and Plant Pathology

This module will be presented in two parts; the first part enables students to acquire more knowledge about fungi with special reproduction, classification and life cycles of representative fungi. This module will also deal with some details with the economic importance of fungi and the uses of fungi and their products in human life. In the second part this module provides theoretical and practical knowledge of plant diseases; their causative agents and their control. It will cover diseases caused by fungi and other agents such as viruses, plant parasites, insects and nematodes. The module will also include plant disease resistance and disease control. Details will be given to molecular aspects of disease resistance and control and the importance of breeding for disease resistance. The course will also cover the ways and means of plant disease bio-control using natural enemies.

BO3210: BO1202: Physiological Stress

Plants and other living organisms may be exposed permanently or occasionally to stress imposed by severe environments such as drought, water shortage and salinity. This module will focus on the mechanisms used by plants to avoid the harmful effects of environmental stress. The modern molecular approaches to study the adaptations of plants to stressful conditions will be stressed in this module.

BO3212: BO2105, Genome Change

This module covers mutations and genome structure and evolution. The first part will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. The second part will cover the functions highly abundant reiterated simple sequences; functions and origins of the sequences of the genome; transposons, and retrotransposons. The structure, function, inheritance and evolution of extranuclear genomes in will be considered in a range of eukaryotes. The impact of whole genome sequencing (genomics) on the study of gene function will be considered for both prokaryotic and eukaryotic organisms.

BO4101: BO3107: Bioenergetics

The aim of this module is to examine the ways in which biochemical pathways are controlled and integrated in plant cells and tissues. Students should gain modern

knowledge of the control of energy flux through metabolic pathways, and the ways in which metabolism is adapted to different physiological states. The module will also consider the amazing diversity and sophistication in the ability of cells to synthesize complex molecules from simple precursors, and the ways in which knowledge of this can lead to the ability to manipulate metabolism in biotechnology. Throughout the module, the ways in which individual pathways illustrate the general principles of metabolism will be highlighted. Examples will be taken from a wide range of micro-organism, plant and animal systems.

BO4103: BO3103: Genetic Engineering

Genetic engineering has developed from knowledge of molecular genetics and genome structure and its application will affect our lives in many ways. The basic technology and methods will be reviewed, so that students will become sufficiently well informed to understand the applications of these techniques. Lectures will deal with the development of method and approaches of gene cloning and gene transfer, genetic libraries and production of genetically modified crops. Details will be given to details of gene transfer to plants.

BO3105: BO2101, Biodiversity and Conservation

This module will cover the ecological principals dealing with the conservation theory and its application, conservation for sustainable development. The main topics of the world include species declination and biodiversity, importance of plant biodiversity, in situ and ex-situ conservation types, sustainable development and conservation in dry and wetland regions. Special attention will be given to the concepts and measurements of biodiversity (diversity, naturalness, rarity other characters), conservation at individual and population level and ecosystem, human impact on plant diversity, construction and development of natural reserved areas in Egypt with a description for these protected areas. The course will include field trips to some of the natural reserves.

BO4107: BO2202, Plant Molecular Systematics

This module will enable the students to learn about the different types of molecular criteria and their application in plant phylogeny and systematics. The course will describe the molecular methods used to generate these criteria and deals in some details with the different approaches for constructing relationships of plant taxa using distance and parsimony approaches using different types of tree building methods.

MB4141: MB3232: Bio-control of Plant Diseases

Biological control is an environmentally sound and effective means of reducing or mitigating pests and pest effects through the use of natural enemies. The enemies controlled may be viral, microbial, nematode, insect, mite, weed, and vertebrate pests in agriculture, aquatic, forest, natural resource, stored product, and urban environments. Biological control of arthropod pests of human and domestic animals is also included. Ecological, molecular, and biotechnological approaches to the understanding of biological control are also part of bio-control technologies.

Molecular technology advances in the understanding of biological control agents and their mechanisms will also be a major topic of the course.

BO4111: BO3204: Environmental Issues

This course will be focused on current ecological and environmental problems that may include the threats to natural resources, energy problem, food problem, desertification, grazing problem in dessert regions, pollution and global climate change. The course may also cover topics such as sustainable development, soil quality, waste management, water shortage problem in the Middle East, management of water resources in arid lands, human impact and ecosystem restoration.

BO4113: Scientific Writing and Presentations

Analysis and interpretation of genetic data are essential skills for modern geneticists and are important for handling of biotechnological information. The purpose of this module is to develop these skills through a directed program of reading, discussion and question answering, based on a series of research papers. This module will introduce the students to the elements of scientific writing starting with how to present the data, prepare tables and graphs and write the sections of research papers. The know-how of presenting scientific data in a poster or oral sessions will be described in detail.

BO4115: BO3103: 1, 2, 2: Botanical Bioinformatics

The first part of this module will focus on the development and implementation of efficient algorithms for problems related to genomics with emphasis on sequence homology and alignment, phylogenetic tree building methods, hidden Markov models and their applications in genetics and biotechnology (e.g. multiple sequence alignment, recognition of genes and promoter sequence). A second part of this module will also deal with retrieval, analysis and interpretation of biological data concerned, protein sequence motif analysis, prediction of RNA and protein secondary structures. Genome analytical methods, annotations, protein and nucleic acids data base searching will also be part of this course.

BO4202: BO2202, Plant Sociology

This course will introduce the students to the hypotheses of plant community, classification system of plant community, characters of plant vegetation and analytical methods of population ecology. Main topics include the Qualitative characters: Floristic composition, life-forms, stratification, phenology, vitality, sociability, interspecific association, dominance, dispersal types, sex form, physiognomy, fidelity and the Quantitative characters: Species diversity, density, frequency, cover, size, biomass, presence or constancy, and pattern. In addition, multivariate analyses of vegetation, similarity coefficient between plant communities, classification methods of plant communities, ordination, and direct gradient analysis.

BO4204: BO4103: Plant Biotechnology and Breeding

This course considers the application of biotechnology to plants, for both agricultural and research uses. It covers the production of transgenic plants and how this technology has resulted in genetically engineered crop plants that have improved qualities or produce novel plant products. It also covers alternative techniques such as culture-induced variation or marker assisted plant breeding that can be used to produce genetically improved crop varieties without use of genetic engineering. The release of engineered crops is having a major impact on society raising issues of economic and ecological importance. An appreciation of these issues will be developed. The principles of plant breeding will be explained and emphasis will be given to molecular markers and their use in breeding.

BO4206: Research Project (Botany)

The module aims to give students experience of laboratory research, and to develop practical and organizational skills essential to a scientific career. Students undertake a research project related to their degree subject(s) and submit their work as a word-processed report, written in the style of a research publication. Projects are undertaken under the supervision of a member of academic staff, and are related to the research activities ongoing in the Department. Most placements are in labs within the Department, but a small proportion of students undertake projects in other locations, such as the pharmaceutical and chemical factories. In this module, students develop skills in the design and execution of experiments, and in the collation, presentation and interpretation of data.

BO4208: BO1202, Quantitative and Population Genetics

This module will concentrate on how the frequencies of different alleles are distributed and altered in populations. The emphasis will be on polymorphisms and of plants. Material covered includes variations in cell proteins and morphological characters, fitness, migration, genetic drift, breeding systems, types of selection, effects of man-made changes, roles of RNA and DNA genomes, introns and gene duplications, on population genetics. Quantitative characters are typically influenced, not by single major genes, but by several to many polygenes acting in concert with the environment. In quantitative genetics, the concepts of heritability will be developed in relation to agricultural and human populations.

BO4210: BO2204: Economic Uses of Algae

This module will deal with some details with the economic importance of algae and the uses of algae and their products in human life, particularly their commercial applications of algal hydro-colloids, role of algae in agriculture and role of micro-algae in liquid waste treatment. The importance of algae as a human food or food complementary will covered in some details. Other uses of algae include: medical uses of algae, lipids and polyols from micro-algae, diatoms role in soil fertility, commercial applications of algal hydro-colloids.

BO4212: BO2105: Genome Analysis

This module deals with the mechanisms of cell growth and division. The molecular aspects of chromosome structure and organization and chromosomal banding and their role in genome analysis are studied. This module will also show how classical and molecular techniques used for protein separation, identification, quantification. The module should also deal with structural proteomics and cellular proteomics.

MB4206: MB3232: Physiology of Fungi

This module deals with aspects related to the physiological processes in fungi, it may deal with the culture media (natural, semi-synthetic and synthetic). Fungal growth and the internal and external factors affecting growth in vitro. The course will further address the organic and inorganic fungal nutrition, the utilization and metabolism of carbon and nitrogen sources and metabolism of proteins and lipids in fungi. Additional topics are the fungicides and their mode of action .

BO4214: BO4105: Environmental Management and Impact Assessment

This course will introduce the students to the regulation and regulatory framework of the environmental and hazardous Waste law; Definitions; policy guidance vs. regulations; role of the states, municipalities and the EEAA, compliance issues; case studies. The course will also give knowledge about the environmental management system (EMS) under standing ISO 14000 scope and definitions; EMS requirements and environmental policy; cost benefit analysis; environmental planning; implementation and operation; checking and corrective action; environmental auditing and the environmental management system in Egypt. The course will further describe the objective and needs of environmental impact assessment (EIA); activities involved in EIA, characteristics of impacts); EIA methods, checklists, overlay mapping, net works, matrices; estimates of resources demand for EIA studies; Recommended methodologies for rapid EIA; case studies; guidelines for EIA in developing countries; environmental impact statement; land evaluation and suitability analysis.

BO4216: BO2202: Plant Molecular Phylogeny

This module covers genome structure and evolution. It will also cover the functions of chromosomes; highly abundant reiterated simple sequences; functions and origins of the non-genic sequences of the genome; transposons, retroviruses and retrotransposons; evolution of genes and gene families. The second part will cover sequencing and mapping studies. The final part will cover the use of molecular information to reconstruct the phylogeny of life based on molecular information.

BO4218: BO4101: Nitrogen metabolism

This module should deal with the metabolism of nitrogen in plants. The course should address the following topics: nitrogen in the biosphere, cycling of nitrogen in nature, loss of nitrogen from its cycle, gain of nitrogen to its cycle and the processing of inorganic nitrogen by the plants. The course should also cover the amino acids and proteins and the metabolism of nitrogen in the seeds.



Programme Title **Microbiology**

Programme Type **Special**

Department(s) **Botany**

MB2101: BO1202: 2, 2, 3: Prokaryotic Organisms

This module deals with the occurrence and distribution of prokaryotic organisms and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to bacteria,

cyanobacteria and actinomycetes particularly their nutritional requirements, physical conditions required for growth, reproduction and economic importance. This course will also cover viruses and their distinctive characters, their structure, size, multiplication and transmission as well as the human, animal and plant viral diseases.

MB2103: BO1202: 2, 3, 3: Principles of Mycology

This module will enable students to acquire knowledge about the science of mycology with special emphases on nutrition, reproduction and classification of fungi. The course will cover reproduction in fungi (vegetative, asexual and sexual) and life history and life cycles of representative taxa. This module will also deal with some details with the economic importance of fungi and the uses of fungi and their products in human life.

MB2105: BO1202: 1, 2, 2: Instrumental Methods in Microbiology

The course includes the following methods and instruments used in microbiology: Methods of Microbial growth study, Microbial cell breakage methods, study of microbial structure details (bright field, dark field, phase contrast, fluorescence, transmission electron and scanning electron microscopes), Gel filtration, Ion exchange chromatography, Affinity chromatography, Gel Electrophoresis technique and Antimicrobial compounds assay.

BO2105: BO1202: 2, 3, 3: General Genetics

This module provides an introduction to the principles of genetics and considers the application of these principles to diverse aspects of biology. The genetic systems of higher organisms and microbes are described, including mechanisms of gene transmission and genetic exchange and mutation. Non-Mendelian genetic systems such as multiple alleles, pseudoalleles, linkage, crossing over and gene mapping, genetics related to sex and polygenes and pleiotropy are additional topics that will be covered in this module. Plant and microbial examples are stressed where appropriate. Applications include fundamental studies in other biological disciplines, such as evolutionary and developmental biology, as well as topics directly concerned with human welfare.

BO2107: BO1202: 1, 2, 2: Cell Biology

The aim of this module is to provide an introduction to the overall structures of prokaryotic and eukaryotic cells; organization and function of biological membranes; compartmentalization of eukaryotic cells and the functions of the major types of organelle; the main elements of the cytoskeleton and their functions; intercellular and intracellular communication

MB2107: BO1202: 1, 2, 2; Actinomycetes

In this module special emphases should be devoted to the habitats in which actinomycetes live. The module will deal with the isolation, characteristics and molecular classification and identification of actinomycetes. The importance and activities of this group of organisms will be studied in details.

BO2109: BO1202: 1, 2, 2: Soil Sciences

This course deals with soil ecology. One part of this course will deal with the soil environment (soil physical and chemical features, soil water status, soil pH, soil temperature, soil light). The second part of the course will deal with the soil biota with special emphasis on the interactions between the soil biota and soil features. The course will also cover the ecology of soil nutrient cycles and soil pollution.

MB2202: BO1202: 1, 2, 3: Principles of Bacteriology

This module deals with the occurrence and distribution of bacterial organisms and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to bacteria, cyanobacteria and actinomycetes particularly their nutritional requirements, physical conditions required for growth, reproduction and economic importance. The importance of bacteria as sources for natural and industrial compounds will be addressed as major part of this course.

MB2204: BO1202, 2, 3, 3: Food Microbiology

This module deals with the microorganisms that live in food and the effects of microbial growth on food quality. The methods used to control, detect, and enumerate microorganisms in food will be addressed. Special emphasis will be devoted to the identification and management of food microorganisms and the ways to protect the consumers of microbes in food.

MB2206: BO1202: 1, 2, 2: Water Microorganisms

This course should deal with the basic principles of aquatic microbiology and aquatic microbial ecology. The course will address the role and identity of aquatic microorganisms and the introduction to modern methodologies for microbial research. Spread of non-indigenous microorganisms by ships and international trade, symbioses and microbial associations with aquatic animal, microbiology related to aquaculture, seafood-borne and water-borne microorganisms will be addressed.

BO2220: BO1101: 2, 3, 3: Fundamental and Applied Ecology

This module provides an introduction to the principles of plant ecology and considers its applications. The main themes of the course will be considered in three parts; the first part will cover the structure of the ecosystem, energy flow and food webs, ecological pyramids, efficiency of energy transfer, biogeochemical cycles and temporal variations at the population and community levels. The second part will cover the ecological factors affecting plant and animal life particularly climatic, soil, biotic and topographic factors. In the third part, topics related to wild life conservation, biodiversity and natural resources will be dealt with in this course. Emphasis will be devoted to responses of plant vegetation and types of ecosystems to ecological factors, plant indicators, responses of plant behaviors to ecological factors. Different field trips to different wild habitats will be made to recognize the components of ecosystems in Egypt.

BO2222, BO2105, 1, 2, 2: Principles of Molecular Genetics

This module gives detailed studies on the molecular aspects of genetics particularly gene structure, expression and regulation in prokaryotes and eukaryotes and describes the detailed mechanisms classic specific cases. This module also covers mutations and will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. Special emphasis will be given to eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing and eukaryotic gene regulation emphasizing transcriptional control and including details of general and specific transcription factors which interact to regulate gene expression in different tissues at different stages.

BO2210: BO1202: 1, 2, 2: Crop Plants

This module deals with the classification, evolution and diversity of crop plants and the different uses of these plants in human life. The structure and classification of field crops that may include topics on environment in relation to crop growth and distribution will be also addressed. Some topics should also deal with seed bed preparation, crop rotation, Crop distribution in Egypt and crop improvement.

BO2208: BO1202: 1, 2, 2: Economic Botany

This module deals with the importance of plants as sources of services and goods of economic importance in human life. It should cover fiber and wood plants, dye plants, rubber, gum and resin plants, fatty oil and wax plants, sugar, starch and cellulose plants, medicinal plants, pasture and forage plants and food plants. The uses of products derived from plant sources should also be addressed in this module.

MB 3101: BO1202: 1, 2, 2: Virology

This module aims to introduce students to the detailed biological properties (structure and replication) of viruses particularly those associated with major diseases of man, and plants and provide awareness of the transmission, epidemiology, pathogenesis and control of these virus groups. The module also embraces the basic specific and non-specific host defense mechanisms associated with these infections, the interaction of viruses with these defenses, and the principles concerned with the diagnosis of viral infections by laboratory procedures.

MB3103: BO1202: 1, 2, 2: Immunology

The module embraces the basic specific and non-specific host defense mechanisms associated with pathogens infections, the interaction of pathogens with these defenses, and the principles concerned with the diagnosis of infections using laboratory procedures. The course should also emphasize the basic immunity, pathogenic mechanisms, modes of transmission, epidemiology, viral latency and viruses and carcinogenesis, among others. Finally antiviral chemotherapy, viral vaccines and the underlying mechanistic rationale for their use is discussed.

MB3105: BO1202: 1, 2, 2: Bacterial Physiology

This course in microbial physiology pay a special emphasis on the structure,

function, and assembly of cell components, bioenergetics, metabolic diversity, environmental stress tolerance, and growth and cellular differentiation of bacteria.

MB3107: MB2202: 1, 2, 2: Medical Microbiology

This module deals with the pathogenesis of medically important microorganisms including bacteria, fungi, viruses, rickettsia and protozoa. The symptoms of diseases caused by microbial pathogens and their diagnosis will be addressed. In addition, the immune-biology of the major microbial diseases, with emphasis on their ways and means of their prevention will be studied.

MB3109: MB2101: 1, 2, 2: Microbial Enzymes

Course in microbial enzymes pays emphasis to fundamentals of enzymology, enzyme preparation, enzyme immobilization, and microbial enzyme applications (Industry, medicine and environment). Recent advances in enzyme technology and future prospects for enzyme technology will be also addressed in this course.

MB3111: MB2101: 1, 2, 2: Microbial Toxins and Secondary Metabolites

This module deals with the toxins and secondary metabolites produced by the microorganisms. The structure and function of major groups of these natural products will be covered giving some examples from different toxins and microbial groups. The role of microbial toxins and secondary metabolites in microorganisms life and the role of microbial activities in the environment and human life will be discussed.

MB3113: MB2101: 1, 2, 2: Applied Microbiology

The aim of this course is to introduce students to areas of microbial biotechnology that are either currently being exploited commercially or that are likely to lead to commercial ventures in the near future. The first part of the course covers the fermentation processes currently utilized in the pharmaceutical and food industries, based on microbial fermentation and illustrates the range of technologies involved in large-scale commercial growth of microorganisms. The second part of the course covers the utilization of gene technology for the production of new products from micro-organisms and micro-algae.

BO3111: BO2105: 1, 2, 2: Control of Gene Expression

Aims of this module are to give a broad overview of gene expression and regulation in prokaryotes and eukaryotes and look at detailed mechanisms by studying classic specific cases. Coverage includes: 1. Transcriptional and post-transcriptional gene regulation in *E. coli*, 2. Eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing with emphasis on mRNA splicing, 3. Eukaryotic gene regulation emphasizing transcriptional control and including details of general and specific transcription factors which interact to regulate gene expression.

MB3202: MB2202: 1, 2, 2: Industrial Microbiology

This module deals with the role of microbes in different industrial process are

covered in two parts: the first one will focus on the different microorganism that have industrial importance; their isolation, identification and different methods of its growing. However, the second part deals with some models of different substances production by microbes like amino acids, enzymes, antibiotics, microbial proteins and bio-fertilizers. In addition, the module will include visits to factories.

MB3204: MB2204: 1, 2, 2: Microorganisms of Extreme Environments

The module is divided into three parts. The first part deals with the basic metabolic strategies that allow microbes to live, e.g. chemoheterotrophy, chemoautotrophy, phototrophy. This is then followed by a brief survey of the geochemical cycles, e.g. the S and N cycles. The second part is should be devoted to a study of how microorganisms are able to live in extreme environments on Earth, e.g. salt lakes and hydrothermal vents. The final part deals with the possibility that microorganisms exist in extreme, non-Earth environments such as Mars. This section concludes with a discussion of how life might have originated on the pre-biotic Earth.

MB3206: MB2204:1, 2, 2: Biological Control

Biological control is an environmentally sound and effective means of reducing or mitigating pests and pest effects through the use of natural enemies. The enemies controlled may be viral, microbial, nematode, insect, mite, weed, and vertebrate pests in agriculture, aquatic, forest, natural resource, stored product, and urban environments. Biological control of arthropod pests of human and domestic animals is also included. Ecological, molecular, and biotechnological approaches to the understanding of biological control are also part of bio-control technologies. Molecular technology advances in the understanding of biological control agents and their mechanisms will also be a major topic of the course

BO3220: BO1101: 2, 3, 3: Energy Bioconversions and Photosynthesis

The aim of this module is to examine ways in which biochemical pathways are controlled and integrated. Students will acquire knowledge of the control of flux through metabolic pathways, and the ways in which metabolism is adapted to different physiological states. The module will also consider the amazing diversity and sophistication in the ability of cells to synthesize complex molecules from simple precursors. The module should also include introduction and historical review to chloroplast structure and function and the structure and function of pigments involved in photosynthesis. The transfer of energy and the electron transport in photosynthesis and its relation to phosphorylation, biochemical reactions of photosynthesis (Calvin cycle), in C3 and C4 plants will be major parts of the course.

BO3222: BO1202: 2, 3, 3: Phycology

In one part of this module the students will be introduced to topics covering the occurrence and distribution of algae and their morphological structure, diversity and classification. The course will also cover reproduction in algae (vegetative, asexual and

sexual) and life history and alternation of generation giving examples from the different groups of fresh water and marine algae. In a second part of the module will deal with the phylogenetic relationships and evolution of representative algal groups based on molecular approaches.

BO3214: BO2105, 1, 2, 2: Genome Change

This module covers mutations and genome structure and evolution. The first part will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. The second part will cover the functions highly abundant reiterated simple sequences; functions and origins of the sequences of the genome; transposons, and retrotransposons. The structure, function, inheritance and evolution of extranuclear genomes in will be considered in a range of eukaryotes. The impact of whole genome sequencing (genomics) on the study of gene function will be considered for both prokaryotic and eukaryotic organisms.

