جامعة طنطـا
كلية العلـوم

توصيف المقررات

Courses Description

Foundation Year – Physical Science Section
Level One - First Semester

Mat101: Calculus (1)
Functions, Definition of a Function, The Domain and Range of a Function, Algebraic of Functions, Composition of Functions, Implicit Relations and Inverse Functions, Classification of Functions, Limits and Continuity, Definition Of Limit, Limit Theorem, Continuous Functions, The Derivatives, Evaluation of the Derivatives Geometric Interpretation of the Derivatives, General Rule of the Derivatives, The Derivatives of Composite Functions Implicit Differentiation, Higher Derivative, Derivative of Inverse Trigonometric Functions , Derivative of Trigonometric Functions, Derivative of the Logarithmic Functions, Derivative of Exponential Functions, Derivative of Hyperbolic Functions, Derivative of Inverse Hyperbolic Functions, 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.

Sta101: Introduction to 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.

Com101: Computer Basics and Programming Principles
Introduction to tie discipline of computing Computer systems, number systems data representation and basic: computer organization. Basic Math operators. 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.

Phy101: Properties of matter and Heat
Properties of Matter
Standards of Length, Mass, and Time - SI system of units -Density and Atomic Mass. Dimensional Analysis - Conversion of Units. Pressure-Pressure Measurements- Pascal's law. Buoyant Forces- Archimedes' Principle. Steady and turbulent flow- Equation of continuity. Bernoulli's Equation. Gravitation. Kepler's Laws. The Gravitational Field- Energy Considerations in Planetary and Satellite Motion- Black Holes. Motion of an Object Attached to a Spring- Simple Harmonic Motion. &Uniform Circular Motion. Pendulum -Damped Oscillations - Forced Oscillations.

Heat

Temperature and heat - Zeroth law of thermodynamics- Thermometers- Calibration of thermometers – Constant Volume Gas Thermometer. Celsius, Fahrenheit, and Kelvin Temperature Scales. Calendar and Griffiths Bridge- Linear and volume expansions. Unusual Behavior of Water. Relation among the quantities volume, pressure and temperature of a sample of gas- Ideal gas- Ideal gas law. Heat and Internal Energy- Units of Heat. Latent Heat. Molecular Model of an Ideal Gas - Molecular Interpretation of Temperature. Molar Specific Heat of an Ideal Gas - Adiabatic processes for an ideal gas. Energy Quantization- Molar Specific Heat of Solids. Thermal Conduction - Home Insulation- Definition of thermal conductivity. Searle's Method for good conductors- Lee's Method for bad conductors - Spherical Shell Method- Cylindrical flow of heat. Heat Transfer by Convection- Newton's law of cooling - Heat Transfer by Radiation- Kirchhoff's Law of Heat Radiation. Practical experiments related to Part 1 and Part 2 during the whole semester

Chm101: General Chemistry (I)

Topics Covered include Matter and measurements, Atoms, molecules and ions; stoichiometry and mass relations in chemical reactions; Properties of gases and gas law calculations; Atomic, electronic structure and periodic correlations; Covalent bonding, hybridization, Lewis structures and molecular geometry; liquids and Solids.

Practical (2 hrs.): Qualitative inorganic analysis: analysis of acid and basic radicals and analysis of mixtures. In addition to the laboratory work as introductory to lab of practical organic chemistry and how to identify organic compounds.

Bot103: General Botany

This course gives an opportunity to provide the students with comprehensive principles and concepts underlying plant structure and plant taxonomy. The course aims to provide students with knowledge and understanding about the concepts of plant morphology, and environmental effects. Also, this course aims to provide students with knowledge and understanding about plant tissues and the anatomy of different parts of the plant body. Furthermore, this course includes topics in plant systematic that will enable students to gain knowledge and understanding of the systematic position, structure and life cycle of different plant groups including, in addition to viruses, bacteria, fungi, algae, archegoniate and angiosperms.

Uni101: Scientific English Language اللغة الانجليزية العلمية

The course aims to improve students' knowledge and use of the conventions of academic English. Students will improve their scientific English vocabulary and grammar and acquire advanced skills such as organizing facts in a chronological order through verb tenses and conjunctions, summarizing and paraphrasing, speaking about their scientific interests, writing scientific essays and reports, giving and understanding presentations relating to their field of study. Active participation of students will be encouraged.