BO3224: BO2220: 1, 2, 2: Environmental Issues

This course will be focused on current ecological and environmental problems that may include the threats to natural resources, energy problem, food problem, desertification, grazing problem in desert regions, pollution and global climate change. The course may also cover topics such as sustainable development, soil quality, waste management, water shortage problem in the Middle East, management of water resources in arid lands, human impact and ecosystem restoration.

BO3234: BO2222: 1, 2, 2: Molecular Phylogeny

This module covers genome structure and evolution. It will also cover the functions of chromosomes; highly abundant reiterated simple sequences; functions and origins of the non-genic sequences of the genome; transposons, retroviruses and retrotransposons; evolution of genes and gene families. The second part will cover sequencing and mapping studies. The final part will cover the use of molecular information to reconstruct the phylogeny of life based on molecular information.

MB4101: MB3202: 1, 2, 2: Yeasts Biology

In this module yeast is used as a model to teach some of the more actively researched areas of cell biology. Areas covered may include different yeast taxonomical groups (classification), physiology, mating type, cell-cell interaction, DNA replication, mitosis, cytoskeletal motors, cell polarity, signal transduction, cell cycle, yeast killer protein modification, some basic in yeast genetics, and yeast technology.

MB4103: MB2103: 1, 2, 2: Soil Microorganisms

This course deals with soil ecology in a microbiological perspective. One part of this course will deal with the soil environment (soil physical and chemical features, soil water, soil pH, soil temperature, soil light). The course will also deal with the soil biota with special emphasis on the interactions between the soil biota and soil

features. The course will also cover the ecology of soil nutrient cycles and soil pollution.

MB4105: MB3204: 1, 2, 2: Antimicrobial Agents

This course should include an introduction to antimicrobial agents (background and brief history), non-specific antimicrobial agents, antibiotics; antibacterial and antifungal agents. Agents acting against the cell wall, cell membrane, nucleic acids, proteins and enzymes, in addition to competitive inhibitors (antimetabolites) will be addressed in details.

MB4107: MB3202: 1, 2, 2: Microbial Bioremediation of pollutants

This module should include the description of modern pollution problems and potential microbiological remediation techniques: focusing on biochemistry and molecular biology of biodegradation of hazardous and toxic compounds.

BO4121: BO3202: 1, 2, 2: Microbial Genetics

This module will show how classical and molecular techniques are used to study the genomes of bacteria and fungi, and to explore fundamental genetic processes. Bacterial genetics will include mutagenesis, selection of mutants, transmission and recombination of genes, analysis of regulatory mutants, transposable elements, and reverse genetics. After an introduction to the yeasts and filamentous fungi used in genetic studies, including model species and those of economic importance, fungal genetics will include mutant selection and characterization, complementation tests, meiotic mapping, tetrad analysis and molecular techniques for analysis of gene function. The impact of whole genome sequencing (genomics) on the study of gene function will be considered for both prokaryotic and eukaryotic micro-organisms

BO4123: BO3222: 1, 2, 2: Physiology of Algae

This module deals with physiological aspects of algae based on detailed studies on the structure of algal cell components. The structure and function of major physiological pathways and the different secondary metabolites will be also addressed in this course. The role of the secondary metabolites in algal tolerance to environment will be discussed.

MB4109 1, 2, 2: Scientific Writings and Presentations

Analysis and interpretation of genetic data are essential skills for modern geneticists and are important for handling of biotechnological information. The purpose of this module is to develop these skills through a directed program of reading, discussion and question answering, based on a series of research papers. This module will introduce the students to the elements of scientific writing starting with how to present the data, prepare tables and graphs and write the sections of research papers. The know-how of presenting scientific data in a poster or oral sessions will be described in detail.

MB 4111: MB3202 1, 2, 2: Microbial Bioinformatics

The first part of this module will focus on the development and implementation of efficient algorithms for problems related to genomics with emphasis on sequence homology and alignment, phylogenetic tree building methods, hidden Markov models and their applications in genetics and biotechnology (e.g. multiple sequence alignment, recognition of genes and promoter sequence). In a second part of this module will also deal with retrieval, analysis and interpretation of biological data concerned, protein sequence motif analysis, prediction of RNA and protein secondary structures. Genome analytical methods, annotations, protein and nucleic acids data base searching will also be part of this course.

BO4125: BO2220, 1, 2, 2: Biodiversity and Natural Reserves

This module will cover the ecological principals dealing with the conservation theory and its application, conservation for sustainable development. The main topics of the world include species declination and biodiversity, importance of plant biodiversity, in situ and ex-situ conservation types, sustainable development and conservation in dry and wetland regions. Special attention will be given to the concepts and measurements of biodiversity (diversity, naturalness, rarity other characters), conservation at individual and population level and ecosystem, human impact on plant diversity, construction and development of natural reserved areas in Egypt with a description for these protected areas. The course will include field trips to some of the natural reserves.

MB 4202: MB3202: 2, 2, 3: Microbial Biotechnology

The aim of this course is to introduce students to areas of microbial biotechnology that are either currently being exploited commercially or that are likely to lead to commercial ventures in the near future. The first part of the course covers the fermentation processes currently utilized in the pharmaceutical and food industries, based on microbial fermentation and illustrates the range of technologies involved in large-scale commercial growth of microorganisms. The second part of the course covers the utilization of gene technology for the production of new products from micro-organisms and micro-algae.

MB4204: MB2101: 1, 2, 2: Microbial Plant Interaction

This module provides theoretical and practical knowledge of plant diseases; their causative agents and their control. It will cover diseases caused by fungi and other agents such as viruses, plant parasites, insects and nematodes. The module will also include plant disease resistance and disease control. Details will be given to molecular aspects of disease resistance and control and the importance of breeding for disease resistance. The course will also cover the ways and means of plant disease bio-control using natural enemies.

MB4206: MB1202: 1, 2, 2: Physiology of Fungi

This module deals with aspects related to the physiological processes in fungi, it may deal with the culture media (natural, semi-synthetic and synthetic). Fungal growth and the internal and external factors affecting growth in vitro. The course will further address the organic and inorganic fungal nutrition, the utilization and metabolism of

carbon and nitrogen sources and metabolism of proteins and lipids in fungi. Additional topics are the fungicides and their mode of action.

MB4208: MB4101: 0, 6, 2: Research Project (Microbiology)

The module aims to give students experience of laboratory research, and to develop practical and organizational skills essential to a scientific career. Students undertake a research project related to their degree subject(s) and submit their work as a word-processed report, written in the style of a research publication. Projects are undertaken under the supervision of a member of academic staff, and are related to the research activities ongoing in the Department. Most placements are in labs within the Department, but a small proportion of students undertake projects in other locations, such as the pharmaceutical and chemical factories. In this module, students develop skills in the design and execution of experiments, and in the collation, presentation and interpretation of data.

BO4222: BO2222: 1, 2, 2 Genetic engineering analysis

Genetic engineering has developed from knowledge of molecular genetics and genome structure and its application will affect our lives in many ways. The basic technology and methods of genetic engineering will be reviewed, so that students will become sufficiently well informed to understand the applications of these techniques. Lectures will deal with the development of methods and approaches of gene cloning and gene transfer, genetic libraries and production of genetically modified organisms.

BO 4220: BO3220 : 1, 0, 1: Physiological Stress

Plants and other living organisms may be exposed permanently or occasionally to stress imposed by severe environments such as drought, water shortage and salinity. This module will focus on the mechanisms used by plants and other living organisms to avoid the harmful effects of environmental stress.

BO4210: BO3222: 1, 2, 3: The Economic Uses of Algae

This module will deal with some details with the economic importance of algae and the uses of algae and their products in human life, particularly their commercial applications of algal hydro-colloids, role of algae in agriculture and role of micro-algae in liquid waste treatment. The importance of algae as a human food or food complementary will covered in some details. Other uses of algae include: medical uses of algae, lipids and polyols from micro-algae, diatoms role in soil fertility, commercial applications of algal hydro-colloids.

BO4212: BO4103: 1, 2, 2: Genome Analysis

This module deals with the mechanisms of cell growth and division. The molecular aspects of chromosome structure and organization and chromosomal banding and their role in genome analysis are studied. This module will also show how classical and molecular techniques used for protein separation, identification, quantification. The module should also deal with structural proteomics and cellular proteomics.

BT4228: Biosafety and Bioethics

Principles and practices of biosafety and management of public concerns about modern biotechnology are the focal points of this module. The module will give an overview of biotechnology and biosafety issues/concerns worldwide and the international treaties/agreements in biosafety. Principles of risk assessment, risk management and risk communication will be also addressed. The module will further deal with factors affecting biodiversity, invasiveness and gene flow as well as possible influences of transgenic crops on non-target organisms, pest resistance management, transgenic safety protocols and field testing procedures. Analysis and building of biosafety regulatory framework, biosafety laboratories, policy analysis, material safety data sheets, review of laboratory associated illness and personal protection and exposure control.

BO4214: BO4103: 1, 2, 2; Environmental Management and Impact Assessment

This course will introduce the students to the regulation and regulatory framework of the environmental and hazardous Waste law; Definitions; policy guidance vs. regulations; role of the states, municipalities and the EEAA, compliance issues; case studies. The course will also give knowledge about the environmental management system (EMS) under standing ISO 14000 scope and definitions; EMS requirements and environmental policy; cost benefit analysis; environmental planning; implementation and operation; checking and corrective action; environmental auditing and the environmental management system in Egypt. The course will further describe the objective and needs of environmental impact assessment (EIA); activities involved in EIA, characteristics of impacts); EIA methods, checklists, overlay mapping, net works, matrices; estimates of resources demand for EIA studies; Recommended methodologies for rapid EIA; case studies; guidelines for EIA in developing countries; environmental impact statement; land evaluation and suitability analysis.

MB2101: BO1202: 2, 2, 3: Prokaryotic Organisms

This module deals with the occurrence and distribution of prokaryotic organisms and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to bacteria, cyanobacteria and actinomycetes particularly their nutritional requirements, physical conditions required for growth, reproduction and economic importance. This course will also cover viruses and their distinctive characters, their structure, size, multiplication and transmission as well as the human, animal and plant viral diseases.

MB2103: BO1202: 2, 3, 3: Principles of Mycology

This module will enable students to acquire knowledge about the science of mycology with special emphases on nutrition, reproduction and classification of fungi. The course will cover reproduction in fungi (vegetative, asexual and sexual) and life history and life cycles of representative taxa. This module will also deal with some details with the economic importance of fungi and the uses of fungi and their products in human life.

MB2105: BO1202: 1, 2, 2: Instrumental Methods in Microbiology

The course includes the following methods and instruments used in microbiology: Methods of Microbial growth study, Microbial cell breakage methods, study of microbial structure details (bright field, dark field, phase contrast, fluorescence, transmission electron and scanning electron microscopes), Gel filtration, Ion exchange chromatography, Affinity chromatography, Gel Electrophoresis technique and Antimicrobial compounds assay.

BO2105: BO1202: 2, 3, 3: General Genetics

This module provides an introduction to the principles of genetics and considers the application of these principles to diverse aspects of biology. The genetic systems of higher organisms and microbes are described, including mechanisms of gene transmission and genetic exchange and mutation. Non-Mendelian genetic systems such as multiple alleles, pseudoalleles, linkage, crossing over and gene mapping, genetics related to sex and polygenes and pleiotropy are additional topics that will be covered in this module. Plant and microbial examples are stressed where appropriate. Applications include fundamental studies in other biological disciplines, such as evolutionary and developmental biology, as well as topics directly concerned with human welfare.

BO2107: BO1202: 1, 2, 2: Cell Biology

The aim of this module is to provide an introduction to the overall structures of prokaryotic and eukaryotic cells; organization and function of biological membranes; compartmentalization of eukaryotic cells and the functions of the major types of organelle; the main elements of the cytoskeleton and their functions; intercellular and intracellular communication

MB2107: BO1202: 1, 2, 2; Actinomycetes

In this module special emphases should be devoted to the habitats in which actinomycetes live. The module will deal with the isolation, characteristics and molecular classification and identification of actinomycetes. The importance and activities of this group of organisms will be studied in details.

BO2109: BO1202: 1, 2, 2: Soil Sciences

This course deals with soil ecology. One part of this course will deal with the soil environment (soil physical and chemical features, soil water status, soil pH, soil temperature, soil light). The second part of the course will deal with the soil biota with special emphasis on the interactions between the soil biota and soil features. The course will also cover the ecology of soil nutrient cycles and soil pollution.

MB2202: BO1202: 1, 2, 3: Principles of Bacteriology

This module deals with the occurrence and distribution of bacterial organisms and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to bacteria, cyanobacteria and actinomycetes particularly their nutritional requirements, physical

conditions required for growth, reproduction and economic importance. The importance of bacteria as sources for natural and industrial compounds will be addressed as major part of this course.

MB2204: BO1202, 2, 3, 3: Food Microbiology

This module deals with the microorganisms that live in food and the effects of microbial growth on food quality. The methods used to control, detect, and enumerate microorganisms in food will be addressed. Special emphasis will be devoted to the identification and management of food microorganisms and the ways to protect the consumers of microbes in food.

MB2206: BO1202: 1, 2, 2: Water Microorganisms

This course should deal with the basic principles of aquatic microbiology and aquatic microbial ecology. The course will address the role and identity of aquatic microorganisms and the introduction to modern methodologies for microbial research. Spread of non-indigenous microorganisms by ships and international trade, symbioses and microbial associations with aquatic animal, microbiology related to aquaculture, seafood-borne and water-borne microorganisms will be addressed.

BO2220: BO1101: 2, 3, 3: Fundamental and Applied Ecology

This module provides an introduction to the principles of plant ecology and considers its applications. The main themes of the course will be considered in three parts; the first part will cover the structure of the ecosystem, energy flow and food webs, ecological pyramids, efficiency of energy transfer, biogeochemical cycles and temporal variations at the population and community levels. The second part will cover the ecological factors affecting plant and animal life particularly climatic, soil, biotic and topographic factors. In the third part, topics related to wild life conservation, biodiversity and natural resources will be dealt with in this course. Emphasis will be devoted to responses of plant vegetation and types of ecosystems to ecological factors, plant indicators, responses of plant behaviors to ecological factors. Different field trips to different wild habitats will be made to recognize the components of ecosystems in Egypt.

BO2222, BO2105, 1, 2, 2: Principles of Molecular Genetics

This module gives detailed studies on the molecular aspects of genetics particularly gene structure, expression and regulation in prokaryotes and eukaryotes and describes the detailed mechanisms classic specific cases. This module also covers mutations and will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. Special emphasis will be given to eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing and eukaryotic gene regulation emphasizing transcriptional control and including details of general and specific transcription factors which interact to regulate gene expression in different tissues at different stages.

BO2210: BO1202: 1, 2, 2: Crop Plants

This module deals with the classification, evolution and diversity of crop plants and the different uses of these plants in human life. The structure and classification of field crops that may include topics on environment in relation to crop growth and distribution will be also addressed. Some topics should also deal with seed bed preparation, crop rotation, Crop distribution in Egypt and crop improvement.

BO2208: BO1202: 1, 2, 2: Economic Botany

This module deals with the importance of plants as sources of services and goods of economic importance in human life. It should cover fiber and wood plants, dye plants, rubber, gum and resin plants, fatty oil and wax plants, sugar, starch and cellulose plants, medicinal plants, pasture and forage plants and food plants. The uses of products derived from plant sources should also be addressed in this module.

MB 3101: BO1202: 1, 2, 2: Virology

This module aims to introduce students to the detailed biological properties (structure and replication) of viruses particularly those associated with major diseases of man, and plants and provide awareness of the transmission, epidemiology, pathogenesis and control of these virus groups. The module also embraces the basic specific and non-specific host defense mechanisms associated with these infections, the interaction of viruses with these defenses, and the principles concerned with the diagnosis of viral infections by laboratory procedures.

MB3103: BO1202: 1, 2, 2: Immunology

The module embraces the basic specific and non-specific host defense mechanisms associated with pathogens infections, the interaction of pathogens with these defenses, and the principles concerned with the diagnosis of infections using laboratory procedures. The course should also emphasize the basic immunity, pathogenic mechanisms, modes of transmission, epidemiology, viral latency and viruses and carcinogenesis, among others. Finally antiviral chemotherapy, viral vaccines and the underlying mechanistic rationale for their use is discussed.

MB3105: BO1202: 1, 2, 2: Bacterial Physiology

This course in microbial physiology pay a special emphasis on the structure, function, and assembly of cell components, bioenergetics, metabolic diversity, environmental stress tolerance, and growth and cellular differentiation of bacteria.

MB3107: MB2202: 1, 2, 2: Medical Microbiology

This module deals with the pathogenesis of medically important microorganisms including bacteria, fungi, viruses, rickettsia and protozoa. The symptoms of diseases caused by microbial pathogens and their diagnosis will be addressed. In addition, the immune-biology of the major microbial diseases, with emphasis on their ways and means of their prevention will be studied.

MB3109: MB2101: 1, 2, 2: Microbial Enzymes

Course in microbial enzymes pays emphasis to fundamentals of enzymology, enzyme preparation, enzyme immobilization, and microbial enzyme applications (Industry, medicine and environment). Recent advances in enzyme technology and future prospects for enzyme technology will be also addressed in this course.

MB3111: MB2101: 1, 2, 2: Microbial Toxins and Secondary Metabolites

This module deals with the toxins and secondary metabolites produced by the microorganisms. The structure and function of major groups of these natural products will be covered giving some examples from different toxins and microbial groups. The role of microbial toxins and secondary metabolites in microorganisms life and the role of microbial activities in the environment and human life will be discussed.

MB3113: MB2101: 1, 2, 2: Applied Microbiology

The aim of this course is to introduce students to areas of microbial biotechnology that are either currently being exploited commercially or that are likely to lead to commercial ventures in the near future. The first part of the course covers the fermentation processes currently utilized in the pharmaceutical and food industries, based on microbial fermentation and illustrates the range of technologies involved in large-scale commercial growth of microorganisms. The second part of the course covers the utilization of gene technology for the production of new products from micro-organisms and micro-algae.

BO3111: BO2105: 1, 2, 2: Control of Gene Expression

Aims of this module are to give a broad overview of gene expression and regulation in prokaryotes and eukaryotes and look at detailed mechanisms by studying classic specific cases. Coverage includes: 1. Transcriptional and post-transcriptional gene regulation in *E. coli*, 2. Eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing with emphasis on mRNA splicing, 3. Eukaryotic gene regulation emphasizing transcriptional control and including details of general and specific transcription factors which interact to regulate gene expression.

MB3202: MB2202: 1, 2, 2: Industrial Microbiology

This module deals with the role of microbes in different industrial process are covered in two parts: the first one will focus on the different microorganism that have industrial importance; their isolation, identification and different methods of its growing. However, the second part deals with some models of different substances production by microbes like amino acids, enzymes, antibiotics, microbial proteins and bio-fertilizers. In addition, the module will include visits to factories.

MB3204: MB2204: 1, 2, 2: Microorganisms of Extreme Environments

The module is divided into three parts. The first part deals with the basic metabolic strategies that allow microbes to live, e.g. chemoheterotrophy, chemoautotrophy, phototrophy. This is then followed by a brief survey of the geochemical cycles, e.g.

the S and N cycles. The second part should be devoted to a study of how microorganisms are able to live in extreme environments on Earth, e.g. salt lakes and hydrothermal vents. The final part deals with the possibility that microorganisms exist in extreme, non-Earth environments such as Mars. This section concludes with a discussion of how life might have originated on the pre-biotic Earth.

MB3206: MB2204:1, 2, 2: Biological Control

Biological control is an environmentally sound and effective means of reducing or mitigating pests and pest effects through the use of natural enemies. The enemies controlled may be viral, microbial, nematode, insect, mite, weed, and vertebrate pests in agriculture, aquatic, forest, natural resource, stored product, and urban environments. Biological control of arthropod pests of human and domestic animals is also included. Ecological, molecular, and biotechnological approaches to the understanding of biological control are also part of bio-control technologies. Molecular technology advances in the understanding of biological control agents and their mechanisms will also be a major topic of the course

BO3220: BO1101: 2, 3, 3: Energy Bioconversions and Photosynthesis

The aim of this module is to examine ways in which biochemical pathways are controlled and integrated. Students will acquire knowledge of the control of flux through metabolic pathways, and the ways in which metabolism is adapted to different physiological states. The module will also consider the amazing diversity and sophistication in the ability of cells to synthesize complex molecules from simple precursors. The module should also include introduction and historical review to chloroplast structure and function and the structure and function of pigments involved in photosynthesis. The transfer of energy and the electron transport in photosynthesis and its relation to phosphorylation, biochemical reactions of photosynthesis (Calvin cycle), in C3 and C4 plants will be major parts of the course.

BO3222: BO1202: 2, 3, 3: Phycology

In one part of this module the students will be introduced to topics covering the occurrence and distribution of algae and their morphological structure, diversity and classification. The course will also cover reproduction in algae (vegetative, asexual and sexual) and life history and alternation of generation giving examples from the different groups of fresh water and marine algae. In a second part of the module will deal with the phylogenetic relationships and evolution of representative algal groups based on molecular approaches.

BO3214: BO2105, 1, 2, 2: Genome Change

This module covers mutations and genome structure and evolution. The first part will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. The second part will cover the functions highly abundant reiterated simple sequences; functions and origins of the sequences of the genome; transposons, and retrotransposons. The structure, function, inheritance and evolution of extranuclear genomes will be considered in a range of eukaryotes.

The impact of whole genome sequencing (genomics) on the study of gene function will be considered for both prokaryotic and eukaryotic organisms.

BO3224: BO2220: 1, 2, 2: Environmental Issues

This course will be focused on current ecological and environmental problems that may include the threats to natural resources, energy problem, food problem, desertification, grazing problem in desert regions, pollution and global climate change. The course may also cover topics such as sustainable development, soil quality, waste management, water shortage problem in the Middle East, management of water resources in arid lands, human impact and ecosystem restoration.

BO3234: BO2222: 1, 2, 2: Molecular Phylogeny

This module covers genome structure and evolution. It will also cover the functions of chromosomes; highly abundant reiterated simple sequences; functions and origins of the non-genic sequences of the genome; transposons, retroviruses and retrotransposons; evolution of genes and gene families. The second part will cover sequencing and mapping studies. The final part will cover the use of molecular information to reconstruct the phylogeny of life based on molecular information.

MB4101: MB3202: 1, 2, 2: Yeasts Biology

In this module yeast is used as a model to teach some of the more actively researched areas of cell biology. Areas covered may include different yeast taxonomical groups (classification), physiology, mating type, cell-cell interaction, DNA replication, mitosis, cytoskeletal motors, cell polarity, signal transduction, cell cycle, yeast killer protein modification, some basic in yeast genetics, and yeast technology.

MB4103: MB2103: 1, 2, 2: Soil Microorganisms

This course deals with soil ecology in a microbiological perspective. One part of this course will deal with the soil environment (soil physical and chemical features, soil water, soil pH, soil temperature, soil light). The course will also deal with the soil biota with special emphasis on the interactions between the soil biota and soil features. The course will also cover the ecology of soil nutrient cycles and soil pollution.

MB4105: MB3204: 1, 2, 2: Antimicrobial Agents

This course should include an introduction to antimicrobial agents (background and brief history), non-specific antimicrobial agents, antibiotics; antibacterial and antifungal agents. Agents acting against the cell wall, cell membrane, nucleic acids, proteins and enzymes, in addition to competitive inhibitors (antimetabolites) will be addressed in details.

MB4107: MB3202: 1, 2, 2: Microbial Bioremediation of pollutants

This module should include the description of modern pollution problems and potential microbiological remediation techniques: focusing on biochemistry and

molecular biology of biodegradation of hazardous and toxic compounds.

BO4121: BO3202: 1, 2, 2: Microbial Genetics

This module will show how classical and molecular techniques are used to study the genomes of bacteria and fungi, and to explore fundamental genetic processes. Bacterial genetics will include mutagenesis, selection of mutants, transmission and recombination of genes, analysis of regulatory mutants, transposable elements, and reverse genetics. After an introduction to the yeasts and filamentous fungi used in genetic studies, including model species and those of economic importance, fungal genetics will include mutant selection and characterization, complementation tests, meiotic mapping, tetrad analysis and molecular techniques for analysis of gene function. The impact of whole genome sequencing (genomics) on the study of gene function will be considered for both prokaryotic and eukaryotic micro-organisms

BO4123: BO3222: 1, 2, 2: Physiology of Algae

This module deals with physiological aspects of algae based on detailed studies on the structure of algal cell components. The structure and function of major physiological pathways and the different secondary metabolites will be also addressed in this course. The role of the secondary metabolites in algal tolerance to environment will be discussed.

MB4109 1, 2, 2: Scientific Writings and Presentations

Analysis and interpretation of genetic data are essential skills for modern geneticists and are important for handling of biotechnological information. The purpose of this module is to develop these skills through a directed program of reading, discussion and question answering, based on a series of research papers. This module will introduce the students to the elements of scientific writing starting with how to present the data, prepare tables and graphs and write the sections of research papers. The know-how of presenting scientific data in a poster or oral sessions will be described in detail.

MB 4111: MB3202 1, 2, 2: Microbial Bioinformatics

The first part of this module will focus on the development and implementation of efficient algorithms for problems related to genomics with emphasis on sequence homology and alignment, phylogenetic tree building methods, hidden Markov models and their applications in genetics and biotechnology (e.g. multiple sequence alignment, recognition of genes and promoter sequence). In a second part of this module will also deal with retrieval, analysis and interpretation of biological data concerned, protein sequence motif analysis, prediction of RNA and protein secondary structures. Genome analytical methods, annotations, protein and nucleic acids data base searching will also be part of this course.

BO4125: BO2220, 1, 2, 2: Biodiversity and Natural Reserves

This module will cover the ecological principals dealing with the conservation theory and its application, conservation for sustainable development. The main

topics of the world include species declination and biodiversity, importance of plant biodiversity, in situ and ex-situ conservation types, sustainable development and conservation in dry and wetland regions. Special attention will be given to the concepts and measurements of biodiversity (diversity, naturalness, rarity other characters), conservation at individual and population level and ecosystem, human impact on plant diversity, construction and development of natural reserved areas in Egypt with a description for these protected areas. The course will include field trips to some of the natural reserves.

MB 4202: MB3202: 2, 2, 3: Microbial Biotechnology

The aim of this course is to introduce students to areas of microbial biotechnology that are either currently being exploited commercially or that are likely to lead to commercial ventures in the near future. The first part of the course covers the fermentation processes currently utilized in the pharmaceutical and food industries, based on microbial fermentation and illustrates the range of technologies involved in large-scale commercial growth of microorganisms. The second part of the course covers the utilization of gene technology for the production of new products from micro-organisms and micro-algae.

MB4204: MB2101: 1, 2, 2: Microbial Plant Interaction

This module provides theoretical and practical knowledge of plant diseases; their causative agents and their control. It will cover diseases caused by fungi and other agents such as viruses, plant parasites, insects and nematodes. The module will also include plant disease resistance and disease control. Details will be given to molecular aspects of disease resistance and control and the importance of breeding for disease resistance. The course will also cover the ways and means of plant disease bio-control using natural enemies.

MB4206: MB1202: 1, 2, 2: Physiology of Fungi

This module deals with aspects related to the physiological processes in fungi, it may deal with the culture media (natural, semi-synthetic and synthetic). Fungal growth and the internal and external factors affecting growth in vitro. The course will further address the organic and inorganic fungal nutrition, the utilization and metabolism of carbon and nitrogen sources and metabolism of proteins and lipids in fungi. Additional topics are the fungicides and their mode of action.

MB4208: MB4101: 0, 6, 2: Research Project (Microbiology)

The module aims to give students experience of laboratory research, and to develop practical and organizational skills essential to a scientific career. Students undertake a research project related to their degree subject(s) and submit their work as a word-processed report, written in the style of a research publication. Projects are undertaken under the supervision of a member of academic staff, and are related to the research activities ongoing in the Department. Most placements are in labs within the Department, but a small proportion of students undertake projects in other locations, such as the pharmaceutical and chemical factories. In

this module, students develop skills in the design and execution of experiments, and in the collation, presentation and interpretation of data.

BO4222: BO2222: 1, 2, 2 Genetic engineering analysis

Genetic engineering has developed from knowledge of molecular genetics and genome structure and its application will affect our lives in many ways. The basic technology and methods of genetic engineering will be reviewed, so that students will become sufficiently well informed to understand the applications of these techniques. Lectures will deal with the development of methods and approaches of gene cloning and gene transfer, genetic libraries and production of genetically modified organisms.

BO 4220: BO3220 : 1, 0, 1: Physiological Stress

Plants and other living organisms may be exposed permanently or occasionally to stress imposed by severe environments such as drought, water shortage and salinity. This module will focus on the mechanisms used by plants and other living organisms to avoid the harmful effects of environmental stress.

BO4210: BO3222: 1, 2, 3: The Economic Uses of Algae

This module will deal with some details with the economic importance of algae and the uses of algae and their products in human life, particularly their commercial applications of algal hydro-colloids, role of algae in agriculture and role of micro-algae in liquid waste treatment. The importance of algae as a human food or food complementary will covered in some details. Other uses of algae include: medical uses of algae, lipids and polyols from micro-algae, diatoms role in soil fertility, commercial applications of algal hydro-colloids.

BO4212: BO4103: 1, 2, 2: Genome Analysis

This module deals with the mechanisms of cell growth and division. The molecular aspects of chromosome structure and organization and chromosomal banding and their role in genome analysis are studied. This module will also show how classical and molecular techniques used for protein separation, identification, quantification. The module should also deal with structural proteomics and cellular proteomics.

BT4228: Biosafety and Bioethics

Principles and practices of biosafety and management of public concerns about modern biotechnology are the focal points of this module. The module will give an overview of biotechnology and biosafety issues/concerns worldwide and the international treaties/agreements in biosafety. Principles of risk assessment, risk management and risk communication will be also addressed. The module will further deal with factors affecting biodiversity, invasiveness and gene flow as well as possible influences of transgenic crops on non-target organisms, pest resistance management, transgenic safety protocols and field testing procedures. Analysis and building of biosafety regulatory framework, biosafety laboratories, policy analysis, material safety data sheets, review of laboratory associated illness and personal protection and exposure control.

BO4214: BO4103: 1, 2, 2; Environmental Management and Impact Assessment

This course will introduce the students to the regulation and regulatory framework of the environmental and hazardous Waste law; Definitions; policy guidance vs. regulations; role of the states, municipalities and the EEAA, compliance issues; case studies. The course will also give knowledge about the environmental management system (EMS) under standing ISO 14000 scope and definitions; EMS requirements and environmental policy; cost benefit analysis; environmental planning; implementation and operation; checking and corrective action; environmental auditing and the environmental management system in Egypt. The course will further describe the objective and needs of environmental impact assessment (EIA); activities involved in EIA, characteristics of impacts); EIA methods, checklists, overlay mapping, net works, matrices; estimates of resources demand for EIA studies; Recommended methodologies for rapid EIA; case studies; guidelines for EIA in developing countries; environmental impact statement; land evaluation and suitability analysis.



B.Sc. Biotechnology (Special)

Programme Title	Biotechnology
Programme Type	Special
Department(s)	Botany

BO2105: BO1202: 2, 3, 3: General Genetics

This module provides an introduction to the principles of genetics and considers the application of these principles to diverse aspects of biology. The genetic systems of higher organisms and microbes are described, including mechanisms of gene transmission and genetic exchange and mutation. Non-Mendelian genetic systems

such as multiple alleles, pseudoalleles, linkage, crossing over and gene mapping, genetics related to sex and polygenes and pleiotropy are additional topics that will be covered in this module. Plant and microbial examples are stressed where appropriate in the course activities. Applications include fundamental studies in other biological disciplines, such as evolutionary and developmental biology, as well as topics directly concerned with human welfare.

BT2101: BO1202: 2, 2, 3: Molecular Biology Methods

This module provides practical knowledge of the key areas of molecular biology, and emphasizes the manner in which the separate disciplines of biochemistry and genetics must be integrated in the laboratory. The module will introduce students to the basic laboratory skills of simple laboratory work and will involve the use of basic laboratory equipment e.g. spectrophotometers and microscopes. As the module progresses, more complicated experiments will be undertaken such as gel electrophoresis and PCR. The rules of laboratory safety will be emphasized. Students will work in pairs with a postgraduate demonstrator to every 8-10 pairs. Each class will be supervised by a member of the academic staff. The associated tutorial sessions will reinforce the theoretical basis of the practical experiments.

BO2131: BO1101: 2, 2, 3: Energy Bioconversions

The aim of this module is to examine ways in which biochemical pathways are controlled and integrated. Students will acquire knowledge of the control of flux through metabolic pathways, and the ways in which metabolism is adapted to different physiological states. The module will also consider the amazing diversity and sophistication in the ability of cells to synthesize complex molecules from simple precursors, and the ways in which knowledge of this can lead to the ability to manipulate metabolism in biotechnology. Throughout the module, the ways in which individual pathways illustrate the general principles of metabolism will be highlighted. Examples will be taken from a wide range of micro-organism, plant and animal systems.

MB2141: BO1202: 2, 3, 3: Prokaryotic Organisms

This module deals with the occurrence and distribution of prokaryotic organisms and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to bacteria, cyanobacteria and actinomycetes particularly their nutritional requirements, physical conditions required for growth, reproduction and economic importance. This course will also cover viruses and their distinctive characters, their structure, size, multiplication and transmission as well as the human, animal and plant viral diseases.

BO2107: BO1101: 1, 2, 2: Cell Biology

The aim of this module is to provide an introduction to the overall structures of prokaryotic and eukaryotic cells; organization and function of biological membranes; compartmentalization of eukaryotic cells and the functions of the major types of organelle; the main elements of the cytoskeleton and their functions; intercellular and intracellular communication

MB2143 : BO1202: 1, 2, 2: Mycology

This module will enable students to acquire more knowledge about fungi with special emphases on nutrition and reproduction and classification of fungi. The course will also cover reproduction in fungi (vegetative, asexual and sexual) and life history and life cycles of representative taxa. This module will also deal in some details with the economic importance of fungi and the uses in human life.

ZO2129: ZO1202: 1,2, 2: Parasitology

This module will deal with the general concepts and terms of parasitology and provide knowledge on the types of the parasites, particularly Zoonoses, parasitic Protozoa, Monogenea and Digenea, Cestoda, Nematoda, Annelida, Arthropoda and Insects. Some details will be given to the life cycles of selected parasites and to the parasites and environment. The course will also deal with host-parasite relationships, pathological manifestations, control and treatments.

BO2230: BO1101: Fundamental Ecology

This module provides an introduction to the principles of plant ecology and considers its applications. The main themes of the course will be considered in three parts; the first part will cover the structure of the ecosystem, energy flow and food webs, ecological pyramids, efficiency of energy transfer, biogeochemical cycles and temporal variations at the population and community levels. The second part will cover the ecological factors affecting plant and animal life particularly climatic, soil, biotic and topographic factors. In the third part, topics related to wild life conservation, biodiversity and natural resources will be dealt with in this course. Emphasis will be devoted to responses of plant vegetation and types of ecosystems to ecological factors, plant indicators, responses of plant behaviors to ecological factors. Different field trips to different wild habitats will be made to recognize the components of ecosystems in Egypt.

BO2232, BO2131: 2, 3, 3: Hormones and Plant Growth

This module provides students with knowledge of the key areas of plant growth and development with emphasis on the role of plant growth regulators on cell division and differentiation. The topics of the course may start with the regions and phases of growth in plant body and the factors affecting growth. Detailed topics may include the chemistry, biosynthesis, translocation, action and role of auxins, gibberellins, cytokinins, ethylene and abscissic acid in plant growth. Additional lectures will be devoted to photoperiodism and vernalization and the molecular biology aspects of seed embryogenesis, dormancy and germination.

BO2234: BO1202: 2, 2, 3: Algae and their Uses

In one part of this module the students will be introduced to topics covering the occurrence and distribution of algae and their morphological structure, diversity and classification. The course will also cover reproduction in algae (vegetative, asexual and sexual) and life history and alternation of generation giving examples from different

algal groups. In a second part of the module will deal with the phylogenetic relationships and evolution of representative algal groups. A third part of this module will deal with some details with the economic importance of algae and the uses of algae and their products in human life, particularly their commercial applications of algal hydro-colloids, role of algae in agriculture and role of micro-algae in liquid waste treatment and land reclamation.

BO2222: BO2105: 1, 2, 2: Molecular Genetics

This module gives detailed studies on the molecular aspects of genetics particularly gene structure, expression and regulation in prokaryotes and eukaryotes and describes the detailed mechanisms classic specific cases. This module also covers mutations and will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. Special emphasis will be given to eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing and eukaryotic gene regulation emphasizing transcriptional control and including details of general and specific transcription factors which interact to regulate gene expression in different tissues at different stages

BO2236: BO2107: 1, 2, 2: Biological Membranes

The aim of this course is to cover fundamental aspects of the structure and function of biological membranes at a molecular level with emphasis on modern methods of investigation. There is an enormous amount of current research interest in biological membranes and the course will of necessity be selective. The first part will consider structural organization of biological membranes; the second part will focus on energy transduction, as an example of membrane function and the third will consider membrane dynamics and interrelationships, membrane biogenesis and protein targeting in eukaryotic cells.

BO2206: BO1101: 1, 2, 2: Medicinal and economic Plants

This module deals with the importance of plants as sources of pharmaceutical drugs. It will also cover fiber and wood plants, dye plants, rubber, gum and resin plants, aromatic oil plants, fatty oil and wax plants, sugar, starch and cellulose plants, medicinal plants, pasture and forage plants and food plants.

MB2242: MB2143: 1, 2, 2: Biological Control

Biological control is an environmentally sound and effective means of reducing or mitigating pests and pest effects through the use of natural enemies. The enemies controlled may be viral, microbial, nematode, insect, mite, weed, and vertebrate pests in agriculture, aquatic, forest, natural resource, stored product, and urban environments. Biological control of arthropod pests of human and domestic animals is also included. Ecological, molecular, and biotechnological approaches to the understanding of biological control are also part of bio-control technologies. Molecular technology advances in the understanding of biological control agents and their mechanisms will also be a major topic of the course.

BT3101: BO2232: 2, 2, 2: Introduction to Biotechnology

This module covers a comprehensive panorama of biotechnology and describes in sufficient details the basic principles and techniques used in biotechnological research. This module will also introduce the different fields of biotechnology particularly in plant science, microbiology environmental sciences as well as in pharmaceutical sciences and medicine. The course will also cover the general outlines of the basic techniques used in biotechnology

BT3103: BO2232: 2, 2, 2: Enzymes

This module will focus on the types, nomenclature and classification of enzymes. The course also covers the structure, kinetics and functions of enzymes. It will also cover topics related to the nature of enzymes, enzyme specificity, mechanisms of enzyme action, separation and purification of enzymes. The following topics will also be dealt with in this course: factor affecting enzymatic reactions, Michaelis-Menten equation and the type of inhibition, regulatory enzymes, multi-enzyme system and prosthetic groups

BO3131: BO2232: 2, 2, 3: Plant Cell and Tissue Culture

This module will outline the principles, concepts and methods of plant cell and tissue culture. It will cover topics dealing with basic techniques of isolating and culturing explants and cells under aseptic conditions and the composition, preparation and sterilization of tissue culture media. The culture of plants on solid and in liquid cultures will be described. The course will further covers the detailed description of cells in callus and suspension cultures and their differentiation to roots and shoots. The course will also deal with anthers and pollen cultures with emphases on the production of haploid plants. Genetics variation of cell under tissue cultures conditions will also be covered in this module.

MB3141: MB2141: 2, 2, 3: Microbial Growth and Fermentation

This module is divided into two parts, in the first part the aim of this module is to help students develop a sound understanding of basic microbial physiology by describing in detail the structures of components of a typical bacterial cell and relating them to the functions they fulfill. The mode of action of flagella will be described, and their role in the controlled movement of bacteria will be discussed. Growth kinetics in batch and continuous culture will also be covered. In the second part the growth of yeast will be addressed with particular emphases on its economic roles. In both parts the principles and concepts of fermentation will be covered

BT3105: BO2222: 1, 2, 2: Introduction to Genomics and Proteomics

This module deals with the mechanisms of eukaryotic cell growth and division. Material to be covered includes the mitotic cell cycle and its control by internal and external signals, role of the cytoskeleton and associated motor proteins in chromosome separation, nuclear movement, polar growth and cytokinesis. The molecular aspects of chromosome structure and organization and chromosomal

banding and their role in genome analysis are studied. This module will also show how classical and molecular techniques are used for protein separation, identification, quantification. The module will also deal with structural proteomics and cellular proteomics.

MB3143: MB2141: 1, 2, 2: Virology and Immunology

This module aims to introduce students to detailed biological properties (structure and replication) of the various groups of viruses particularly associated with major diseases of man, and provide awareness of the transmission, epidemiology, pathogenesis and control of these virus groups. The module also embraces the basic specific and non-specific host defense mechanisms associated with these infections, the interaction of viruses with these defenses, and the principles concerned with the diagnosis of viral infections by laboratory procedures. The nature of animal viruses are considered along with a range of associated phenomena - basic immunity, pathogenic mechanisms, modes of transmission, epidemiology, viral latency and viruses and carcinogenesis, among others. Finally antiviral chemotherapy, viral vaccines and the underlying mechanistic rationale for their use is discussed.

BO3133: BO2222: 1, 2, 2: Control of Gene Expression

Aims of this module are to give a broad overview of gene expression and regulation in prokaryotes and eukaryotes and look at detailed mechanisms by studying classic specific cases. Coverage includes: 1. Transcriptional and post-transcriptional gene regulation in *E. coli*, 2. Eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing with emphasis on mRNA splicing, 3. Eukaryotic gene regulation emphasizing transcriptional control and including details of general and specific transcription factors which interact to regulate gene expression.

BO3135: BO2232: 1, 2, 2: Secondary Metabolites

This module deals with secondary metabolites of plants and animals. The structure and function of major groups of these natural products will be covered giving some examples from different plant groups such as phenolics, alkaloids, terpenes and other plant secondary metabolites as well as sterols, cholesterol and vitamins particularly vitamin D₃ & D₄, Bile, vitamin B complex, vitamin B1 (thiamine), vitamin B2, vitamin H, biotin, vitamin E group, vitamin K group, vitamin K1 and vitamin A. The role of the secondary metabolites in plants tolerance to environment will be discussed.

BO3137: 2, 0, 2: Fundamentals of Biostatistics

This course is designed to introduce the student to data analytic and applied statistical methods commonly used in industrial and scientific applications. The module will focus on computer-aided data analysis using comparisons between batches, analysis of variance, regression and correlation. The module will also deal with estimation and hypothesis testing, multivariate analysis, and nonparametric techniques. Approximations and errors (accuracy and precision; errors; blunders, formulation error, and data uncertainty).

BT3202: BO2230: 2, 2, 3: Bioremediation

Bioremediation is the use of plants and microorganisms to combat pollution. The aim of one part of this module is to address the traditional methods of bioremediation. A second part of the course covers the interactions between metals and microorganisms, including discussions of metal toxicity, biosorption, biosensers and metal leaching/mining. A third part of the course will concentrate on the biotechnology of micro-algae and the bioremediation of polluted groundwater systems. The course will also deal with the role of genetic engineering of plants and microbes in developing new approaches for bioremediation.