Uni103: Environmental Culture الثقافة البيئية

Introduction to core themes, questions, and methods within interdisciplinary field of environmental humanities. Examination of how different culture forms (e.g., fiction, journalism,

poetry, visual art) represent environmental issues. Topics may include biodiversity, wilderness, food, urban ecologies, postcolonial ecologies, environmental justice, and climate change.

Uni105: History and Philosophy of Sciences **تاريخ وفلسفة العلوم**

This degree investigates the history of science from antiquity to the present and globally. The goal is to better understand science's many methods, fundamental concepts, logic, and ethics. We aim to provide our students with the ability to build a broad perspective on the origins of science and its role in our modern world.

Uni107: Innovation and Entrepreneurship **الابتكار وريادة الأعمال**

This course acquaints students with various aspects of innovation and entrepreneurship, broadly understood. Topics cover methodologies, theories, and history of innovation. The course focuses largely on projects pursued by teams which conceive and conduct ventures that illuminate innovation and entrepreneurship. Class activities include lectures, discussions, and student presentations. Experienced guest experts will offer advice and guidance to student teams. May not be taken on an S/U basis.

Uni109: Health and Fitness **الصحة واللياقة**

Health and Fitness emphasizes the importance of knowledge, attitudes, and practices relating to personal health and fitness. It is a course designed to expose students to a broad range of issues and information relating to the various aspects of personal health, which include the physical, social, emotional, intellectual, and environmental aspects.

Uni111: Lab Safety **الأمان المعملي**

The Principles of Laboratory Safety at this course outlines the standards you should follow and will help you to understand the principles of laboratory safety – simple and practical ways to help you stay safe and prevent harm to yourself and those around you.

Mat102: Algebra and Geometry

Algebra (1 hr.):

The logic of Compound Statements- The logic of Quantified Statements- Direct and Indirect proofs - Algebra of sets - Relations and their representation - Equivalence relations and Partitions - Congruence modulo n on the set Z of integers - Algebra of Matrices - Mathematical Induction - Partial fraction – Mappings.

Geometry (1 hr.):

Polar coordinates, Relating polar and rectangular coordinates, polar equations, parametric equations, coordinate transforms, conic sections, pairs of Straight lines, the general equation, the polar equation, the tangent equation and the normal equation of circle. Parabola, the equation of parabola, the polar equation, the tangent equation and the normal equation of parabola. Ellipse, equation of ellipse, the polar equation, the tangent equation and the normal equation of ellipse. Hyperbola, equation of hyperbolic, the polar equation, the tangent equation and the normal equation of hyperbola.

Mat104: Calculus (2)

Topics include the basic and advanced techniques of integration, analytic geometry of graphs of functions, and their limits, integrals and derivatives, including the Fundamental Theorem of Calculus. Also, some applications of the integral, like arc length and volumes of solids with rotational symmetry, are discussed. Applications to the physical sciences will be a focus of this course, as this sequence of courses is designed to meet the needs of students in these disciplines.

Com102: Introduction to Computer Science for Multidisciplinary Studies

Introduction to tie discipline of computing Computer systems, number systems data representation and basic: computer organization. Basic Math operators, 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.

Phy102: Electricity and Geometrical Optics

Electricity &Magnetism

Properties of Electric Charges- Coulomb's Law- The Electric Field. Electric Flux - Gauss's Law. Application of Gauss's Law to Various Charge Distributions. Potential Difference and Electric Potential - Potential Differences in a Uniform Electric Field - Electric Potential and Potential Energy Due to Point Charges. Definition of Capacitance - Calculating Capacitance.