BT3204: BO2238: 2, 2, 3: Pharmaceutical Biotechnology

This module will cover the actual status of biotechnology and its applications in pharmaceutical industry. It also covers the impact of biotechnology and genomics on the drug development process and the ways and means to increase productivity and accelerate the drug development process. The module will emphasize the biopharmaceuticals expressed in plants, particularly the use of transgenic plants as functional neutraceuticals and the use transgenic plants and plant cell culture as bioreactors of secondary metabolites and recombinant proteins. Other topics of this module may include the process of DNA vaccines, characterization and bioanalytical aspects of recombinant proteins as pharmaceutical drugs. The module will further cover the pharmacokinetics and pharmacodynamics of biotech drugs, patents in the pharmaceutical biotechnology industry and maintaining high standards in quality assurance of products

BT3206: BO2222: 2, 3, 3: Gene Transfer

Genetic engineering has developed from knowledge of molecular genetics and genome structure and its application will affect our lives in many ways. The basic technology and methods will be reviewed, so that students will become sufficiently well informed to understand the applications of these techniques. Lectures will deal with the development of method and approaches of gene cloning and gene transfer, genetic libraries and production of genetically modified crops.

BT3208: BT3101: 2, 3, 3: Instrumentation for Biotechnologists

This module will consider the methods used to study biotechnology particularly the laboratory equipments and other apparatus used to upscale the lab level experiments to semi-industrial.

BT3210: BT3101: 1, 2, 2: Forensic Biotechnology

The so called molecular markers have had an even greater impact and advanced the understanding in the identification of criminals in certain crimes and testing the susceptibility to genetic diseases in carrier parents and infants. The most common of these techniques are Restriction fragment length polymorphisms (RFLPs): Random amplified polymorphic DNA (RAPDs): Amplified fragment length polymorphisms (AFLPs): Simple sequence repeats (SSRs) or micro-satellites. The techniques used to

produce these markers will be described particularly PCR and Real time PCR. Other markers derived from sequencing data and DNA micro-array will also be dealt with in this course. The particular role of these markers in crime diagnosis is emphasized.

BT3212: BO 2232: 1, 2, 2: Enzymes Biotechnology

This module will focus on the processes involved in the production of enzymes in several groups of living organisms and the up-scaling of enzyme production. This module should also cover the various applications of enzymes in several fields of life including industrial, medical and pharmaceutical and environmental applications. The methods used for the different uses of enzymes will particularly addressed in details.

BO3232: BO2230: 1,2, 2: Environmental Impact Assessment

This module will cover the role of gene technology in dealing with environmental challenges. In particular, this course will deal with the environmental impact assessment (EIA) under standing ISO 14000 scope and definitions; EMS requirements and environmental policy; cost benefit analysis; Environmental planning; implementation and operation; Checking and corrective action; Environmental auditing; Environmental management system in Egypt. Activities involved in (EIA); (Major components and subcomponents, characteristics of Impacts); EIA methods, Checklists, Overlay mapping, net works, matrices; Estimates of resources demand for EIA studies; Recommended methodologies for rapid EIA; Case studies; Guidelines for EIA in developing countries; Environmental impact statement; Land evaluation and suitability analysis.

BO3234: BO2222: 1, 2, 2: Molecular Phylogeny

This module covers genome structure and evolution. It will also cover the functions of chromosomes; highly abundant reiterated simple sequences; functions and origins of the non-genic sequences of the genome; transposons, retroviruses and retrospoons; evolution of genes and gene families. The second part will cover sequencing and mapping studies. The final part will cover the use of molecular information to reconstruct the phylogeny of life based on molecular information.

BO3208: BO2105: 1, 2, 2: Quantitative and Population Genetics

This module will concentrate on how the frequencies of different alleles are distributed and altered in populations. The emphasis will be on polymorphisms and of plants. Material covered includes variations in cell proteins and morphological characters, fitness, migration, genetic drift, breeding systems, types of selection, effects of man-made changes, roles of RNA and DNA genomes, introns and gene duplications, on population genetics. Quantitative characters are typically influenced, not by single major genes, but by several to many polygenes acting in concert.

BT4101: BT3101: 2, 2, 3: Plant Biotechnology

This course considers the application of biotechnology to plants, for both agricultural, industrial and research uses. It covers techniques such as cell and

tissue culture-induced variation that can be used to produce genetically improved crop varieties. It also covers the use of genetic engineering for the production of transgenic plants and how this technology has resulted in genetically engineered crop plants that have improved qualities or produce novel plant products. The release of engineered crops is having a major impact on society raising issues of economic and ecological importance. The use of plants and plant products in producing commercial products will be dealt with in this course. In addition, the impact of genetically engineered plants on biodiversity and crop evolution will be covered in this module.

BT4103: BT3101: 2, 2, 3: Bioinformatics for Biotechnology

The first part of this module will focus on the development and implementation of efficient algorithms for problems related to genomics with emphasis on sequence homology and alignment, phylogenetic tree building methods, hidden Markov models and their applications in genetics and biotechnology (e.g. multiple sequence alignment, recognition of genes and promoter sequence). In a second part of this module will also deal with retrieval, analysis and interpretation of biological data concerned, protein sequence motif analysis, prediction of RNA and protein secondary structures. Genome analytical methods, annotations, protein and nucleic acids data base searching will also be part of this course.

BT4105: BT3101: 0, 6, 2: Library project (Review Article)

In this module students are required to write an essay on a topic of their choice. The aim is to develop skills of several types: information technology skills will be required in designing and implementing a strategy for obtaining information from the literature; analytical and interpretative skills will be needed in assessing this information as it accumulates; and presentation skills will be called upon in writing the dissertation

BT4107: BT3206: 1, 0, 1: Bio-safety and Bioethics

Principles and practices of biosafety and management of public concerns about modern biotechnology are the focal points of this module. The module will give an overview of biotechnology and biosafety issues/concerns worldwide and the international treaties/agreements in biosafety. Principles of risk assessment, risk management and risk communication will be also addressed. The module will further deal with factors affecting biodiversity, invasiveness and gene flow as well as possible influences of transgenic crops on non-target organisms, pest resistance management, transgenic safety protocols and field testing procedures. Analysis and building of bio-safety regulatory framework, bio-safety laboratories, policy analysis, material safety data sheets, review of laboratory associated illness and personal protection and exposure control.

BT4109: BO3101: 2, 3, 2: Food Biotechnology

The application of modern biotechnology to food production presents new opportunities and challenges for human life and health. This module will focus on technologies used for traditional foods developed by natural methods food

production. The advantages of modern biotechnology to the producer or consumer of foods for example, in terms of a lower price, greater benefit, durability or nutritional value or both. The potential benefits to the public health through altering the nutrient content of foods, decreasing their allergenic potential, and improving the efficiency of food production systems. On the other hand, the potential effects on human health of the consumption of food produced through genetic modification will be addressed.

BT4111: BT3101: 1, 2, 2: Current Topics in Biotechnology

The aim of this course is to introduce students to areas of biotechnology that are either currently being exploited commercially or that are likely to lead to commercial ventures in the near future. The first part of the course cover the fermentation processes currently utilized in the pharmaceutical and food industries and illustrates the range of technologies involved in large-scale commercial growth of microorganisms and higher eukaryotic cells. Part of the module will be devoted to open topics and visits to biotechnological factories.

BT4113: BT3101: 1, 2, 2: Scientific Writing and Presentations

Analysis and interpretation of genetic data are essential skills for modern geneticists and are important for handling of biotechnological information. The purpose of this module is to develop these skills through a directed program of reading, discussion and question answering, based on a series of research papers. This module will introduce the students to the elements of scientific writing starting with how to present the data, prepare tables and graphs and write the sections of research papers. The know-how of presenting scientific data in a poster or oral sessions will be described in detail.

BT4115: BO2234: 1, 2, 2: Biotechnology of Algae

This course deals with the environmental factors affecting mass culture and the principles governing the design and operation of mass cultivation systems. The potential uses of algae: in wastewater treatment, a source of food and feed, an energy source, and in the production of common and fine chemicals, such as polysaccharides, lipids, glycerol, pigments, and enzymes. Pharmaceutical uses of algae and their potential as a source of novel biologically-active compounds. Future developments and the great potential of algae transformation for useful compounds production. Production of products such as pharmaceuticals, biofuels and bioplastics from algae.

BO4131: BO2222: 1, 2, 2: Mutations and Genome Changes

This module covers mutations and genome structure and evolution. The first part will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. The second part will cover the functions highly abundant reiterated simple sequences; functions and origins of the sequences of the genome; transposons, and retrotransposons. The structure, function, inheritance and evolution of extra-nuclear genomes in will be considered in a range of eukaryotes.

The impact of whole genome sequencing (genomics) on the study of gene function will be considered for both prokaryotic and eukaryotic organisms.

BT4202: BT3101: 2, 2, 3: Microbial Biotechnology

The aim of this course is to introduce students to areas of microbial biotechnology that are either currently being exploited commercially or that are likely to lead to commercial ventures in the near future. The first part of the course covers the fermentation processes currently utilized in the pharmaceutical and food industries, based on microbial fermentation and illustrates the range of technologies involved in large-scale commercial growth of microorganisms. The second part of the course covers the utilization of gene technology for the production of new products from micro-organisms and micro-algae.

BT4204: BT4101: 2, 2, 3: Medical Biotechnology

The genetic constitution of man has a major influence on lifetime health, influencing the risk that we will suffer from various common diseases. Identification of the alleles contributing to the risk would allow predictive tests of individual susceptibility and the development of novel treatments for the disease when they have occurred. However, identification of the alleles concerned is very difficult. This course will deal with the causes and types of genetic diseases and review the strategies that are being employed to identify these alleles. Changes in chromosome structure and number are also a common cause of disease. The course will also consider the mechanisms by which these occur and how they are diagnosed.

BT4206: BT4107: 1, 2, 2: Molecular Diagnosis

Recent progress has made possible the use of characters derived from DNA in genetic and biotechnological studies. These so called molecular markers have had an even greater impact and advanced the understanding in several fields of biological sciences including estimation of genetic diversity between individuals, populations and groups, Reconstruction of phylogeny for species, genera, and other taxonomic ranks, breeding and identification of strains, cultivars and varieties, identification of criminals in certain crimes and testing the susceptibility to genetic diseases in carrier parents and infants. The particular role of molecular markers in disease diagnosis is emphasized.

BT4208: BT4105: 0, 6, 2: Laboratory Project

The module aims to give students experience of laboratory research, and to develop practical and organizational skills essential to a scientific career. Students undertake a research project related to their degree subject(s) and submit their work as a word-processed report, written in the style of a research publication. Projects are undertaken under the supervision of a member of academic staff, and are related to the research activities ongoing in the Department. Most placements are in labs within the Department, but a small proportion of students undertake projects in other locations, such as the Medical Schools and pharmaceutical factories. In this module, students develop skills in the design and execution of experiments, and in the collation, presentation and interpretation of data.

BT4210: BT4101: 0, 1, 1: Nano-Biotechnology

This course considers the application of the newly emerging science of nano-technology and its principles, concepts and tools. The working principles of some important apparatus such as atomic force microscopy will be described and its cellular and molecular applications will be taught. In addition, the possible biological applications of carbon nanotubes, quantum dots, and the rapidly developing techniques of DNA chips. The module will also consider single molecular manipulation techniques, particularly those concerning DNA and proteins. This course will be continuously updated to include new discoveries and applications of nano-techniques in biological sciences.

BT4212: BT3103: 1, 0, 1: Protein Bio-processing

The production of several biotechnology products depends on the processing of proteins produced using biotechnology. This module focuses on the processes used to understand the processes involved in protein bio-processing at both laboratory and industrial scale. This course may involve visits to research institutions and industrial companies in order to show the students on site observations of protein processing.

BT4214: BT3202: 2, 0, 2: Marketing of Biotechnology Products

This course introduces students to the strategic and tactical approaches used in the marketing of biotechnological products and services. The roles of managers and leaders within biotechnology companies undergo constant change. Students gain thorough understanding of the research and planning necessary methodologies to develop a marketing plan, the relationship between the marketing and sales functions, the difference between marketing a scientific product and a scientific service ,pricing strategies, distribution alternatives, communications, promotion, and the importance of perception. Knowledge of marketing terminology and techniques prove helpful to anyone in the industry.

BT4216: BT3206: 1, 2, 2: Functional Genomics

This unit builds on and addresses the contemporary experimental strategies for elucidating functional information from the growing number of organisms for which genome sequences are available. There will be a strong emphasis placed on experimental approaches for the determination and interrogation of genome sequences. Comparative genomics will explore the evolutionary relationships between genomes and will provide the framework for discussing the organization of chromosomes. The second half of the unit will deal with studies informing our understanding of fundamental developmental genetics such as tissue specific gene expression and the molecular basis of diseases.

BO4230: BT3202: 1, 0, 1: Physiology Stress

Plants and other living organisms may be exposed permanently or occasionally to stress imposed by severe environments such as drought, water shortage and salinity.

This module will focus on the mechanisms used by plants and other living organisms to avoid the harmful effects of environmental stress.

BO4232: BT3202: 1, Biodiversity Conservation

This course is designed to provide the student with sufficient knowledge on the biodiversity and conservation of wild life and sustainable ecological systems. The topics of the course will cover the importance and types of biodiversity, the problems of species extinction, conservation of natural resources and the characteristics of wildlife conservation (e.g. biodiversity, rarity, naturalness and others). The module will also be concerned with the phytogeographical regions of Egypt - Plant diversity in the Nile valley and the Delta, Eastern and Western Deserts and oases, Mediterranean Sea coast, Red Sea coast, Gebel Elba, and Sinai region. The module should also deal with the nature reserves in Egypt and description for these protected areas, Field trips to some of the natural reserves will be made.

Programme Title CHEMISTRY/BOTANY

Programme Type Double Major

Department(s) Chemistry and Botany

BO2101: BO1101: 2, 3, 3 General Ecology

This module introduces the students to plant ecology and covers several topics in two parts. The first part deals with the component of the ecosystem, energy flow, food chain, ecological pyramids, bio-geochemical cycles, Temporal Variations (at population and community Level). The second part deals with the ecological factors: (biotic factors, climate, topography, soil) and their effect on plants, plant vegetation and ecosystems. The course will also cover plant indicators, responses of plant behaviors to ecological factors, different field trips to different wild habitats to recognize the components of ecosystems.

BO2105: BO1101: 2, 3, 3: General Genetics

This module provides an introduction to the principles of genetics and considers the application of these principles to diverse aspects of biology. The genetic systems of higher organisms and microbes are described, including mechanisms of gene transmission and genetic exchange and mutation. Non-Mendelian genetic systems such as multiple alleles, pseudoalleles, linkage, crossing over and gene mapping, genetics related to sex and polygenes and pleiotropy are additional topics that will be covered in this module. Plant and microbial examples are stressed where appropriate. Applications include fundamental studies in other biological disciplines, such as evolutionary and developmental biology, as well as topics directly concerned with human welfare.

BO2202: BO1101: 2, 3, 3: Plant Taxonomy

This module introduces the students to the principles of plant taxonomy and the definitions and terms used in plant taxonomy and systematics, taxonomic categories and taxa definitions and the history and development of plant classifications. The course will give attention to the recent systems of plant classifications and the modern phenetic and cladistic approaches in plant classifications. A major part of this module will deal with the sources of taxonomic information, and the classification of selected families of angiosperms, as classified in Cronquist system with reference to their taxonomic position in the Engler system. The impact of plant geography, breeding system and cytological features on the classification of some groups will be also covered in this course.

BO2204: BO1202: 2, 3, 3: Algae

In one part of this module the students will be introduced to topics covering the occurrence and distribution of algae and their morphological structure, diversity and classification. The course will also cover reproduction in algae (vegetative, asexual and sexual) and life history and alternation of generation giving examples from the different groups of fresh water and marine algae. In a second part of the module will deal with the phylogenetic relationships and evolution of representative algal groups.

BO2206: BO1101: 1, 2, 2: Medicinal and Aromatic Plants

This module deals with the importance of plants as sources of pharmaceutical drugs. It will also cover fiber and wood plants, dye plants, rubber, gum and resin plants, aromatic oil plants, fatty oil and wax plants, sugar, starch and cellulose plants, medicinal plants, pasture and forage plants and food plants.

MB2240: BO1202, 1, 2, 2: Plant Virology

This module aims to introduce students to the detailed biological properties (structure and replication) of viruses particularly those associated with major diseases of plants and provide awareness of the transmission, epidemiology, pathogenesis and control of these virus groups. The module also embraces the basic specific and non-specific host defense mechanisms associated with these infections, the interaction of viruses with these defenses, and the principles concerned with the diagnosis of viral infections.

BO3101: BO1101: 2, 2, 3: Plant Growth and Development

This module provides the students with knowledge of the key areas of plant growth and development with emphasis on the role of plant growth regulators on cell division and differentiation. The topics of the course may start with the regions and phases of growth in plant body and the factors affecting growth. Detailed topics may include the chemistry, biosynthesis, translocation, action and role of auxins, gibberellins, cytokinins, ethylene and abscissic acid in plant growth. Additional lectures will be devoted to photoperiodism and vernalization and the molecular biology aspects of seed embryogenesis, dormancy and germination.

BO3131: BO2204: 1, 2, 2: Photosynthesis and bioenergetics

The aim of this module is to study with some details the process of photosynthesis with its biochemical pathways. Students will acquire knowledge of the control of flux through photosynthetic pathways, and the ways in which photosynthesis is adapted to different physiological states. The module will also consider the amazing diversity and sophistication in the ability of cells to synthesize complex molecules from simple precursors, and the ways in which knowledge of this can lead to the ability to manipulate metabolism in plants. Throughout the module, the ways in which individual pathways illustrate the general principles of metabolism will be highlighted. Examples will be taken from a wide range of plant and algal systems.

BO3133: BO2105: 1, 3, 2: Plant Cytogenetics

This module will illustrate how genetic approaches have been used to understand the mechanisms of eukaryotic cell growth and division. Material to be covered

includes the mitotic cell cycle and its control by internal and external signals. Meiosis will be described and its genetic significance illustrated. The molecular aspects of chromosome structure, organization and chromosomal banding and their use in karyotype analysis are studied. In addition, the consequences of chromosomal variations and their role in evolution and plant breeding will be studied. Examples illustrating this role will be given from different plant groups.

BO3135: BO2105, 1, 0, 1: Biodiversity and Conservation

This module will cover the ecological principals dealing with the conservation theory and its application, conservation for sustainable development. The main topics of the world include species declination and biodiversity, importance of plant biodiversity, in situ and ex-situ conservation types, sustainable development and conservation in dry and wetland regions. Special attention will be given to the concepts and measurements of biodiversity (diversity, naturalness, rarity other characters), conservation at individual and population level and ecosystem, human impact on plant diversity, construction and development of natural reserved areas in Egypt with a description for these protected areas. The course will include field trips to some of the natural reserves

BO3202: BO3101: 2, 3, 3: Plants water relation and mineral nutrition and translocation

This module will deal with the role of water in plants including the properties of water and aqueous solutions. The course should also address cell-water relations and the absorption of water and factors affecting this process. A major part of the module should deal with the translocation of water to stem and leaves and the transpiration and factors affecting this important process. Stomatal mechanisms and measurements of stomatal apertures and their contribution to plant-water balance and water stress will be major topics of this course.

BO3204: BO2101: 1, 0, 1: Wetland and Desert Ecology

In one part of this module the following topics will be covered: origin and development of deserts, the scientific and practical scope of deserts, structure and function relationships of desert organisms and also the impact of man and desertification, combating desertification desert distribution and uses of desert plants. The course will also cover non- biological resources in arid lands; minerals, energy and water; culture and demography of desert population; properties of Egyptian desert. In a second part of the course the concept and the categories of wetlands will be explained. Plant stratification and succession, diversity, factors controlling the properties of wetland (watering, fertility, disturbances, and competitions, grazing) will also be covered. Other topics include remediation of wetlands, Job's functions, conservation management of wetland, study the situation current of Egyptian's wetland.

BO3206: BO2202: 1, 3, 2: Flora of Egypt

This course will give knowledge about the preparation of plant collection, historical review of Egyptian flora. The characteristics of natural vegetation of Egypt covering recent studies will be explained and the geographic regions and its properties (The

Nile region, Deserts, Oases, Mediterranean Sea coast, Red sea coast, Gebel Elba, and Sinai flora) will be described. The students will be asked to make their collections through field trips to some of the Egyptian geographical regions. They will also be encouraged to make collections of the Egyptian cultivated plants, ornamental plants of Orchards and street trees, crop plants (vegetables and fruits), medicinal plants and learn the methods of plant collections and establishment the Herbarium.

BO3230, BO2105, 1, 0, 1: Molecular Genetics

This module gives detailed studies on the molecular aspects of genetics particularly gene structure, expression and regulation in prokaryotes and eukaryotes and describes the detailed mechanisms classic specific cases. This module also covers mutations and will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. Special emphasis will be given to eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing and eukaryotic gene regulation emphasizing transcriptional control and including details of general and specific transcription factors which interact to regulate gene expression in different tissues at different stages.

BO3232: BO2202: 1, 2, 2: Economic Botany and Crop Plants

This module deals with the importance of plants as sources of services and goods of economic importance in human life. It should cover fiber and wood plants, dye plants, rubber, gum and resin plants, fatty oil and wax plants, sugar, starch and cellulose plants, medicinal plants, pasture and forage plants and food plants. This module will also deal with the classification, evolution and diversity of crop plants and the different uses of these plants in human life. The structure and classification of field crops that may include topics on environment in relation to crop growth and distribution will be also addressed. Some topics should also deal with seed bed preparation, crop rotation, Crop distribution in Egypt and crop improvement.

BO4105: BO2202, 1, 2, 2: Plant Molecular Systematics

This module will enable the students to learn about the different types of molecular criteria and their application in plant phylogeny and systematics. The course will describe the molecular methods used to generate these criteria and deals in some details with the different approaches for constructing relationships of plant taxa using distance and parsimony approaches using different types of tree building methods.

BO4118: BO3101: 1, 2, 2: Nitrogen metabolism

This module should deal with the metabolism of nitrogen in plants. The course should address the following topics: nitrogen in the biosphere, cycling of nitrogen in nature, loss of nitrogen from its cycle, gain of nitrogen to its cycle and the processing of inorganic nitrogen by the plants. The course should also cover the amino acids and proteins and the metabolism of nitrogen in the seeds.

BO4131: BO2105: 1, 3, 2: Plant Genetic Engineering

Genetic engineering has developed from knowledge of molecular genetics and genome structure and its application will affect our lives in many ways. The basic technology and methods will be reviewed, so that students will become sufficiently well informed to understand the applications of these techniques. Lectures will deal with the development of method and approaches of gene cloning and gene transfer, genetic libraries and production of genetically modified crops. Details will be given to details of gene transfer to plants.

BO4115: 1, 2, 2: Bioinformatics

The first part of this module will focus on the development and implementation of efficient algorithms for problems related to genomics with emphasis on sequence homology and alignment, phylogenetic tree building methods, hidden Markov models and their applications in genetics and biotechnology (e.g. multiple sequence alignment, recognition of genes and promoter sequence). A second part of this module will also deal with retrieval, analysis and interpretation of biological data concerned, protein sequence motif analysis, prediction of RNA and protein secondary structures. Genome analytical methods, annotations, protein and nucleic acids data base searching will also be part of this course.

BO4131: BO2105: 1, 2, 2: Mutations and Genome Changes

This module covers mutations and genome structure and evolution. The first part will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. The second part will cover the functions highly abundant reiterated simple sequences; functions and origins of the sequences of the genome; transposons, and retroposons. The structure, function, inheritance and evolution of extra-nuclear genomes in will be considered in a range of eukaryotes. The impact of whole genome sequencing (genomics) on the study of gene function will be considered for both prokaryotic and eukaryotic organisms.

BO4123: BO2101: 1, 2, 2: Physiology of Algae

This module deals with physiological aspects of algae based on detailed studies on the structure of algal cell components. The structure and function of major physiological pathways and the different secondary metabolites will be also addressed in this course. The role of the secondary metabolites in algal tolerance to environment will be discussed.

MB4133: MB2240: 1, 2, 2: Bacteriology

This module deals with the occurrence and distribution of bacterial organisms and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to bacteria, cyanobacteria and actinomycetes particularly their nutritional requirements, physical conditions required for growth, reproduction and economic importance. The importance of bacteria as sources for natural and industrial compounds will be addressed as major part of this course.

BO4230: BO3103: 2, 3, 2; Plant Biotechnology

This course considers the application of biotechnology to plants, for both agricultural and research uses. It covers the production of transgenic plants and how this technology has resulted in genetically engineered crop plants that have improved qualities or produce novel plant products. It also covers alternative techniques such as culture-induced variation or marker assisted plant breeding that can be used to produce genetically improved crop varieties without use of genetic engineering. The release of engineered crops is having a major impact on society raising issues of economic and ecological importance. An appreciation of these issues will be developed. The principles of plant breeding will be explained and emphasis will be given to molecular markers and their use in breeding.

MB4232: MB2240: 1, 2, 2: Mycology and Plant Pathology

This module provides theoretical and practical knowledge of plant diseases; their causative agents and their control. It will cover diseases caused by fungi and other agents such as viruses, plant parasites, insects and nematodes. The module will also include plant disease resistance and disease control. Details will be given to molecular aspects of disease resistance and control and the importance of breeding for disease resistance. The course will also cover the ways and means of plant disease bio-control using natural enemies.

BO4202: BO2202, 1, 2, 2: Plant Sociology

This course will introduce the students to the hypotheses of plant community, classification system of plant community, characters of plant vegetation and analytical methods of population ecology. Main topics include the Qualitative characters: Floristic composition, life-forms, stratification, phenology, vitality, sociability, interspecific association, dominance, dispersal types, sex form, physiognomy, fidelity and the Quantitative characters: Species diversity, density, frequency, cover, size, biomass, presence or constancy, and pattern. In addition, multivariate analyses of vegetation, similarity coefficient between plant communities, classification methods of plant communities, ordination, and direct gradient analysis.

BO4208: BO1202, 1, 2, 2: Quantitative and Population Genetics

This module will concentrate on how the frequencies of different alleles are distributed and altered in populations. The emphasis will be on polymorphisms and of plants. Material covered includes variations in cell proteins and morphological characters, fitness, migration, genetic drift, breeding systems, types of selection, effects of man-made changes, roles of RNA and DNA genomes, introns and gene duplications, on population genetics. Quantitative characters are typically influenced, not by single major genes, but by several to many polygenes acting in concert with the environment. In quantitative genetics, the concepts of heritability will be developed in relation to agricultural and human populations.

BO4210: BO2204: 1, 2, 3: The Economic Uses of Algae

This module will deal with some details with the economic importance of algae and the uses of algae and their products in human life, particularly their commercial applications of algal hydro-colloids, role of algae in agriculture and role of micro-algae in liquid waste treatment. The importance of algae as a human food or food complementary will covered in some details. Other uses of algae include: medical uses of algae, lipids and polyols from micro-algae, diatoms role in soil fertility, commercial applications of algal hydro-colloids.

BO4212: BO2105: 1, 2, 2: Genome Analysis

This module deals with the mechanisms of cell growth and division. The molecular aspects of chromosome structure and organization and chromosomal banding and their role in genome analysis are studied. This module will also show how classical and molecular techniques used for protein separation, identification, quantification. The module should also deal with structural proteomics and cellular proteomics.

BO4214: BO3206: 1, 2, 2; Environmental Management and Impact Assessment

This course will introduce the students to the regulation and regulatory framework of the environmental and hazardous Waste law; Definitions; policy guidance vs. regulations; role of the states, municipalities and the EEAA, compliance issues; case studies. The course will also give knowledge about the environmental management system (EMS) under standing ISO 14000 scope and definitions; EMS requirements and environmental policy; cost benefit analysis; environmental planning; implementation and operation; checking and corrective action; environmental auditing and the environmental management system in Egypt. The course will further describe the objective and needs of environmental impact assessment (EIA); activities involved in EIA, characteristics of impacts); EIA methods, checklists, overlay mapping, net works, matrices; estimates of resources demand for EIA studies; Recommended methodologies for rapid EIA; case studies; guidelines for EIA in developing countries; environmental impact statement; land evaluation and suitability analysis.

BO 4220: BO1202: 1, 0, 1: Physiology Stress

Plants and other living organisms may be exposed permanently or occasionally to stress imposed by severe environments such as drought, water shortage and salinity. This module will focus on the mechanisms used by plants and other living organisms to avoid the harmful effects of environmental stress.

MB4206: BO1202: 1, 2, 2: Physiology of Fungi

This module deals with aspects related to the physiological processes in fungi, it may deal with the culture media (natural, semi-synthetic and synthetic).Fungal growth and the internal and external factors affecting growth in vitro. The course will further address the organic and inorganic fungal nutrition, the utilization and metabolism of carbon and nitrogen sources and metabolism of proteins and lipids in fungi. Additional topics are the fungicides and their mode of action.

Programme Title CHEMISTRY/MICROBIOLOGY

Programme Type Special

Department(s) Chemistry and Botany

MB2101: BO1202: 2, 2, 3: Prokaryotic Organisms

This module deals with the occurrence and distribution of prokaryotic organisms and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to bacteria, cyanobacteria and actinomycetes particularly their nutritional requirements, physical conditions required for growth, reproduction and economic importance. This course will also cover viruses and their distinctive characters, their structure, size, multiplication and transmission as well as the human, animal and plant viral diseases.

BO2105: BO1101: 2, 3, 3: General Genetics

This module provides an introduction to the principles of genetics and considers the application of these principles to diverse aspects of biology. The genetic systems of higher organisms and microbes are described, including mechanisms of gene transmission and genetic exchange and mutation. Non-Mendelian genetic systems such as multiple alleles, pseudoalleles, linkage, crossing over and gene mapping, genetics related to sex and polygenes and pleiotropy are additional topics that will be covered in this module. Plant and microbial examples are stressed where appropriate. Applications include fundamental studies in other biological disciplines, such as evolutionary and developmental biology, as well as topics directly concerned with human welfare.

MB2220: BO1202: 1 3, 2: Principles of Mycology

This module will enable students to acquire knowledge about the science of mycology with special emphases on nutrition, reproduction and classification of fungi. The course will cover reproduction in fungi (vegetative, asexual and sexual) and life history and life cycles of representative taxa. This module will also deal with some details with the economic importance of fungi and the uses of fungi and their products in human life.

MB2222: BO1202: 1, 3, 2: Fundamental Virology

This module aims to introduce students to the detailed biological properties (structure and replication) of viruses particularly those associated with major diseases of man, and plants and provide awareness of the transmission, epidemiology, pathogenesis and control of these virus groups. The module also

embraces the basic specific and non-specific host defense mechanisms associated with these infections, the interaction of viruses with these defenses, and the principles concerned with the diagnosis of viral infections by laboratory procedures.

MB2224: MB2101: 1, 0, 1: Applied Bacteriology

This module deals with the occurrence and distribution of bacterial organisms and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to bacteria, cyanobacteria and actinomycetes particularly their nutritional requirements, physical conditions required for growth, reproduction and economic importance. The importance of bacteria as sources for natural and industrial compounds will be addressed as major part of this course.

BO2240: BO1202: 1, 0, 1: Plant Ecology

This module provides an introduction to the principles of plant ecology and considers its applications. The main themes of the course will cover the structure of the ecosystem, energy flow and food webs, ecological pyramids, efficiency of energy transfer, biogeochemical cycles and temporal variations at the population and community levels. Another part of this module will cover the ecological factors affecting plant and animal life particularly climatic, soil, biotic and topographic factors. In the third part, topics related to wild life conservation, biodiversity and natural resources will be dealt with in this course. Emphasis will be devoted to responses of plant vegetation and types of ecosystems to ecological factors, plant indicators, responses of plant behaviors to ecological factors.

BO2242: BO1101: 1, 3, 2: Photosynthesis and energy bio- conversions

The aim of this module is to examine ways in which biochemical pathways are controlled and integrated. Students will acquire knowledge of the control of flux through metabolic pathways, and the ways in which metabolism is adapted to different physiological states. The module will also consider the amazing diversity and sophistication in the ability of cells to synthesize complex molecules from simple precursors. The module should also include introduction and historical review to chloroplast structure and function and the structure and function of pigments involved in photosynthesis. The transfer of energy and the electron transport in photosynthesis and its relation to phosphorylation, biochemical reactions of photosynthesis (Calvin cycle), in C₃ and C₄ plants will be major parts of the course.

MB3103: BO: 1202 1, 2, 2: Immunology

The module embraces the basic specific and non-specific host defense mechanisms associated with pathogens infections, the interaction of pathogens with these defenses, and the principles concerned with the diagnosis of infections using laboratory procedures. The course should also emphasize the basic immunity, pathogenic mechanisms, modes of transmission, epidemiology, viral latency and

viruses and carcinogenesis, among others. Finally antiviral chemotherapy, viral vaccines and the underlying mechanistic rationale for their use is discussed.

MB3107: MB2220: 1, 2, 2: Medical Microbiology

This module deals with the pathogenesis of medically important microorganisms including bacteria, fungi, viruses, rickettsia and protozoa. The symptoms of diseases caused by microbial pathogens and their diagnosis will be addressed. In addition, the immune-biology of the major microbial diseases, with emphasis on their ways and means of their prevention will be studied.

BO3117: BO1101: 1, 2, 2: Cell Biology

The aim of this module is to provide an introduction to the overall structures of prokaryotic and eukaryotic cells; organization and function of biological membranes; compartmentalization of eukaryotic cells and the functions of the major types of organelle; the main elements of the cytoskeleton and their functions; intercellular and intracellular communication

BO3141: BO1202: 2, 3, 3: Introduction to Algae

In one part of this module the students will be introduced to topics covering the occurrence and distribution of algae and their morphological structure, diversity and classification. The course will also cover reproduction in algae (vegetative, asexual and sexual) and life history and alternation of generation giving examples from the different groups of fresh water and marine algae. In a second part of the module will deal with the phylogenetic relationships and evolution of representative algal groups based on molecular approaches.

MB3210: BO1202, 1, 3, 2: Food Microbiology

This module deals with the microorganisms that live in food and the effects of microbial growth on food quality. The methods used to control, detect, and enumerate microorganisms in food will be addressed. Special emphasis will be devoted to the identification and management of food microorganisms and the ways to protect the consumers of microbes in food.

MB3202: BO1202: 1, 3, 2: Water and soil microbiology

This course should deal with the basic principles of aquatic microbiology and aquatic microbial ecology. The course will address the role and identity of aquatic and soil microorganisms and the introduction to modern methodologies for microbial research. Spread of non-indigenous microorganisms by ships and international trade, symbioses and microbial associations with aquatic and soil microbiology related to aquaculture, seafood-borne and water-borne microorganisms will be addressed.

MB3204: BO1202: 1, 2, 2; Introduction to Actinomycetes

In this module special emphases should be devoted to the habitats in which actinomycetes live. The module will deal with the isolation, characteristics and molecular classification and identification of actinomycetes. The importance and

activities of this group of organisms will be studied in details.

MB3206: 1, 2, 2: Biological Control

Biological control is an environmentally sound and effective means of reducing or mitigating pests and pest effects through the use of natural enemies. The enemies controlled may be viral, microbial, nematode, insect, mite, weed, and vertebrate pests in agriculture, aquatic, forest, natural resource, stored product, and urban environments. Biological control of arthropod pests of human and domestic animals is also included. Ecological, molecular, and biotechnological approaches to the understanding of biological control are also part of bio-control technologies. Molecular technology advances in the understanding of biological control agents and their mechanisms will also be a major topic of the course

MB3208: MB2101: 1, 2, 2: Enzymes in Microorganisms

This course in microbial enzymes pays emphasis to fundamentals of enzymology, enzyme preparation, enzyme immobilization, and microbial enzyme applications (industry, medicine and environment). Recent advances in enzyme technology and future prospects for enzyme technology will be also addressed in this course.

BO3242, BO2105, 1, 2, 2: Introduction to Molecular Genetics

This module gives detailed studies on the molecular aspects of genetics particularly gene structure, expression and regulation in prokaryotes and eukaryotes and describes the detailed mechanisms classic specific cases. This module also covers mutations and will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. Special emphasis will be given to eukaryotic gene expression including details of the different RNA polymerases and mechanisms of RNA processing and eukaryotic gene regulation emphasizing transcriptional control and including details of general and specific transcription factors which interact to regulate gene expression in different tissues at different stages.

MB4101: MB3202: 1, 2, 2: Yeasts Biology

In this module yeast is used as a model to teach some of the more actively researched areas of cell biology. Areas covered may include different yeast taxonomical groups (classification), physiology, mating type, cell-cell interaction, DNA replication, mitosis, cytoskeletal motors, cell polarity, signal transduction, cell cycle, yeast killer protein modification, some basic in yeast genetics, and yeast technology.

BO4121: BO2105: 1, 2, 2: Microbial Genetics

This module will show how classical and molecular techniques are used to study the genomes of bacteria and fungi, and to explore fundamental genetic processes. Bacterial genetics will include mutagenesis, selection of mutants, transmission and recombination of genes, analysis of regulatory mutants, transposable elements, and reverse genetics. After an introduction to the yeasts and filamentous fungi used in genetic studies, including model species and those of economic importance, fungal

genetics will include mutant selection and characterization, complementation tests, meiotic mapping, tetrad analysis and molecular techniques for analysis of gene function. The impact of whole genome sequencing (genomics) on the study of gene function will be considered for both prokaryotic and eukaryotic micro-organisms

BO4123: BO2105, 1, 2, 2: Biodiversity conservation

This module will cover the ecological principals dealing with the conservation theory and its application, conservation for sustainable development. The main topics of the world include species declination and biodiversity, importance of plant biodiversity, in situ and ex-situ conservation types, sustainable development and conservation in dry and wetland regions. Special attention will be given to the concepts and measurements of biodiversity (diversity, naturalness, rarity other characters), conservation at individual and population level and ecosystem, human impact on plant diversity, construction and development of natural reserved areas in Egypt with a description for these protected areas. The course will include field trips to some of the natural reserves.

MB4105: MB3202: 1, 2, 2: Antimicrobial Agents

This course should include an introduction to antimicrobial agents (background and brief history), non-specific antimicrobial agents, antibiotics; antibacterial and antifungal agents. Agents acting against the cell wall, cell membrane, nucleic acids, proteins and enzymes, in addition to competitive inhibitors (antimetabolites) will be addressed in details.

MB4107: MB3202: 1, 0, 1: Microbial Bioremediation

This module should include the description of modern pollution problems and potential microbiological remediation techniques: focusing on biochemistry and molecular biology of biodegradation of hazardous and toxic compounds.

MB4113: MB3202: 1, 2, 2: Microbial Toxins

This module deals with the toxins and secondary metabolites produced by the microorganisms. The structure and function of major groups of these toxins will be covered giving some examples from different toxins and microbial groups. The role of microbial toxins in microorganism's life and the role of microbial activities in the environment and human life will be discussed.

BO4123: BO3141: 1, 2, 2: Physiology of Algae

This module deals with physiological aspects of algae based on detailed studies on the structure of algal cell components. The structure and function of major physiological pathways and the different secondary metabolites will be also addressed in this course. The role of the secondary metabolites in algal tolerance to environment will be discussed.

BO4131: BO2105: 1, 2, 2: Mutations and Genome Changes

This module covers mutations and genome structure and evolution. The first part will concentrate on types of gene mutations, mutants and causes of mutations as well as mutation repair mechanisms. The second part will cover the functions highly abundant reiterated simple sequences; functions and origins of the sequences of the genome; transposons, and retroposons. The structure, function, inheritance and evolution of extra-nuclear genomes in will be considered in a range of eukaryotes. The impact of whole genome sequencing (genomics) on the study of gene function will be considered for both prokaryotic and eukaryotic organisms.

BT4103: MB3242: 1, 2, 2: Microbial Bioinformatics

The first part of this module will focus on the development and implementation of efficient algorithms for problems related to genomics with emphasis on sequence homology and alignment, phylogenetic tree building methods, hidden Markov models and their applications in genetics and biotechnology (e.g. multiple sequence alignment, recognition of genes and promoter sequence). In a second part of this module will also deal with retrieval, analysis and interpretation of biological data concerned, protein sequence motif analysis, prediction of RNA and protein secondary structures. Genome analytical methods, annotations, protein and nucleic acids data base searching will also be part of this course.

MB4141: 1, 2, 2: Scientific Writings and Presentations

Analysis and interpretation of genetic data are essential skills for modern geneticists and are important for handling of biotechnological information. The purpose of this module is to develop these skills through a directed program of reading, discussion and question answering, based on a series of research papers. This module will introduce the students to the elements of scientific writing starting with how to present the data, prepare tables and graphs and write the sections of research papers. The know-how of presenting scientific data in a poster or oral sessions will be described in detail.

BT4202: MB4105: 2, 3, 3: Microbial Biotechnology

The aim of this course is to introduce students to areas of microbial biotechnology that are either currently being exploited commercially or that are likely to lead to commercial ventures in the near future. The first part of the course covers the fermentation processes currently utilized in the pharmaceutical and food industries, based on microbial fermentation and illustrates the range of technologies involved in large-scale commercial growth of microorganisms. The second part of the course covers the utilization of gene technology for the production of new products from micro-organisms and micro-algae.

BO4240: BO2105: 1, 0, 1: Gene engineering

Genetic engineering has developed from knowledge of molecular genetics and genome structure and its application will affect our lives in many ways. The basic technology and methods of genetic engineering will be reviewed, so that students will become sufficiently well informed to understand the applications of these

techniques. Lectures will deal with the development of methods and approaches of gene cloning and gene transfer, genetic libraries and production of genetically modified organisms.

MB4204: 1, 2, 2: Microbial Plant Interaction

This module provides theoretical and practical knowledge of plant diseases; their causative agents and their control. It will cover diseases caused by fungi and other agents such as viruses, plant parasites, insects and nematodes. The module will also include plant disease resistance and disease control. Details will be given to molecular aspects of disease resistance and control and the importance of breeding for disease resistance. The course will also cover the ways and means of plant disease bio-control using natural enemies.

MB4206: MB2101, 1, 2, 2: Physiology of Fungi

This module deals with aspects related to the physiological processes in fungi, it may deal with the culture media (natural, semi-synthetic and synthetic). Fungal growth and the internal and external factors affecting growth in vitro. The course will further address the organic and inorganic fungal nutrition, the utilization and metabolism of carbon and nitrogen sources and metabolism of proteins and lipids in fungi. Additional topics are the fungicides and their mode of action.

BO4210: BO3141 1, 2, 3: Economic Uses of Algae

This module will deal with some details with the economic importance of algae and the uses of algae and their products in human life, particularly their commercial applications of algal hydro-colloids, role of algae in agriculture and role of micro-algae in liquid waste treatment. The importance of algae as a human food or food complementary will be covered in some details. Other uses of algae include: medical uses of algae, lipids and polyols from micro-algae, diatoms role in soil fertility, commercial applications of algal hydro-colloids.

BO4212: BO2105: 1, 2, 2: Genome Analysis

This module deals with the mechanisms of cell growth and division. The molecular aspects of chromosome structure and organization and chromosomal banding and their role in genome analysis are studied. This module will also show how classical and molecular techniques used for protein separation, identification, quantification. The module should also deal with structural proteomics and cellular proteomics.

BT4214: Biosafety and Bioethics

Principles and practices of biosafety and management of public concerns about modern biotechnology are the focal points of this module. The module will give an overview of biotechnology and biosafety issues/concerns worldwide and the international treaties/agreements in biosafety. Principles of risk assessment, risk management and risk communication will be also addressed. The module will further deal with factors affecting biodiversity, invasiveness and gene flow as well as possible influences of transgenic crops on non-target organisms, pest resistance management, transgenic safety protocols and field testing procedures. Analysis and

building of biosafety regulatory framework, biosafety laboratories, policy analysis, material safety data sheets, review of laboratory associated illness and personal protection and exposure control.

BO4242: B01202: 1, 2, 2: Introduction to Soil Science

This course deals with soil ecology. One part of this course will deal with the soil environment (soil physical and chemical features, soil water status, soil pH, soil temperature, soil light). The second part of the course will deal with the soil biota with special emphasis on the interactions between the soil biota and soil features. The course will also cover the ecology of soil nutrient cycles and soil pollution.