Combinations of Capacitors - Energy Stored in a Charged Capacitor - Capacitors with Dielectrics. Electric Current – Resistance – A Model for Electrical Conduction - Resistance and Temperature. Electromotive Force - Resistors in Series and Parallel. Kirchhoff's Rules - RC Circuits - Electrical Meters. Magnetic Force Acting on a Current-Carrying Conductor. Motion of a Charged Particle in a Uniform Magnetic Field. The Biot-Savart Law - The Magnetic Force between Two Parallel Conductors - Ampere's Law. The Magnetic Field of a Solenoid- Magnetic Flux. Faraday's Law of Induction - Motional emf - Lenz's Law. Induced emf and Electric Fields. Generators and Motors - Self-Inductance Definition of Capacitance - Calculating Capacitance. Combinations of Capacitors - Energy Stored in a Charged Capacitor - Capacitors with Dielectrics.

Chm102: General Chemistry (2)

Thermodynamics; reaction kinetics; Gaseous chemical equilibria; Acids and bases; Chemical equilibrium in acid base solutions; Precipitation equilibria; Spontaneity of chemical reactions; electrochemistry; nuclear reactions; properties of metals and metal complexes; Introduction to organic compounds and macromolecules.

Practical, 2 hrs.: Simple general chemistry experiments, and studies of the scheme of organic compounds depending on their functional groups.

Zoo104: Principles of Zoology

This course covers life processes of animals from the cellular level through systems to the whole organism. The very nature of zoology requires students to view animals in different settings and to identify many of the animal phyla.

Uni102: Information Technology **تكنولوجيا المعلومات**

Fundamentals of Information Technology course is packed with relevant, up-to-date knowledge in the world of computing. First we will get a broad – but comprehensive look at the basics of

IT. **Types of computers**, **parts of a computer**, **computer storage**, **5 generations of programming languages**, and **steps to programming systems and applications** will all be covered. Then we will look at computer networking and learn about both wired and wireless networking, **IPv4** and **IPv6**.

Uni104: Quality Culture ثقافة الجودة

In this context, the importance of promoting an institution-specific quality culture has drawn increasing attention. The concept of quality culture expands traditional approaches to quality assurance by focusing on aspects of organizational psychology, such as shared attitudes and commitment to quality. Despite growing discussion of quality culture, sound empirical approaches that capture this key construct have not been developed systematically.

Uni106: Professional Ethics أخلاقيات المهنة

course of Professional ethics explained and understanding about the standards set by professional organizations for the behavior and values of people working within a specific field. Codes of professional ethics are established in order to provide guidance to professionals, usually to not abuse client relationships and preserve the integrity and reputation of the applicable profession. When a person violates one or more of these promulgated ethics, he or she is subject to disciplinary action by the governing body of the profession. A high level of adherence to a code of professional ethics is needed so that the public will be confident in the moral standards of those working in the field.

Uni110: Transferable Skills مهارات التواصل

Transferable skills, or portable skills, are all the skills that you take with you from one job to another. The ability to clearly communicate ideas to others, solve unexpected problems, or work well in a team are all examples of transferable skills.

Foundation Year- Biology Section

Bot101: Botany (1)

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 roots, stem and leaves and their secondary growth and anatomical adaptations to water, saline and drought conditions.

Zoo101: General Zoology

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

Chm101: General Chemistry (1)

Topics Covered include Matter and measurements, Atoms, molecules and ions; stoichiometry and mass relations in chemical reactions; Properties of gases and gas law calculations; Atomic, electronic structure and periodic correlations; Covalent bonding, hybridization, Lewis structures and molecular geometry; liquids and Solids.

Practical (2 hrs.): Qualitative inorganic analysis: analysis of acid and basic radicals and analysis of mixtures. In addition to the laboratory work as introductory to lab of practical organic chemistry and how to identify organic compounds.

Mat103: General Mathematics

Functions, Limits, Continuous Functions, The Derivatives, Evaluation of the Derivatives Geometric Interpretation of the Derivatives, General Rule of the Derivatives, applications.

The logic of Compound Statements - The logic of Quantified Statements. Polar coordinates, Relating polar and rectangular coordinates, polar equations, parametric equations, coordinate transforms, conic sections, pairs of Straight lines, the general equation, the polar equation.