مقررات قسم النبات التابعه للبرامج الأخرى

BO1121: General Botany

The aim of this module is to give the students sufficient knowledge on the plant external and internal structures of plants. The external morphology criteria should deal with the following topics: seed types and seed germination, types of roots, stems and leaves, types of inflorescences and the adaptation of plants to the environment. The endo-morphological criteria should deal with the following topics: types of plant cells and tissues, the primary structure of plant body, root, stem leaves secondary thickening and ecological anatomy.

BO1123: Systematic Botany

This module deals with the classification of plants kingdom including non flowering and flowering plants. The topics should cover the occurrence, structure, classification and evolutionary relationships of the major plant groups of non flowering plants with special emphasis on the evolution of stele structure in the different non flowering plants and the life cycles of selected examples. The module will also cover the flower structure and the classification of flowering plants with special reference to selected families.

BO2240: Plant Pathology

The course deals with the causes, nature and control of plant diseases. Methods of diagnosing plant diseases caused by fungi, bacteria, viruses, nematodes, and abiotic agents are considered. Mechanisms, biochemistry, and genetics of plant disease; induction, development, and management.



Department of Zoology

Programme Title Zoology

Programme Type Special

Department(s) Zoology

ZO 2101 Cell Biology & Genetics

This course is designed to give an introduction to the animal cell structure and function. This will include the chemical components of the cell, the structure and function of the cell organelles and their role in the development and differentiation of the cell. This course is also designed to teach students the mechanisms of hereditary transmission and variation of organismal characteristics. The various basic concepts which have been established in genetics will be discussed. Gene regulation and developmental patterns, as well as irregularities, both will be studied structurally and functionally. Students will also have some knowledge of the recent progress made through biochemical and microbial studies. Principles of Genetic Engineering will also be discussed to enhance

students' ability to think scientifically and solve problems in Biology.

ZO 2103 Invertebrate systematics

The course will be primarily designed to provide the student with the principals of systematics and Phylogeny of invertebrates with new approaches and modern trends in studying fundamentals of systematics. The course is concerned with systematics and Phylogeny of Lower invertebrates (Protozoa, Porifera, Cnidaria, and Helminthes). Special consideration will be given to characters, classification; morphology, functional anatomy and biology of different kinds of these invertebrates. Many representative animal types from different phyla of these Lower Nonchordata are studied.

ZO 2105 Entomology

This course will enable students to acquire knowledge and critical understanding of the principles of internal and external morphology of insects; insect development and compare between different insects in different orders. Also enable them to collect and store insects in the laboratory, and mounting insects for permanent display. Also the principles of internal and external anatomy: integument; digestive system; tracheal system; circulatory system; excretory system; reproductive system; nervous system and sense organs; and to develop understanding of the underlying principles of chemical communication.

ZO 2107 Ecological adaptation

An examination of common ecological circumstances faced by animals and the morphological, behavioral and life history characteristics that have evolved in response. Particular emphasis will be placed on evolutionary processes and on adaptive aspects of thermoregulation, foraging strategies, spatial distribution, social and reproductive strategies. The course will emphasize both the theoretical basis and the empirical evidence for ecological adaptation.

ZO 2109 Fauna of Egypt

The Egyptian fauna is very diverse in view of the large number of habitat types. This course includes the study of the most common species, especially vertebrates fish, amphibians, reptiles, birds and mammals in Egypt. The course reviews different types of animal behavior with examples to understand how they respond and behave in their live.

ZO 2111 Animal biotechnology

This is a Module that considers the exploitation of microorganisms and microbial processes in the context of modern developments in biotechnology. Economic and ethical aspects of the development of novel products and the potential environmental benefits of using biotechnological processes will be examined. Process aspects of scale-up and volume production will be covered in addition to methods for increasing yield. Specific aspects to be examined will be antibiotic production, microbes as hosts for production of mammalian gene products, plant biomass conversion, microbial informatics, biocatalysts and biosensors. Students will gain understanding of: The economics, ethics and regulation of modern biotechnological processes. The impact of recombinant DNA technology on the biotechnology industry. Modern approaches to strain improvement and genetic manipulation. The microbial technology of the production of alternative fuels and feedstuffs Biosensors and their commercial application.

ZO 2113 Zoogeography

To provide students with the basic concepts of animal distribution in the zoogeographical realms. The past and current geographical distributions of animals and the ecological and historical processes leading to these distributions. The role of physical, ecological, and evolutionary processes in determining the geographic distribution of animals, with implications for speciation and conservation.

ZO 2202 Chordates

This course will enable students to gain knowledge and an appreciation of the major groups of vertebrates with emphasis on (i) the basic features of chordate (vertebrate) design, (ii) diversity of body form and function, (iii) inter-relationships.

ZO 2204 Invertebrate Biology

This is a basic invertebrate zoology course that will teach the students the biology of higher invertebrates (Annelida, Mollusca, Arthropods, Echinodermata). The course will provide an understanding of the taxonomy, phylogeny and basic biology of these invertebrates which the students will experience directly on the field course. It will stress the evolutionary relationships between different phyla. Lectures concentrate on functional morphology, identification, classification, anatomy, ecology, behavior and evolutionary relationships of these Higher Nonchordates.

ZO 2206 Protozoology

The course is intended for students interested in pursuing a professional career in the fields of parasitology, biodiversity and invertebrate biology. The course aims to 1- provides students with principles, practices and informative knowledge concerning protozoology. This will be achieved through the study of taxonomy, biology, and ecology of free living and parasitic protozoa. The study will include the study of the structure, life cycle, development, host parasite relationship, and protozoan potential to cause disease and economic losses. 2- develop awareness of concepts underlying design of epidemiological studies , control strategies , and modern trends in parasitology 3- Provide students with knowledge concerning arthropod vectors and modes of transmission of parasitic protozoa. 4-develop intellectual and practical skills of current and potential approaches for parasite/disease diagnosis and control

ZO 2208 Biological Associations

The course aims to: 1-Provide students with informative knowledge concerning the types of relations that exist between different types of living organisms. 2- interpret interactions among organisms exhibiting predation, parasitism, symbiosis, commensalism, and mutualism 3-Provide students with informative knowledge to differentiate between the beneficial and harmful living organisms and their impact on human and animal health and welfare. 4-Develop intellectual and practical skills for the use of parasitic microorganisms as biological control agents, with special references to the insect vectors.

ZO 2210 Molecular Biology

This course will enable students to gain knowledge and study of an introduction to the biology of cells; fundamentals of molecular biology; organismal and molecular genetics; human genetic variation; diversity and biology of microorganisms; microbial virulence and disease processes. This course covers the traditional molecular biology curriculum which includes transcription, translation, and gene expression in both prokaryotes and eukaryotes. Lecture includes theory on key molecular techniques. Laboratory exercises emphasize current techniques in molecular biology such as molecular cloning, blotting, PCR, and assays of gene expression.

ZO 2212 Community Ecology

A course on the structure and dynamics of communities, dealing with both theoretical and applied aspects of community ecology. Emphasis is on the modern quantitative view of community ecology, and on the development of problem-solving skills. Particular emphasis will be placed on the effect of interspecific interactions on the structure and dynamics of natural and managed communities; including concepts of guild structure and trophic web dynamics and their importance to the productivity, diversity, stability, and sustainability of communities.

ZO 2214 Immunology

The aim of this course is to provide an understanding of the key immunological principles and terminology and to perform and interpret basic serological and leucocyte tests. As well as to elucidate the molecular, cellular and organic components of the immune system; the nature and causes of its malfunctions; and the scope for intervention and exploitation

ZO 2216 Medically Important Animals and human health

Venomous animals are a significant health problem for country populations in many habitats. This course will enable students to gain knowledge about the recognition and general biology of dangerous animals (invertebrates & vertebrates), causing poisoning and toxic reactions. The nature of animal venoms and aspects of envenomation is given. In cases of accidents, advice for first aid and treatment of bites and stings are included. Also, some animals contain substances of interest to the pharmaceutical industry as bio-medicine. These animals proved to include medically important substances as drugs for human health.

ZO 3101 Embryology & Experimental Embryology

The lecture course is a comparative study of vertebrate embryology with emphasis on the fundamental developmental processes shared by vertebrate embryos. Topics include gametogenesis, fertilization, and development of Amphioxus, Amphibia, Chick and Human embryos from zygote through the differentiation of the neural tube. Besides the development of selected organ systems including the nervous system, sense organs, and the cardiovascular, digestive, respiratory, and urinogenital systems. The course includes all the principals of the embryonic stem cells; the differentiation potential of stem cells, basic concepts

and definitions, sources of adult stem cells, defining properties of an embryonic stem cell, adult stem cell, Stem cells and repairing a damaged heart, mouse embryonic stem cell cultures.

ZO 3103 Invertebrates of Egypt

This advanced invertebrate zoology course will face the need of student to gain knowledge and skills about Egyptian invertebrate fauna and up-to date account. It will deal with the taxonomical characters, classification, checklist and taxonomic keys of invertebrate animals (Major & Minor Phyla) with special emphasis on representative types of Egyptian fauna. Diagnostic characters associated with taxonomic categories to the class or order level for most of the invertebrate phyla are studied. The course provides practical experience in methods of collecting, preserving, and identifying local invertebrates through laboratory and field course studies.

ZO 3105 Functional Histology

This course enables students to be familiar with the histology of all organ systems of the body (e.g. Digestive, Endocrine, Respiratory, Urinary and Circulatory systems) and to acquire basic understanding of at the practical level of the histology of the normal organs under the microscope and differentiate between them and to correlate between the histological structure and functions of various tissues and organs, in addition to the detailed structures of each organ (its layers, tissue components, cells, glands, modification of the organ).

ZO 3107 Animal techniques

This course will enable students to gain knowledge about the theory and practice of important laboratory techniques used in cell biology research. Studies techniques such as microscopy, electrophoresis, spectrophotometry, chromatography, immunological methods, tissue and cell culture.

ZO 3109 Fish Biology and Fisheries

This course is designed to deal with several topics in Fish Biology and Fisheries. This will include fish anatomy, fish taxonomy and fish culture as well as the early life history of fish. Age and rate of growth and the relationship between the weight and the length of different species of fish will be studied. Special attention will be given to the food bases for different types of fish in different waters. Students will be made aware of the limnological factors of the Egyptian waters. Both the physical and the chemical data will be studied. Commercial fishing data such as stock assessment,

population dynamics and fish processing of different fish types will be dealt with. An introduction to the gear technology and the effectiveness of the different fishing methods in different kinds of water will be discussed. Students after completing this course and other related courses should be able to work in organizations dealing with fishing and to be capable of carrying out any task related to fishery biology.

ZO 3111 Field trips

This course will enable students to 1-survey systematics of local marine fauna, with familiarization of the marine environment. Laboratory emphasizes field work and independent projects. 2- Recognize main invertebrate groups. 3- Mention the adaptation of invertebrate at different existence environments.

ZO 3113 Aquaculture

The main objective of the course is to introduce students to today's aquaculture industry and provide professionals in aquaculture with information and training with emphasis on planning, operation, and development of aquaculture. The course will be based on principles rather than being species specific. Sustainability and environmental issues will be integrated into all topics. The students will gain sound knowledge on how to evaluate and identify the appropriate aquaculture operations for any particular environment, both in terms of suitable species and site selection.

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ZO 3202 Parasitology

The course is intended for students interested in pursuing a professional career in the fields of parasitology, biodiversity and human health. The course aims to: 1- provides students with principles, practices and informative knowledge concerning parasitism and the diversity of helminth parasites. This will be achieved through the study of the structure, life cycle, development, host parasite relationship, and helminth potential to cause disease and economic losses. 2- develop awareness of concepts underlying design of epidemiological studies, control strategies, and modern trends in parasitology 3- develop intellectual and practical skills to develop professional competence in the fields related to parasitology.

ZO 3204 Physiology 1

The course will focus on the aspects of metabolism and physiology of digestion and nutrition, draw on examples from the phyla studied in Level 2 and with an emphasis on Egyptian fauna. The

course will focus on organ-system physiology; however, cellular and molecular mechanisms will be discussed in order to present a current view of physiological principles. It also familiarizes students with some of the laboratory techniques and equipment used in the acquisition of physiological data and in development of their investigative skills and scientific careers.

ZO 3206 Animal Ecology and behaviour

This course focuses on the ecology of individuals, populations and communities. It examines demography and population growth, competitive and predatory interactions between populations, the structure of communities and the role of competitors, natural enemies and disturbances in organizing communities. The laboratory work provides experience in the design, execution, analysis and interpretation of quantitative studies to answer ecological questions in the field and laboratory, and in critical evaluation of papers dealing with current controversial topics in ecology.

ZO 3210 Invertebrate pathology

This course will enable students to gain knowledge and study of diseases affecting invertebrate animals of economic importance, including etiology, pathogenesis, symptomatology, pathology, histopathology, physiology and epizootiology.

ZO 3212 Molecular Embryology

The aim of developmental biology is to understanding how animals and plants are put together, a process in which a cell gives rise to many different cells that become organized into functional structures and assembled into whole organisms. This involves a beautiful and reproducible choreography of cells dividing, moving, and changing shape in a coordinated manner over time. Traditionally these descriptions have fallen within the realm of embryology. However, developmental biology is not embryology. Whereas embryology describes the way a single cell gives rise to an organism, developmental biology adds experimentation and causal analysis to this description. Where embryology aims to tell us what happens during the development of an organism, developmental biology wants to know how and why it happens. Both disciplines have the cell as their unit but whereas for an embryologist the cell is the element of description, for the developmental biologist it is an agent of action.

ZO 3208 Immunology of Parasites & control

The course is intended for students pursuing careers in the field of parasitology, such as diagnostic parasitology laboratories, pharmaceutical companies and health centers. The course aims to: 1-provide students with principle, practice and informative knowledge concerning mechanisms involved in host parasite relationship, the role of the immune system against parasitic infections and the response of different parasitic species, and current and potential approaches in control strategies.2-develop intellectual and practical skills to plan control strategies and to use immunoparasitological techniques in the diagnosis and control of parasitic infections.

ST 3202: Biostatistics

This course is designed to introduce the student to data analytic and applied statistical methods commonly used in industrial and scientific applications. The module will focus on computer-aided data analysis using comparisons between batches, analysis of variance, regression and correlation. The module will also deal with estimation and hypothesis testing, multivariate analysis, and nonparametric techniques. Approximations and errors (accuracy and precision; errors; blunders, formulation error, and data uncertainty).

ZO 4101 Histochemistry

Prepare the microscopic sections (how slides are made) and provide students with a basic understanding of the equipments for preparation and staining of histological sections by routine stain (H&E). Know the different histochemical techniques, and learn to distinguish between normal and pathogenic state of tissue and diagnostic the abnormality of the different chemical components and functional enzymes within tissues.

ZO 4103 Physiology 2

In this course, emphases will focus on the aspects of physiology of circulation and defensive mechanisms, osmoregulation and behavior, draw on examples from the phyla studied in Level 2 and with an emphasis on Egyptian fauna. It also familiarizes students with some of the laboratory techniques and equipment used in the acquisition of physiological data and in development of their investigative skills.

ZO 4105 Epidemiology & Clinical Parasitology

The course is intended for students pursuing careers in the field of parasitology, such as diagnostic parasitology laboratories and health centers.

The course aims to: 1-provide students with knowledge related to clinical and veterinary parasitology. This includes general classification and characteristics of pathogenic parasites, life cycles of parasites, host parasite relationship, and pathogenic effects on the host. 2-develop awareness of concepts underlying the design of epidemiological studies, control strategies , and to modern trends in parastiology. 3-provides students with applicable knowledge of the tests to identify parasites of medical and veterinary importance and the diseases they cause with emphasis on endemic diseases. 4-develop intellectual and technical skills to use laboratory methods for clinical diagnosis, detection of parasitic infection, and making epidemiological surveys of parasitic diseases.

ZO 4107 Scientific writing and presentations (Zoology)

Students know the fundamentals of scientific essay writing. An essay should be organized into a number of distinct sections. These are: a title, an introduction, a main section or results, Summary & Conclusions, and a List of references. References should be arranged in alphabetical order (according to the name of the first author). A research or scientific paper has many things in common with an essay but its outline is slightly different with Materials and Methods section with Discussion section.

ZO 4109 Molecular Parasitology

It is primarily aimed at students interested in pursuing a research career, who do not have sufficient molecular or parasitological laboratory experience and wish to improve their knowledge of modern molecular, biochemical, cell biological and genetic techniques for parasitological research. The course aims to:1- provide students with principle, practice and informative knowledge concerning molecular parasitology which encompasses the biochemistry, genetics, cell biology and molecular biology of parasites and their human and animal hosts. Students will study basic principles and concepts in the field of molecular parasitology.2- develop awareness of research skills, such as experimental design, laboratory safety, IT skills, literature searching, research ethics, scientific writing, basic statistics and presentation skills. 3-develop intellectual and practical skills for professional competence in key techniques such as diagnostic methods, vaccine development, and drug design.

ZO 4115 Ecological Pollution

Introduction to pollution, particles, gases, ozone, layer heavy metals, oil, radiations, noise and food pollution, pollutant side effects on animals, relationship between pollutant and ecological factors, method of pollution control. Methods for measurement of water air and soil pollutants. Determining the internationally accepted pollution percentages, some methods adopted for measurement of pollutants in Egypt. Environmental flow and fate of contaminants. Ecological risk assessment.

ZO 4111 Biodiversity and conservation

This course is designed to study biodiversity, its values, and factors leading to biodiversity losses; Habitat loss; Overuse of resources; Invasive species; Habitat pollution; Global climate change; Extinctions and habitat fragmentation; Protected Areas; Captive breeding; Reintroduction and rewilding; Human population growth; Nature protection in Egypt; Ecotourism. Conservation Biology aims to 1-explain the importance and origins of biodiversity and reasons for its current loss.2-provide an up-to-date and critical account of how biological knowledge can be applied to help conserve biodiversity.3- explore how biological principles can be integrated with economic, political and social concerns to achieve conservation goals.4-help students appreciate that the successful solution of practical conservation problems usually involves a multi-faceted approach.

ZO 4107 Writing Skills and presentation

The main objective of the course is to introduce students for writing Scientific Papers; Organization of Scientific Papers: Abstract, Introduction, Materials and Methods, Results, Discussion, Literature Cited, Tables and Illustrations; principal of grammar, style and reader expectations applied to biological writing; Guidelines for Oral Presentations; Guidelines for Poster Presentations; Help with the language .

ZO 4113 Histopathology

The aims of the histopathological course is to 1- study microscopic structural abnormalities in the tissue under the affect of different stimuli.2- familiarize students with the basic diseases patterns and their underlying mechanisms within the specific organ system.3- identify and understand different disease processes encountered , their causes (etiology), and how the disease develops in response to the etiologic agents (pathogenesis).4- describe or fully describe and discuss characteristic gross and microscopic lesions within specific organ system and the associated functional disturbances.5-

correlate between histological structure and function of any organ or tissue in normal and abnormal cases.

ZO 4202 Comparative Anatomy of Vertebrates

Comparative anatomy is the study of structural patterns and the influence of evolutionary design. This course presents functional and comparative morphology within a developmental and evolutionary framework. A goal of the course is to provide the students with the tools to access the scientific literature and to integrate current research by updating systematic relationships and taxonomy. Among these are phylogenetic relationships for the majority of groups covered in the course, character transformations presented phylogenetically and the position of developmental genetics in understanding evolution. The course discusses the following systems; integumentary system, skeletal system, circulatory system, nervous system, urinogenital system, and digestive system.

ZO 4204 Physiology 3

The aim of this course is to provide an introduction to the comparative structure and physiology of the nervous, muscular, endocrine and neuro-endocrine systems of invertebrates and vertebrates. This module examines the anatomy and functioning of the various divisions of the nervous system, the muscles and the senses, and traces its relationship to the endocrine system through neuro-secretory cells. Several important invertebrate endocrine systems are studied, including how hormones control growth and metabolism.

ZO 4206 Aquatic Biology

The primary objective of aquatic biology course is to introduce students to the biology of local aquatic life in marine, freshwater and brackish-water habitats. Egypt has a great variety of aquatic ecosystems: marine (Red Sea, Mediterranean Sea), fresh water (River Nile, lakes, ponds) and brackish –water where River Nile meets the Mediterranean Sea. This module will introduce the students to the several aquatic biomes which are unique to Egyptian waters and are ecologically and economically important. These include benthic and pelagic systems, coral reefs, mangroves, biofouling and boring organisms. The students will be able to understand how freshwater ecosystems function including the physical, chemical, and biological components of lentic and lotic systems. Aquatic biology course is

designed to provide experience for students wishing to practice careers in aquatic, environmental, and ecological fields.

ZO 4208 Essay or Research Project (Zoology)

A research project on a given zoological topic shall be carried out by those who specialize in Zoology. The candidate is expected to write the Research Proposal, carry out the necessary Literature Survey and, after the completion of the project, make an oral presentation of the results prior to submission of the written report. Marks will be allocated for both the oral presentation and the written report.

ZO 4210 Biological assays

This course will provide students with the principle of assays of various biological molecules and metabolites from the diagnostic point of view. It will also help students practice diagnostic assays of these metabolites in the body fluids and provide critical report and interpretation of the data and results.

ZO 4212 Toxicology

This module will provide students with various definitions of toxicological terms and concepts. It also will help them to understand the principle of detoxification of various foreign molecules and the role undertaken by the liver in drug metabolism. The impact of environmental hazards on the animal and human life will also consider.

ZO 4214 Molecular Systematics

This course will enable students to 1- provide an understanding of how processes internal to the genome affect its evolution. 2- show how information contained in genome structure and gene sequences can be used to infer phylogenetic relationships and patterns of character evolution. 3- explore how the mechanisms of individual development have been molded, through evolution, to generate the diversity of form in the animal kingdom. The course includes 1- techniques and applications. 2- theoretical background. 3- characteristics and assumptions of molecular systematic. 4- history of molecular phylogeny

ZO 4216 Human Biology

This course is designed to give a complete idea on the structure and the function of the different organs and systems of the human body. The structure and the development of the skeletal system as well as the muscular system will be discussed. The bone and muscle injuries

will be explained. The circulatory system and its role in energy production and how it is affected by smoking and drug addiction will be explained. Nervous system and the endocrine system and their role in controlling the body functions will be studied in details. The digestive system will be studied to show the structure and function of its different parts in both health and sickness. Both the urinary system and the reproductive system will be studied and the common diseases of these systems will be explained. The relationship between humans and their environment and how this affects our well-being will be studied.

Chemistry / Zoology

General Degree (Double)

ZO1101 General Zoology (1)

This course will enable students to gain knowledge and understanding to zoological principles relating to cells, organ systems, genetics, development, physiology and environmental relations. Laboratory exercises illustrating animal structure, physiology, Embryology, and ecology.

EN 1101 Introduction to Entomology (1)

This course will enable students to acquire knowledge and critical understanding of the intimacy between insect and environment .The components of insect success-insect adaptations and their role in the success of insect and gain knowledge of classification of insects.

ZO1202 General Zoology (2)

The module of General Zoology provides an introduction to Animal diversity that considers the heart of zoology sciences. The course will enable students to gain knowledge and understanding about the concept of biodiversity and hierarchical classification system (taxonomy). The aim of this module is to provide a systematic survey of animal-like Protists (Protozoa) with invertebrate and vertebrate animals with an emphasis on Egyptian examples. The course includes practical experience in the identification of representative organisms with systematic position of different species, using slides, specimens and dissections.

EN 1204 Introduction to Entomology (2)

This course will enable students to acquire knowledge and critical understanding of the general physiological principles and the functional mechanisms of life processes in insect body and how they apply to the integrated functions of organ systems.

ZO 2101 Cell Biology & Genetics

This course is designed to give an introduction to the animal cell structure and function. This will include the chemical components of the cell, the structure and function of the cell organelles and their role in the development and differentiation of the cell. This course is also designed to teach students the mechanisms of hereditary transmission and variation of organismal characteristics. The various basic concepts which have been established in genetics

will be discussed. Gene regulation and developmental patterns, as well as irregularities, both will be studied structurally and functionally. Students will also have some knowledge of the recent progress made through biochemical and microbial studies. Principles of Genetic Engineering will also be discussed to enhance students' ability to think scientifically and solve problems in Biology.

ZO 2123 Invertebrate systematics and Phylogeny

The course will be primarily designed to provide the student with the principals of systematics and Phylogeny of invertebrates with new approaches and modern trends in studying fundamentals of systematics. The course is concerned with systematics and Phylogeny of Lower invertebrates (Protozoa, Porifera, Cnidaria, and Helminthes). Special consideration will be given to characters, classification; morphology, functional anatomy and biology of different kinds of these invertebrates. Many representative animal types from different phyla of these Lower Nonchordata are studied.

ZO 2240 Chordates

This course will enable students to gain knowledge and an appreciation of the major groups of vertebrates with emphasis on (i) the basic features of chordate (vertebrate) design, (ii) diversity of body form and function, (iii) inter-relationships.

ZO 2242 Invertebrate Biology

This is a basic invertebrate zoology course that will teach the students the biology of higher invertebrates (Annelida, Mollusca, Arthropds, and Echinodermata). The course will provide an understanding of the taxonomy, phylogeny and basic biology of these invertebrates which the students will experience directly on the field course. It will stress the evolutionary relationships between different phyla. Lectures concentrate on functional morphology, identification, classification, anatomy, ecology, behavior and evolutionary relationships of these Higher Nonchordates.

ZO 2244 Entomology

This course will enable students to acquire knowledge and critical understanding of the principles of internal and external morphology of insects; insect development and compare between different insects in different orders. Also enable them to collect and store insects in the laboratory, and mounting insects for permanent display. Also the principles of internal and external anatomy: integument; digestive system; tracheal system; circulatory system;

excretory system; reproductive system; nervous system and sense organs; and to develop understanding of the underlying principles of chemical communication.

ZO 3141 Embryology & Experimental Embryology

The lecture course is a comparative study of vertebrate embryology with emphasis on the fundamental developmental processes shared by vertebrate embryos. Topics include gametogenesis, fertilization, and development of Amphioxus, Amphibia, Chick and Human embryos from zygote through the differentiation of the neural tube. Besides the development of selected organ systems including the nervous system, sense organs, and the cardiovascular, digestive, respiratory, and urinogenital systems. The course includes all the principals of the embryonic stem cells; the differentiation potential of stem cells, basic concepts and definitions, sources of adult stem cells, defining properties of an embryonic stem cell, adult stem cell, Stem cells and repairing a damaged heart, mouse embryonic stem cell cultures.

ZO 3143 Invertebrates of Egypt

This advanced invertebrate zoology course will face the need of student to gain knowledge and skills about Egyptian invertebrate fauna and up-to date account. It will deal with the taxonomical characters, classification, checklist and taxonomic keys of invertebrate animals (Major & Minor Phyla) with special emphasis on representative types of Egyptian fauna. Diagnostic characters associated with taxonomic categories to the class or order level for most of the invertebrate phyla are studied. The course provides practical experience in methods of collecting, preserving, and identifying local invertebrates through laboratory and field course studies.

ZO 3145 Functional Histology

This course enables students to be familiar with the histology of all organ systems of the body (e.g. Digestive, Endocrine, Respiratory, Urinary and Circulatory systems) and to acquire basic understanding of at the practical level of the histology of the normal organs under the microscope and differentiate between them and to correlate between the histological structure and functions of various tissues and organs, in addition to the detailed structures of each organ (its layers, tissue components, cells, glands, modification of the organ.

ZO 3202 Parasitology

The course is intended for students interested in pursuing a professional career in the fields of parasitology, biodiversity and

human health. The course aims to: 1- provides students with principles, practices and informative knowledge concerning parasitism and the diversity of helminth parasites. This will be achieved through the study of the structure, life cycle, development, host parasite relationship, and helminth potential to cause disease and economic losses. 2- develop awareness of concepts underlying design of epidemiological studies, control strategies, and modern trends in parasitology 3- develop intellectual and practical skills to develop professional competence in the fields related to parasitology.

ZO 3242 Physiology 1

The course will focus on the aspects of metabolism and physiology of digestion and nutrition, draw on examples from the phyla studied in Level 2 and with an emphasis on Egyptian fauna. The course will focus on organ-system physiology; however, cellular and molecular mechanisms will be discussed in order to present a current view of physiological principles. It also familiarizes students with some of the laboratory techniques and equipment used in the acquisition of physiological data and in development of their investigative skills and scientific careers.

ZO 3244 Animal Ecology & Behavior

This course focuses on the ecology of individuals, populations and communities. It examines demography and population growth, competitive and predatory interactions between populations, the structure of communities and the role of competitors, natural enemies and disturbances in organizing communities. The study of the mechanisms and evolution of animal behavior. Topics include methods for the observation and quantification of behavior, natural selection and evolution of behavior, behavior genetics, neural and physiological mechanisms of behavior, communication, aggression, sexual reproduction, parental investment, and mating systems.

ZO 4141 Histochemistry

Prepare the microscopic sections (how slides are made) and provide students with a basic understanding of the equipments for preparation and staining of histological sections by routine stain (H&E). Know the different histochemical techniques, and learn to distinguish between normal and pathogenic state of tissue and diagnostic the abnormality of the different chemical components and functional enzymes within tissues.

ZO 4143 Physiology 2

In this course, emphases will focus on the aspects of physiology of circulation and defensive mechanisms, osmoregulation and

behavior, draw on examples from the phyla studied in Level 2 and with an emphasis on Egyptian fauna. It also familiarizes students with some of the laboratory techniques and equipment used in the acquisition of physiological data and in development of their investigative skills.

ST 4107: Biostatistics

This course is designed to introduce the student to data analytic and applied statistical methods commonly used in industrial and scientific applications. The module will focus on computer-aided data analysis using comparisons between batches, analysis of variance, regression and correlation. The module will also deal with estimation and hypothesis testing, multivariate analysis, and nonparametric techniques. Approximations and errors (accuracy and precision; errors; blunders, formulation error, and data uncertainty).

ZO 4147 Epidemiology & Clinical Parasitology

The course is intended for students pursuing careers in the field of parasitology, such as diagnostic parasitology laboratories and health centers.

The course aims to: 1-provide students with knowledge related to clinical and veterinary parasitology. This includes general classification and characteristics of pathogenic parasites, life cycles of parasites, host parasite relationship, and pathogenic effects on the host. 2-develop awareness of concepts underlying the design of epidemiological studies, control strategies, and to modern trends in parasitology. 3-provides students with applicable knowledge of the tests to identify parasites of medical and veterinary importance and the diseases they cause with emphasis on endemic diseases. 4-develop intellectual and technical skills to use laboratory methods for clinical diagnosis, detection of parasitic infection, and making epidemiological surveys of parasitic diseases.

ZO 4149 Field trips

This course will enable students to 1-survey systematics of local marine fauna, with familiarization of the marine environment. Laboratory emphasizes field work and independent projects. 2- Recognize main invertebrate groups. 3- Mention the adaptation of invertebrate at different existence environments.

ZO 4151 Biodiversity and conservation

This course is designed to study biodiversity, its values, and factors leading to biodiversity losses; Habitat loss; Overuse of resources; Invasive species; Habitat pollution; Global climate change; Extinctions and habitat fragmentation; Protected Areas; Captive

breeding; Reintroduction and rewilding; Human population growth; Nature protection in Egypt; Ecotourism. Conservation Biology aims to 1- explain the importance and origins of biodiversity and reasons for its current loss.2- provide an up-to-date and critical account of how biological knowledge can be applied to help conserve biodiversity.3- explore how biological principles can be integrated with economic, political and social concerns to achieve conservation goals.4-help students appreciate that the successful solution of practical conservation problems usually involves a multi-faceted approach.

ZO 4153 Animal techniques

This course will enable students to gain knowledge about the theory and practice of important laboratory techniques used in cell biology research. Studies techniques such as microscopy, electrophoresis, spectrophotometry, chromatography, immunological methods, tissue and cell culture.

ZO 4155 Ecological Pollution

introduction to pollution, particles, gases, ozone, layer heavy metals, oil, radiations, noise and food pollution, pollutant side effects on animals, relationship between pollutant and ecological factors, method of pollution control. Methods for measurement of water air and soil pollutants. Determining the internationally accepted pollution percentages, some methods adopted for measurement of pollutants in Egypt. Environmental flow and fate of contaminants. Ecological risk assessment.

ZO 4157 Fauna of Egypt

The Egyptian fauna is very diverse in view of the large number of habitat types. This course includes the study of the most common species, especially vertebrates fish, amphibians, reptiles, birds and mammals in Egypt. The course reviews different types of animal behavior with examples to understand how they respond and behave in their live.

ZO 4240 Comparative Anatomy of Vertebrates

Comparative anatomy is the study of structural patterns and the influence of evolutionary design. This course presents functional and comparative morphology within a developmental and evolutionary framework. A goal of the course is to provide the students with the tools to access the scientific literature and to integrate current research by updating systematic relationships and

taxonomy. Among these are phylogenetic relationships for the majority of groups covered in the course, character transformations presented phylogenetically and the position of developmental genetics in understanding evolution. The course discusses the following systems; integumentary system, skeletal system, circulatory system, nervous system, urinogenital system, and digestive system.

ZO 4242 Physiology 3

The aim of this course is to provide an introduction to the comparative structure and physiology of the nervous, muscular, endocrine and neuro-endocrine systems of invertebrates and vertebrates. This module examines the anatomy and functioning of the various divisions of the nervous system, the muscles and the senses, and traces its relationship to the endocrine system through neuro-secretory cells. Several important invertebrate endocrine systems are studied, including how hormones control growth and metabolism.

ZO 4244 Essay & Research (Zoology)

Students know the fundamentals of scientific essay writing. An essay should be organized into a number of distinct sections. These are: a title, an introduction, a main section or results, Summary & Conclusions, and a List of references. References should be arranged in alphabetical order (according to the name of the first author). A research or scientific paper has many things in common with an essay but its outline is slightly different with Materials and Methods section with Discussion section. A research project on a given zoological topic shall be carried out by those who specialize in Zoology. The candidate is expected to write the Research Proposal, carry out the necessary Literature Survey and, after the completion of the project, make an oral presentation of the results prior to submission of the written report. Marks will be allocated for both the oral presentation and the written report.

ZO 4246 Biological assays

This course will provide students with the principle of assays of various biological molecules and metabolites from the diagnostic point of view. It will also help students practice diagnostic assays of these metabolites in the body fluids and provide critical report and interpretation of the data and results.

ZO 4248 Toxicology

This module will provide students with various definitions of toxicological terms and concepts. It also will help them to understand the principle of detoxification of various foreign molecules and the role undertaken by the liver in drug metabolism. The impact of environmental hazards on the animal and human life will also consider.

ZO 4250 Animal biotechnology

This is a Module that considers the exploitation of microorganisms and microbial processes in the context of modern developments in biotechnology. Economic and ethical aspects of the development of novel products and the potential environmental benefits of using biotechnological processes will be examined. Process aspects of scale-up and volume production will be covered in addition to methods for increasing yield. Specific aspects to be examined will be antibiotic production, microbes as hosts for production of mammalian gene products, plant biomass conversion, microbial informatics, biocatalysts and biosensors. Students will gain understanding of: The economics, ethics and regulation of modern biotechnological processes. The impact of recombinant DNA technology on the biotechnology industry. Modern approaches to strain improvement and genetic manipulation. The microbial technology of the production of alternative fuels and feedstuffs Biosensors and their commercial application.

ZO 4252 Histopathology

The aims of the histopathological course is to 1- study microscopic structural abnormalities in the tissue under the affect of different stimuli.2- familiarize students with the basic diseases patterns and their underlying mechanisms within the specific organ system.3- identify and understand different disease processes encountered , their causes (etiology), and how the disease develops in response to the etiologic agents (pathogenesis).4- describe or fully describe and discuss characteristic gross and microscopic lesions within specific organ system and the associated functional disturbances.5- correlate between histological structure and function of any organ or tissue in normal and abnormal cases.

ZO 4254 Aquatic Biology

The primary objective of aquatic biology course is to introduce students to the biology of local aquatic life in marine, freshwater

and brackish-water habitats. Egypt has a great variety of aquatic ecosystems: marine (Red Sea, Mediterranean Sea), fresh water (River Nile, lakes, ponds) and brackish –water where River Nile meets the Mediterranean Sea. This module will introduce the students to the several aquatic biomes which are unique to Egyptian waters and are ecologically and economically important. These include benthic and pelagic systems, coral reefs, mangroves, biofouling and boring organisms. The students will be able to understand how freshwater ecosystems function including the physical, chemical, and biological components of lentic and lotic systems. Aquatic biology course is designed to provide experience for students wishing to practice careers in aquatic, environmental, and ecological fields.

ZO 4256 Immunology

The aim of this course is to provide an understanding of the key immunological principles and terminology and to perform and interpret basic serological and leucocyte tests. As well as to elucidate the molecular, cellular and organic components of the immune system; the nature and causes of its malfunctions; and the scope for intervention and exploitation.

ZO 4258 Biological Associations

The course aims to: 1-Provide students with informative knowledge concerning the types of relations that exist between different types of living organisms.2- interpret interactions among organisms exhibiting predation, parasitism, symbiosis, commensalism, and mutualism 3-Provide students with informative knowledge to differentiate between the beneficial and harmful living organisms and their impact on human and animal health and welfare.4-Develop intellectual and practical skills for the use of parasitic microorganisms as biological control agents, with special references to the insect vectors.

ZO 4260 Fish Biology and Fisheries

This course is designed to deal with several topics in Fish Biology and Fisheries. This will include fish anatomy, fish taxonomy and fish culture as well as the early life history of fish. Age and rate of growth and the relationship between the weight and the length of different species of fish will be studied. Special attention will be given to the food bases for different types of fish in different waters. Students will be made aware of the limnological factors of the Egyptian waters. Both the physical and the chemical data will be studied. Commercial fishing data such as stock assessment,

population dynamics and fish processing of different fish types will be dealt with. An introduction to the gear technology and the effectiveness of the different fishing methods in different kinds of water will be discussed. Students after completing this course and other related courses should be able to work in organizations dealing with fishing and to be capable of carrying out any task related to fishery biology.



قسم علم الحيوان (علم الحشرات)

ZO1101 General Zoology (1)

This course will enable students to gain knowledge and understanding to zoological principles relating to cells, organ systems, genetics, development, physiology and environmental relations. Laboratory exercises illustrating animal structure, physiology, Embryology, and ecology.

EN 1101 Introduction to Entomology (1)

This course will enable students to acquire knowledge and critical understanding of the intimacy between insect and environment .The components of insect success-insect adaptations and their role in the success of insect and gain knowledge of classification of insects.

ZO1202 General Zoology (2)

The module of General Zoology provides an introduction to Animal diversity that considers the heart of zoology sciences. The course will enable students to gain knowledge and understanding about the concept of biodiversity and hierarchical classification system (taxonomy). The aim of this module is to provide a systematic survey of animal-like Protists (Protozoa) with invertebrate and vertebrate animals with an emphasis on Egyptian examples. The course includes practical experience in the identification of representative organisms with systematic position of different species, using slides, specimens and dissections.

EN 1204 Introduction to Entomology (2)

This course will enable students to acquire knowledge and critical understanding of the general physiological principles and the functional mechanisms of life processes in insect body and how they apply to the integrated functions of organ systems.

EN 2101 Insect Morphology

This course will enable students to acquire knowledge and critical understanding of the principles of internal and external morphology of insects; insect development and compare between different insects in different orders. Also enable them to collect

and store insects in the laboratory, and mounting insects for permanent display.

EN 2103 Insect Anatomy and histology

This course will enable students to acquire knowledge and critical understanding of the principles of internal and external anatomy of insects: integument; digestive system; tracheal system; circulatory system; excretory system; reproductive system; nervous system and sense organs; and to develop understanding of the underlying principles of chemical communication.

EN 2105 Economic Entomology

This course will enable students to acquire knowledge and critical understanding of insect that have economic values, distinct facets, types of beneficial insects to human economy as (silk industry, honey bee keeping; insect as polarizer's, entomophagous insects in biological control and insect in medicine and insect in scientific researches. On other hand this course aims to cover the insects that considered as Agriculture pests, termites, stored food pests, fabric pests and domestic animals insects that annoy and injure man.

EN 2107 Population and Community Ecology

EN 2109 Insect Interrelations

This module aims to enable students to acquire essential knowledge about the inter-relationships between insect species, role of insects as vectors of human, animal, or plant, host-pest relationships and to develop understanding methods of detecting and controlling insect pests. as well as acquire knowledge about beneficial and destructive insects and insect diseases.

EN 2111 Insect and society

The course emphasizes the impact of insects on society. Influence of arthropods on beliefs, culture and fears and view insects in folklore and mythology from the ancient times to present. Focus on the use of insects as model systems in biological research. Explore the use of insects in teaching, music art, literature and cinema.

EN 2113 Behavioral ecology and life histories

The course uses an evolutionary approach to examine behavior and life histories. Topics addressed include the optimality approach, constraints on optimality, kin and group selection, predator and prey behavior, social and mating behaviors and life history evolution.

EN 2202 Insect Taxonomy

This module aims to enable students to acquire knowledge and critical understanding of the principles of classification of insects, show how to identify all insect orders, families and genera.

EN 2204 Insect evolution

Examines major events of insect evolution including origins, fossils, wings and flight, metamorphosis, extinct orders, diversification patterns of modern orders, climate change, plate tectonics, coevolution with plants, parasitism, social behavior and origin of modern faunas.

EN 2206 Taxonomy of immature insects

This course aims to study the taxonomy of Exopterygota and Endopterygota immature insects. Study morphological features unique to each of the major orders, identification of immature insects to the order and to family insight and the biology of immature insects.

EN 2208 Insect population genetics

This survey course examines the population dynamic and equilibrium of genes in nuclei and mitochondria. Emphasis will be given on biological relevance in insects.

EN 2210 Aquatic Entomology

This course will enable students to acquire knowledge and critical understanding of biology of insects in aquatic environments, including systematic, morphology, and ecology. Field trips emphasize relations between species and habitat and the role of insects in aquatic management programs.

EN 2212 Fresh water biomonitoring

This course teaches students how micro invertebrates are used to monitor the environmental health of fresh water ecosystem.

EN 2214 Genetics

This course will enable students to acquire knowledge and critical understanding cell culture, characteristics and cell division in insects; chromosomes structure, number, diversity and types in insects; chromosomes and parthenogenesis in insects; modern concept of gene; gene-determined characters; environmental effect on gene expression; sex determination in insects; mutations and variations.

EN 2216 Insect molecular genetics

Introduction to molecular biology. Techniques used in molecular biology DNA and RNA analysis in insect –transcription and translation mechanisms .DNA recombinant technology .Identification of genes/nucleotide sequences for characters of insects. Genes that interest in entomological research-marker genes for sex identification and neuropeptides.

EN 3101 Medical Entomology

This course will enable students to acquire knowledge and critical understanding of life history, classification, habits, and control of insects and other arthropods affecting human health. Topics include public health significance, vector-parasite interactions, and survey and research methodologies.

EN 3103 Live stock Entomology

This course is concerned with classification, biology and behavior of insects and other arthropods associated with livestock and poultry, economic importance and management of livestock insects and other arthropods.

EN 3105 Forensic Entomology

This course will enable students to acquire knowledge about the relation between crime and some insects (flies). Entomological evidence must be properly recognized, collected, and preserved if such evidence is to be used in evaluations of death cases .Depending on what species are present (or not) and their stage of development, criminalists can make accurate estimates of the post-mortem interval. They can do this because of the flies' dependence on temperature.

EN 3107 Protozoology and molecular Biology of Protozoa

This course includes analysis of cellular systems, molecules, and organelles of pathogenic protozoan parasites. Emphasis is placed on processes and systems that are unique to protozoa are important to understanding vector-parasite-host biology/ecology, or are targets of disease prevention/treatment programs.

EN 3109 Application of Biotechnology in Arthropod and pathogen control.