Phy103: General Physics (1)

Properties of Matter

Standards of Length, Mass, and Time - SI system of units – derived units - dimensions. Dimensional Analysis –Derived units and dimensions of any physical quantities. Establishment of a formula for physical quantities Simple harmonic motion, the vibrating spring. Circular motion, centripetal acceleration and force. Pendulum, Equation of simple harmonic motion, satellites. Elasticity, stress, strain, Hooke's law, Elastic limit of material. Measurement of Young modulus, Bulk modulus, Shear modulus, Poisson's ratio.

Heat

Concept of temperature – temperature scales- Platinum resistance thermometer. Thermoelectric thermometer- constant volume hydrogen thermometer. Heat energy and specific heat- specific

heat of a solid by the method of mixture- specific heat of liquid by the electrical method "Joule's method. Latent heat – latent heat of evaporation of water by the method of mixture- Bunsen's ice calorimeter. Newton's law of cooling- latent heat of fusion by cooling curve method-specific heat of a liquid by the method of cooling. The nature of heat – relation between heat and electric energy. Joule's paddle- wheel experiment for determining the mechanical equivalent of heat- Callander and Barnes continuous flow method of measuring the electrical equivalent of heat. Practical experiments related to Part 1 and Part 2 during the whole semester.

Bot102: Botany (2)

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 nonflowering 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.

Zoo102: Animal Diversity

The module 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.

Chm102: General Chemistry (2)

Thermodynamics; reaction kinetics; Gaseous chemical equilibria; Acids and bases; Chemical equilibrium in acid base solutions; Precipitation equilibria; Spontaneity of chemical reactions; electrochemistry; nuclear reactions; properties of metals and metal complexes; Introduction to organic compounds and macromolecules.

Practical, 2 hrs.: Simple general chemistry experiments, and studies of the scheme of organic compounds depending on their functional groups.

Com104: Computer Skills

Introduction to tie discipline of computing Computer systems, number systems data representation and basic: computer organization. Basic Math operators, 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.

Phy104: General Physics (2)
Electricity &Magnetism

Electric charges- Insulators and conductors - Coulomb's law - The electric field. Electric Flux and Gauss's law. Potential Energy- Electric potential. Electrical Circuits Components: Capacitance- Electric Current: Resistance and Ohm's law- Sources of e.m.f. Magnetism: Magnets - magnetic field.

Geometrical Optics

The Nature of Light- The Ray Approximation in Geometric Optics. Reflection: the law of reflection - The Double-Reflected Light Ray. Measurements of the Speed of Light- Refraction. Index of Refraction - Snell's law. Dispersion and Prisms- Rainbow- Measuring the refractive index by using the prism- Total Internal Reflection. Optical fibers. Fermat's Principle- Images Formed by Flat Mirrors- Images Formed by Spherical Mirrors and Refraction. Thin Lenses – The eye. The Simple Magnifier - The Compound Microscope. Practical experiments related to Part1 and Part2 during the whole semester.

Foundation Year- Geology Section

Chm101: General Chemistry (I)

Topics Covered include: Matter and measurements, Atoms, molecules and ions; stoichiometry and mass relations in chemical reactions; Properties of gases and gas law calculations; Atomic, electronic structure and periodic correlations; Covalent bonding, hybridization, Lewis structures and molecular geometry; liquids and Solids.

Practical (2 hrs.): Qualitative inorganic analysis: analysis of acid and basic radicals and analysis of mixtures. In addition to the laboratory work as introductory to lab of practical organic chemistry and how to identify organic compounds.

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Functions, Limits, Continuous Functions, The Derivatives, Evaluation of the Derivatives Geometric Interpretation of the Derivatives, General Rule of the Derivatives, applications.

The logic of Compound Statements - The logic of Quantified Statements. Polar coordinates, Relating polar and rectangular coordinates, polar equations, parametric equations, coordinate transforms, conic sections, pairs of Straight lines, the general equation, the polar equation.

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Heat

Temperature and heat - Zeroth law of thermodynamics- Thermometers- Calibration of thermometers – Constant Volume Gas Thermometer. Celsius, Fahrenheit, and Kelvin Temperature Scales. Calendar and Griffiths Bridge- Linear and volume expansions. Unusual

Behavior of Water. Relation among the quantities volume, pressure and temperature of a sample of gas- Ideal gas- Ideal gas law. Heat and Internal Energy- Units of Heat. Latent Heat. Molecular Model of an Ideal Gas - Molecular Interpretation of Temperature. Molar Specific Heat of an Ideal Gas - Adiabatic processes for an ideal gas. Energy Quantization- Molar Specific Heat of Solids. Thermal Conduction - Home Insulation- Definition of thermal conductivity. Searle's Method for good conductors- Lee's Method for bad conductors - Spherical Shell Method- Cylindrical flow of heat. Heat Transfer by Convection- Newton's law of cooling - Heat Transfer by Radiation- Kirchhoff's Law of Heat Radiation. Practical experiments related to Part 1 and Part 2 during the whole semester

Geo101: General and Historical Geology

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, mantle, and core. Introduction to Plate tectonic theory and Earth's material. 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, hand specimen description and simple classification of crystal models, minerals and rocks.

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.

Bot103: General Botany

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Chm102: General Chemistry (2)

Thermodynamics; reaction kinetics; Gaseous chemical equilibria; Acids and bases; Chemical equilibrium in acid base solutions; Precipitation equilibria; Spontaneity of chemical reactions; electrochemistry; nuclear reactions; properties of metals and metal complexes; Introduction to organic compounds and macromolecules.

Practical, 2 hrs.: Simple general chemistry experiments, and studies of the scheme of organic compounds depending on their functional groups.

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Phy102: Electricity and Geometrical Optics

Electricity &Magnetism

Properties of Electric Charges- Coulomb's Law- The Electric Field. Electric Flux - Gauss's Law. Application of Gauss's Law to Various Charge Distributions. Potential Difference and Electric Potential - Potential Differences in a Uniform Electric Field - Electric Potential and Potential Energy Due to Point Charges. Definition of Capacitance - Calculating Capacitance.

Combinations of Capacitors - Energy Stored in a Charged Capacitor - Capacitors with Dielectrics. Electric Current – Resistance – A Model for Electrical Conduction - Resistance and Temperature. Electromotive Force - Resistors in Series and Parallel. Kirchhoff's Rules - RC Circuits - Electrical Meters. Magnetic Force Acting on a Current-Carrying Conductor. Motion of a Charged Particle in a Uniform Magnetic Field. The Biot-Savart Law - The Magnetic Force between Two Parallel Conductors - Ampere's Law. The Magnetic Field of a Solenoid- Magnetic Flux. Faraday's Law of Induction - Motional emf - Lenz's Law. Induced emf and Electric Fields. Generators and Motors - Self-Inductance Definition of Capacitance - Calculating Capacitance. Combinations of Capacitors - Energy Stored in a Charged Capacitor - Capacitors with Dielectrics.

The Nature of Light

Measurements of the Speed of Light. The Ray Approximation in Geometric Optics. Reflection: the law of reflection - The Double-Reflected Light Ray Refraction. Index of Refraction - Snell’s law Huygens's Principle. Huygens’s Principle Applied to Reflection and Refraction Dispersion and Prisms – Rainbow- Measuring the refractive index by using the prism. Total Internal Reflection. Optical fibers. Fermat's Principle. Assessment. Images Formed by Flat Mirrors. Images Formed by Spherical Mirrors. Images Formed by Refraction. Thin Lenses. Lens Aberrations. The Camera - The Eye. The Simple Magnifier. The Compound Microscope. The Telescope. Practical experiments related to Part1 and Part2 during the whole semester.

Geo102: Crystallography, Minerals and Rocks

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 ordinary light; plane polarized light, methods of light polarization, and optical properties using polarized light; and Interference between crossed Nicols, optical properties between crossed Nicols (Interference and interference colors, birefringence, retardation, extinction and extinction angle); Convergent light and interference figures; Optical orientation.

Laboratory work: Optical properties and microscopic examination and description of selected minerals in thin sections.

Crystallography: Introduction, definition of mineral, physical properties of minerals, classification of minerals, origin and processes of mineral formation; rock definition, rock types and rock cycles, classification and descriptions of igneous rocks, sedimentary rocks and metamorphic rocks.
Laboratory work: Identification and descriptions of physical properties of minerals, minerals in hand specimens; identification, classification and descriptions of different types of rocks in hand specimens.