Introduction to underlying technology, products being developed, their effectiveness and associated problems of concerns resulting from their use.

EN 3111 Special research problems in Entomology

Advanced independent research projects supervised by members of

the research and unrelated to thesis research. Projects developed to meet individual needs.

EN 3113 Cell Biology

This course deals with the biology of cells of insects. The structure, function, and biosynthesis of cellular membranes and organelles, cell growth and oncogenic transformation, transport, receptors, and cell signaling; the cytoskeleton, the extracellular matrix, and cell membranes; chromatin structure and RNA synthesis.

EN 3202 Insect Pathology

The course is intended to acquaint the students with the principles of pathogens that infect insects including viruses, bacteria, fungi, protozoa, nematodes, etc. Studies of epizootiology, naturally occurring insect diseases, physiopathology, and symptomology. Demonstrate skills in the collection of infected insects, pathogens isolation, and mass production of these pathogens in the laboratory. Develop an advanced level of understanding of how to use these pathogens as microbial agents in controlling of insect pests

EN 3204 Biological control

This course will enable students to acquire knowledge and critical understanding the natural regulation of pest abundance. Theoretical issues and practical experience in the use of biological controls for managing insect.

EN 3206 Insect Behavior

The course explores the diverse behaviour of insects ranging from individual sensory and physiological mechanisms that are the basis of insect behavior, to behavioral dynamics of foraging, courtship, parental care.

- Topics including insect learning, perceptual abilities, host finding strategies, predation, parasitoid host finding and communication systems

- Emphasis on patterns highly developed or uniquely expressed in insects such as social behaviour of social wasps, ants, bees and termites were also explore

EN 3208 Chemical Ecology

This course will enable students to acquire knowledge and critical understanding of major chemical groups of natural products.- herbivory and the chemical defenses of plants. Chemical interactions among plants.-Chemical attack and defense in insects and human use of chemicals in the environment.

ST3202: Biostatistics

This course is designed to introduce the student to data analytic and applied statistical methods commonly used in industrial and scientific applications. The module will focus on computer-aided data analysis using comparisons between batches, analysis of variance, regression and correlation. The module will also deal with estimation and hypothesis testing, multivariate analysis, and nonparametric techniques. Approximations and errors (accuracy and precision; errors; blunders, formulation error, and data uncertainty).

EN 3210 Phylogenetic systematic

Introduction; evolutionary groups of insects ;geological time table in relation to origin ;evolutionary history of insects; theories of origin of insects ,mechanisms of evolution ;cytological, cytotaxonomic and embryological evidences; phylogenetic theories; origin of species and higher categories, phylogenetic arrangement of orders and families; variation; fossil history of insects.

EN 3212 Biometry and Experimental design in Entomology

Study the theory and applications of statistics, mathematics and computing to Entomological problems. The course focuses on entomological data organization and manipulation. Applications of sample means. Means comparison. Least significant difference Chi square and other similar tests. Analysis of variance (ANOVA- One and N-way). Duncan's test. The practical meaning of ANOVA- Results presentation and interpretation. The meaning of Simple and Multiple Regression and Correlation. Electronic data files organization-data, processing-data analysis by the use of various statistical packages. Practical applications principles of experimental design, experimental accuracy, assumptions underlying the analysis of variance. Field experimental planning and implementation, data processing and interpretation. Experimental design (RCP, Factorial, split-plot, split-block, incomplete block designs, lattices. Multiple comparisons (LSD, Duncan, Orthogonal, least squares, trends) combined analysis of trials. Genotype environment interactions- stability analysis-covariance analysis. Computer applications on experimental design and management.

EN 4101 Insect Physiology

Introduction to the often unique ways in which insects have met their

basic needs. Examines each organ system with emphasis on basic principles and specific examples. Also introduces students to some common methods used in physiological research and to the critical reading of scientific literature.

EN 4103 Insect Hormones

This course will enable students to acquire knowledge of insect hormones and its role in molting, metamorphosis and vitellogenesis. Understanding the types of hormones in insects.

EN 4105 Insect pheromones

This module aims to enable students to acquire knowledge and critical understanding of insect pheromones, the role of pheromones in insect behavior.

EN 4107 Molecular Entomology

This course will enable students to acquire knowledge and critical understanding of plasmids, replication mechanism, nucleic acids. -DNA synthesis and replication, damage and repair, synthesis of proteins.

EN 4109 Insect Biochemistry

This course will enable students to cover the classification, nomenclature of enzymes, vitamins and the biochemical pathways involving coenzymes.

- Develop understanding of the processes of digestion and metabolism of carbohydrates.
- Give a description of digestion of proteins and metabolism of amino acids.
- Acquire knowledge of the digestion of lipids, metabolism of lipids and metabolism of nucleotides.

EN 4111 Insect transmission of plant diseases

This course will enable students to acquire knowledge and critical understanding of insect-plant relationship, what is the pest history and basic principles of pest control. Also understanding the relation of insects to spread and development of plant diseases, the classification of the phenomenon of insect transmission of diseases.

EN 4113 Entomology Seminar

EN 4115 Apiculture

This course will enable students to acquire knowledge and critical understanding how to start and care for a honey bee colony. Learn basic bee biology, behavior, and techniques for managing honey bees. Examine colonies, install package bees, and see how honey and beeswax are prepared for market. This course is designed to give students the skills and experience necessary to successfully start and care for a honey bee colony.

EN 4202 Integrated Pest Management

This course will enable students to acquire knowledge and critical understanding the past and present pest-control strategies in light of insect ecology. Development of pest-management systems emphasizing biological control, resistant plants, and ecosystem redesign.

EN 4204 Insecticide and Toxicology

This course will provide an over view of insecticide classification, mode of action, genetic basis of resistance, metabolism, environmental fate, formulation, and pesticide laws and regulations. Insecticide toxicity with emphasis on chemistry, toxicity, carcinogenesis, methods of toxicity testing, probability analysis, analytical methods of detecting pesticide residues, biological and environmental factors affecting toxicity of insecticides and economic aspects of insecticide use.

EN 4206 Nology insect biotech

Role of biotechnology in pest management biological control and biotechnology. Genetic improvement of natural enemies. Mass production techniques-in vitro production of entomopathogens in cell lines. Genetic engineering with baculo-viruses. *Bacillus thuriengensis* and entomopathogenic fungi. Recombinant DNA technology and pest control-cloning of *B. t.* into other organisms. Transgenic plants for pest resistance. *B. t.* toxin genes. Trypsin inhibitor and other genes, peptides and neuropeptides in pest management. Resistant management strategies in transgenic crops.

EN 4208 Special research topics in Entomology

EN 4210 Insecticide resistance

This course is designed to introduce the student to develop recognition and understanding of the major pest and environmental management problems worldwide; develop understanding of how such problems can be

managed by integrated management measures with minimal environmental impact. Show how pest and environmental management is directed to economic and social objectives and how ecological understanding can be used to meet these objectives.

EN 4212 Biological control of weeds

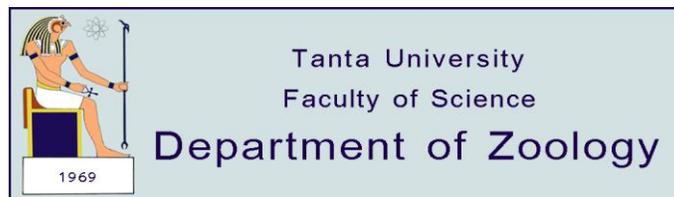
This course will enable students to acquire knowledge and critical understanding the natural regulation of pest abundance. Theoretical issues and practical experience in the use of biological controls for managing insect and weed problems.

EN 4214 Ecological based pest management strategies

Basic tenets of integrated pest management emphasizing ecological principles; integration of chemicals, biological, cultural and physical tactics into an over all strategy for the agroecosystem; chemical pesticides, cultural practices, host resistance, biological control, sterility principle, economics of pest control and pest/host relationships.

EN 4216 Pesticide in the Environment

Study of how natural and synthetic insecticides mediate interactions between organisms and their biotic and abiotic environment. Biochemical and physiological mechanisms of synthetic insecticides, production and defense mechanisms of natural toxicants, effects on populations, communities and ecosystems, evolutionary ecotoxicology, and socio-economic impact (human resources and sustainable agriculture).



Chemistry / Entomology

General Degree

ZO1101 General Zoology (1)

This course will enable students to gain knowledge and understanding to zoological principles relating to cells, organ systems, genetics, development, physiology and environmental relations. Laboratory exercises illustrating animal structure, physiology, Embryology, and ecology.

EN 1101 Introduction to Entomology (1)

This course will enable students to acquire knowledge and critical understanding of the intimacy between insect and environment .The components of insect success-insect adaptations and their role in the success of insect and gain knowledge of classification of insects.

ZO1202 General Zoology (2)

The module of General Zoology provides an introduction to Animal diversity that considers the heart of zoology sciences. The course will enable students to gain knowledge and understanding about the concept of biodiversity and hierarchical

classification system (taxonomy). The aim of this module is to provide a systematic survey of animal-like Protists (Protozoa) with invertebrate and vertebrate animals with an emphasis on Egyptian examples. The course includes practical experience in the identification of representative organisms with systematic position of different species, using slides, specimens and dissections.

EN 1204 Introduction to Entomology (2)

This course will enable students to acquire knowledge and critical understanding of the general physiological principles and the functional mechanisms of life processes in insect body and how they apply to the integrated functions of organ systems.

EN2121 Insect morphology and Anatomy

This course will enable students to acquire knowledge and critical understanding of the principles of internal and external morphology of insects; insect development and compare between different insects in different orders. Also enable them to collect and store insects in the laboratory, and mounting insects for permanent display. Also, understanding of the principles of internal and external anatomy of insects: integument; digestive system; tracheal system; circulatory system; excretory system; reproductive system; nervous system and sense organs.

EN2123 Economic Entomology

This course will enable students to acquire knowledge and critical understanding of insect that have economic values, distinct facets, types of beneficial insects to human economy as (silk industry, honey bee keeping; insect as polarizer's, entomophagous insects in biological control and insect in medicine and insect in scientific researches. On other hand this course aims to cover the insects that considered as Agriculture pests, termites, stored food pests, fabric pests and domestic animals insects that annoy and injure man.

EN2240 Insect taxonomy

This module aims to enable students to acquire knowledge and critical understanding of the principles of classification of insects ,show how to identify all insects orders, families and genera.

EN2242 Insect interrelations

This module aims to enable students to acquire essential knowledge about the inter-relationships between insect species, role of insects as vectors of human, animal, or plant, host-pest relationships and to develop understanding methods of detecting and controlling insect

pests. as well as acquire knowledge about beneficial and destructive insects and insect diseases.

EN2244 Insect Ecology

The course examines the unique ecological roles of insects and considers aspects of insect biology as they relate to relationships between individuals and populations and their environment. Students will learn key elements in these relationships, with a particular emphasis on current areas of controversy. Also, students will learn techniques used in ecological studies on insects.

EN 3141 Insect Behavior

The course explores the diverse behaviour of insects ranging from individual sensory and physiological mechanisms that are the basis of insect behavior, to behavioral dynamics of foraging, courtship, parental care. Topics including insect learning, perceptual abilities, host finding strategies, predation, parasitoid host finding and communication systems. Emphasis on patterns highly developed or uniquely expressed in insects such as social behaviour of social wasps , ants , bees and termites were also explore.

EN 3143 Insect Pathology

The course is intended to acquaint the students with the principles of pathogens that infect insects including viruses, bacteria, fungi, protozoa , nematodes ,ect.studies of epizootiology , naturally occurring insect diseases ,physiopathology , and symptomology. demonstrate skills in the collection of infected insects, pathogens isolation ,and mass production of these pathogens in the laboratory. Develop an advanced level of understanding of how to use these pathogens as microbial agents in controlling of insect pests

EN 3145 Chemical Ecology

This course will enable students to acquire knowledge and critical understanding of major chemical groups of natural products.- herbivory and the chemical defenses of plants.Chemical interactions among plants.-Chemical attack and defense in insects and human use of chemicals in the environment.

EN 3240 Medical and Veterinary Entomology

This course will enable students to acquire knowledge and critical understanding of life history, classification, habits, and control of insects and other arthropods affecting human and animal health.

Topics include public health significance, vector-parasite interactions, and survey and research methodologies.

EN 3242 Forensic Entomology

This course will enable students to acquire knowledge about the relation between crime and some insects (flies). Entomological evidence must be properly recognized, collected, and preserved if such evidence is to be used in evaluations of death cases. Depending on what species are present (or not) and their stage of development, criminalists can make accurate estimates of the post-mortem interval. They can do this because of the flies' dependence on temperature.

EN 3244 Insect Population Genetics

This survey course examines the population dynamic and equilibrium of genes in nuclei and mitochondria. Emphasis will be given on biological relevance in insects

EN 4141 Insect physiology

Introduction to the often unique ways in which insects have met their basic needs. Examines each organ system with emphasis on basic principles and specific examples. Also introduces students to some common methods used in physiological research and to the critical reading of scientific literature.

EN 4143 Insecticide Toxicology

This course will provide an over view of insecticide classification, mode of action, genetic basis of resistance, metabolism, environmental fate, formulation, and pesticide laws and regulations. Insecticide toxicity with emphasis on chemistry, toxicity, carcinogenesis, methods of toxicity testing, probability analysis, analytical methods of detecting pesticide residues, biological and environmental factors affecting toxicity of insecticides and economic aspects of insecticide use.

MA 4122: Biostatistics

testing, multivariate analysis, and nonparametric This course is designed to introduce the student to data analytic and applied statistical methods commonly used in industrial and scientific applications. The module will focus on computer-aided data analysis using comparisons between batches, analysis of variance, regression and correlation. The module will also deal with estimation and hypothesis techniques. Approximations and errors (accuracy and precision; errors; blunders, formulation error, and data uncertainty).

EN 4147 Cell Biology

This course deals with the biology of cells of insects. The structure, function, and biosynthesis of cellular membranes and organelles, cell growth and oncogenic transformation, transport, receptors, and cell signaling; the cytoskeleton, the extracellular matrix, and cell membranes; chromatin structure and RNA synthesis.

EN 4149 Ecology of fresh water insects

This course will enable students to acquire knowledge and critical understanding of biology of insects in aquatic environments, including systematic, morphology, and ecology. Field trips emphasize relations between species and habitat and the role of insects in aquatic management programs.

EN 4151 Biological monitoring of fresh water ecosystem

This course teaches students how micro invertebrates are used to monitor the environmental health of fresh water ecosystem.

EN 4153 Insect Biogeography and evolution

This course covers insect distribution and covers advanced topics in evolution and evolutionary processes. Phenomena occurring both within populations (selection, inheritance, population subdivisions) and between populations (gene flow, competition). Quantitative genetics measurements of selection, phylogenetic analyses of comparative data and molecular systematic.

EN 4155 Apiculture

This course will enable students to acquire knowledge and critical understanding how to start and care for a honey bee colony. Learn basic bee biology, behavior, and techniques for managing honey bees. Examine colonies, install package bees, and see how honey and beeswax are prepared for market. This course is designed to give students the skills and experience necessary to successfully start and care for a honey bee colony.

EN 4157 Molecular Entomology

This course aims to give introduction to the eukaryotic invertebrate genome .gene structure and expression, genome organization of insects. Also enable students to acquire knowledge and critical understanding chromosome evolution and genetic mapping.-molecular systematic, evolution and genetics of insect populations. Improving virulence of biological control agents of pest insects. This course will enable students to acquire knowledge and critical understanding of plasmids,replication mechanism,nucleic acids.DNA synthesis and replication,damage and repair,synthesis of proteins.

EN 4240 Integrated pest management

This course will enable students to acquire knowledge and critical understanding the past and present pest-control strategies in light of insect ecology. Development of pest-management systems emphasizing biological control, resistant plants, and ecosystem redesign.

EN 4242 Biological control

This course will enable students to acquire knowledge and critical understanding the natural regulation of pest abundance.

EN 4244 Essay and research

EN 4246 Biological control of weeds

This course will enable students to acquire knowledge and critical understanding the natural regulation of pest abundance. Theoretical issues and practical experience in the use of biological controls for managing insect and weed problems.

EN 4248 Transgenic plants in agriculture

EN 4250 Post harvest pests

The biology and management of insect pests of bulk stored grains, flour, seed, dried fruits and nuts, and those of quarantine significance for export of fresh fruits and vegetables within food processing plants, ware houses whole sale and retail distribution systems.

EN 4252 Insect societies

The course provide a broad overview of social insects emphasizing their role and importance in ecosystem, their economic importance, and their role as model systems in the study of important questions in biology.

EN 4254 Insect Biochemistry

This course will enable students to cover the classification, nomenclature of enzymes, vitamins and the biochemical pathways involving coenzymes.

Develop understanding of the processes of digestion and metabolism of carbohydrates.

Give a description of digestion of proteins and metabolism of amino acids. Acquire knowledge of the digestion of lipids, metabolism of lipids and metabolism of nucleotides.

EN 4256 Insect genetics

This course will enable students to acquire knowledge and critical understanding cell culture ,characteristics and cell division in insects; chromosomes structure, number ,diversity and types in insects; chromosomes and parthenogenesis in insects; modern concept of gene; gene-determined characters; environmental effect on gene expression; sex determination in insects; mutations and variations.

EN 4258 Insect transmission of plant diseases

This course will enable students to acquire knowledge and critical understanding of insect-plant relationship, what is the pest history and basic principles of pest control. Also understanding the relation of insects to spread and development of plant diseases, the classification of the phenomenon of insect transmission of diseases.

EN 4260 Invasive insect species

This course will examine circumstances that allow introduced insect species to become invasive species threaten human resources. The course focus on the biology of invasions, and life-history adaptations and dispersal strategies which contribute to their success at both the individual and population levels. Problems caused by invasive species and how invasions are prevented, mitigated and managed. Invasive species impact agriculture, forestry, natural systems and human health. Local, national and international examples of invaders in diverse systems will be included in investigations of invasive insect species.

مقررات قسم علم الحيوان التابعه للبرامج الأخرى

B.Sc. Bio-Physics (Special)

ZO 2101 Cell Biology & Genetics

This course is designed to give an introduction to the animal cell structure and function. This will include the chemical components of the cell, the structure and function of the cell organelles and their role in the development and differentiation of the cell. This course is also designed to teach students the mechanisms of hereditary transmission and variation of organismal characteristics. The various basic concepts which have been established in genetics

will be discussed. Gene regulation and developmental patterns, as well as irregularities, both will be studied structurally and functionally. Students will also have some knowledge of the recent progress made through biochemical and microbial studies. Principles of Genetic Engineering will also be discussed to enhance students' ability to think scientifically and solve problems in Biology.

ZO 2242 Invertebrate Biology

This is a basic invertebrate zoology course that will teach the students the biology of Higher invertebrates (Annelida, Mollusca, Arthropods, Echinodermata). The course will provide an understanding of the taxonomy, phylogeny and basic biology of these invertebrates which the students will experience directly on the field course. It will stress the evolutionary relationships between different phyla. Lectures concentrate on functional morphology, identification, classification, anatomy, ecology, behavior and evolutionary relationships of these Higher Nonchordates.

B.Sc. Biochemistry (Special)

ZO 2101 Cell Biology and Genetics

This course is designed to give an introduction to the animal cell structure and function. This will include the chemical components of the cell, the structure and function of the cell organelles and their role in the development and differentiation of the cell.

This course is designed to teach students the mechanisms of hereditary transmission and variation of organismal characteristics. The various basic concepts which have been established in genetics will be discussed. Gene regulation and developmental patterns, as well as irregularities, both will be studied structurally and functionally. Students will also have some knowledge of the recent progress made through biochemical and microbial studies. Principles of Genetic Engineering will also be discussed to enhance students' ability to think scientifically and solve problems in Biology.

B.Sc. Chemistry / Biochemistry (Special)

ZO 2101 Cell Biology and Genetics

This course is designed to give an introduction to the animal cell structure and function. This will include the chemical components of the cell, the structure and function of the cell organelles and their role in the development and differentiation of the cell.

This course is designed to teach students the mechanisms of hereditary transmission and variation of organismal characteristics. The various basic concepts which have been established in genetics will be discussed. Gene regulation and developmental patterns, as well as irregularities, both will be studied structurally and functionally. Students will also have some knowledge of the recent progress made through biochemical and microbial studies. Principles of Genetic Engineering will also be discussed to enhance students' ability to think scientifically and solve problems in Biology.

B.Sc. Geology

ZO 2127 Invertebrates -forming Skeletons

This course aims to study invertebrates forming skeletons & fossils which are important for the study of Paleontology and Marine Geology. The course provides theoretical knowledge and practical experience in the identification of these invertebrates e.g. foraminifera, corals, coral reefs, Mollusca, Echinodermata and others. It provides an overview of the biodiversity, classification, morphology, biology, polymorphism, feeding, reproduction and life cycle of these invertebrates. Also; it explains the process of coral formation, calcification of reef-building corals as well as hard exoskeletons and shells of invertebrates.

B.Sc. Biotechnology

ZO2129 Parasitology

The course is intended for students interested in pursuing a professional career in the fields of parasitology, biodiversity and human health. The course aims to: 1- provides students with principles, practices and informative knowledge concerning parasitism and the diversity of helminth parasites. This will be achieved through the study of the structure, life cycle,

development, host parasite relationship, and helminth potential to cause disease and economic losses.2- develop awareness of concepts underlying design of epidemiological studies, control strategies, and modern trends in parasitology 3- develop intellectual and practical skills to develop professional competence in the fields related to parasitology.

B. Sc. Microbiology

ZO3151 Parasitology

The course is intended for students interested in pursuing a professional career in the fields of parasitology, biodiversity and human health. The course aims to: 1- provides students with principles, practices and informative knowledge concerning parasitism and the diversity of helminth parasites. This will be achieved through the study of the structure, life cycle, development, host parasite relationship, and helminth potential to cause disease and economic losses.2- develop awareness of concepts underlying design of epidemiological studies, control strategies, and modern trends in parasitology 3- develop intellectual and practical skills to develop professional competence in the fields related to parasitology.