Zoo104: Principles of Zoology

The course aimed to know the history of taxonomy of animal kingdom and binomial nomenclature. And identify the general scheme of animal classification and the characteristics of the major phyla. Also, to be aware of some examples for each studied phylum and their structure, life cycle, economic importance, ecology, and medical importance.



Program Title	**Mathematics Science**
Program Type	**Single**
Department(s)	**Mathematics**

Mat201: Dynamics (1)
Motion of particles in Straight line- Motion of particles in the plane in Cartesian and polar coordinates - Motion in a resistive medium- Projectiles- Motion of particles on the circle- Simple harmonic motion- Motion of particles of variable Mass.

Mat203: Introduction to Abstract Algebra
Binary operations- Semigroups- Semigroup of Mappings on a set - Elementary properties of groups- Congruence Relations - Permutation groups - Group of Symmetries and Dihedral groups - Cyclic Subgroups - Coset Decomposition and normal subgroups - Homomorphism theorems- Elementary properties of Rings and Fields.

Sta223: Probability Theory and Distributions
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)

Mat205: Mathematical Analysis (1)
Function of reveal variables limits- Continuity - Differentially – 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 nonhomogeneous of ordinary Differential Equations of higher-order.

Mat207: Logic and Set Theory

Valid and Invalid Arguments - Inference Rules - Arguments with Quantified Statements and Rules of universal instantiation - Methods of proof, direct and indirect - Proofs involving quantifiers - Properties of set of integers - Sequences - Cardinal sets - Infinite sets - The ordering of cardinal numbers - Comparability of cardinal numbers - Well-ordered sets and ordinal numbers - The Axiom of choice, the well ordering Theorem and Zorn's lema and their equivalence - Some theorems equivalent to the Axiom of choice - The Paradoxes of Intuitive Set Theory.

Mat209: Discrete Mathematics

Inference Rules, Valid and Invalid arguments, Arguments of quantified Statements, Rules of universal instantiation, Methods of proofs, Properties of set of integers, Sequences and Strings, counting: Permutations, The Algebra of combinations, Pigeonhole Principle, Recursion, Boolean Matrices and representation of relations, Paths in relations and Digraphs, Closure of relations and Warshall's Algorithm, partially ordered sets, Lattices, Applications of finite Boolean algebra.

Mat225: History of Mathematics

Positional number system, base 10, Addition, multiplication, division. Fractions, Complicated formalism, limited algebra, Only perfect squares (no irrational numbers). Area of circle, Volume of pyramid, Squares, cubes, square roots, cube roots, Solve quadratic equations, Foundations of Geometry: The Theorem of Pythagoras, The Discovery of Irrational Numbers , The Eudoxian Response , The Continuum from Zeno to , Tiling the Plane, Bradwardine Revisited**,** Conic Sections, Quintisection, Algebraic, Petersen Revisited**,** A Chinese Problem, Horner's Method , Descartes' Rule of Signs, De Gua's Theorem**,** Dihedral Angles , Inscribing Circles in Right Triangles , cos 9◦ , Old Values of π, Using Polynomials to Approximate π , π `a la Horner , Parabolas, Finite Geometries and Bradwardine's Conclusion, Root, Statistical Analysis, The Growth of Science, Programming**.**

BPh219: Basics of Biometrics

Measurements of human characteristics to confirm identity, Photographic and video camera technology, Pressure measurement, Heat measurement, Speech recognition, Computer technology.

BPh221: Basics of Bioinformatics

Introduction to Bioinformatics, Biology and Bioinformatics, Genomics and Proteomics, Computers in Biology and Medicine, computer algorithms, Biological Macromolecules, Topics covered include: central dogma and introduction to macromolecular sequences; Genome Analysis, sequencing methods and physical mapping of genomes; genome data and databases, Databases and Search Tools, 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, Proteome Analysis, Recent issues in bioinformatics.

Mat202: Ordinary Differential Equations

Basic concepts definition of order, degree, solution of differentioal equation, formulation equation. Equation of the firSta order and firSta degree (separation variable, homogeneous, Exact equation, Integratory factor, Bernoulli equation). Equation of the firSta order and firSta but not the degree, Equation solvable for (x,y), Lagrangian,s, Clairaot,s equation. Linear rquatios with conStaant coefficients, Definition, Auxiliary equation complementary function, Determination of particular integeral (solution). SyStaem of differential equations. Application and modeling (Population Dynamics, Chemical reaction, Orthogonal trajectoiec, Economics infected diseases.

Mat204: Vector analysis and Solid Geometry

Vector Algebra, Line, Surface and Volume Integrals, Gradient, Divergence and Curl, Suffix Notation and its Applications, Integral Theorems, Curvilinear Coordinates, Cartesian Tensors, Applications of Vector Calculus, Cartesian coordinates in space - cylindrical coordinates - spherical coordinates - Lines in space - the parametric and the symmetric equations of lines - angle between two lines - the perpendicular diStaance from a point to the line, equation of the plane - norMatl, symmetrical, and general equation of the plane, angle between two planes, the intersection of two planes - the perpendicular diStaance from a point to a plane - surface in space - quadratic surfaces in three variables - equation of the sphere, intersection of a sphere and a line - intersection of a sphere and a plane, intersection of two spheres - sphere through a given circle - tangent plane - condition for two sphere to be orthogonal, simplified form of the equation of two sphere - definition of a cone – vertex - guiding curve – generators - equation of the cone with a given vertex and guiding curve – The homogeneous equation in three variable is a cone with vertex at origin - condition that the general equation of the second degree should represent a cone - equation of the right circular cylinder with a given axis and radius - equation to the cylinder whose generators intersect a given conic and are parallel to a given line - the ellipsoid, the paraboloid, the hyperboloid of one sheet - the hyperboloid of two sheets - the elliptic paraboloid - hyperbolic paraboloid.

Mat206: Linear Algebra

Vector Spaces - Algebra of subspaces - Linear combinations - Dependence - Bases and Dimensions - Linear Transformations - Kernel and range - Operations on linear transformations - Singular transformations - Invertible Linear transformations - Matrix Representations of transformations -Similarity - Change of bases - Basic Matrix Arithmetic - Rank and Nullity of linear Maps - System of linear equations - Reductions of Matrices to canonical forms - Eigen values - Characteristic equations - Cayley's Hamilton Theorem - Inner product space.

Mat208: Dynamics (2)

Motion of particles in central orbits- The restricted planar motion of particles- Moments and products of inertia- Planar motion of rigid bodied- Three-dimensional motion of particles- Motion of a rigid body in three dimensions- Euler's equations and some applications.

Mat210: Mathematical Analysis (2)
Sequences – limit of Sequences- The Theorems of Convergent Sequences- Caucluy Sequence- Series of number- The teStas of Convergent of Series Sequences of functions. Uniformly Convergence Series of functions- Uniformly Convergence of Series- Applications.

Mat212: Number Theory
Divisibility - Division algorithm - The greatest common divisor - The least common multiple - Diophantine linear equation -The Fundamental Theorem of Arithmetic - The study of some numerical functions and specific numbers - Congruences in Z - Fermat's Theorem - Euler's Theorem - A complete solution to the congruence $ax \equiv c \pmod{b}$ - The Chinese ReMatinde Theorem - Wilson's Theorem - Congruences of Higher Degree - Quadratic Residue - Quadratic Reciprocity - Pythagorean Triples.

Com224: Data Structures and Algorithms
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 Implementation arrays, Strings, Structures and files Specification. Implementation and specification of Stacks, queues, hsts. trees and graphs Searching and sorting algorithms.

Phy220: Introduction to Physical Optics
Physical Optics. 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 - 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 - Nickol prism, Polarization and dispersion of light. Circular and elliptical polarization.

Phy222: Astronomical Physics
Introduction – Astronomical unit-the light year- Parsec - Galaxies-Types of galaxies- spiral galaxies (normal and Barred spiral)- Elliptical galaxies-Lenticular galaxies- irregular galaxies- Galactic clusters and mergers- The principle parts of galaxies. Milky way galaxy. Celestial coordinates-Horizontal coordinates- Altitude – Azimuth - Equatorial Coordinates – Declination - Right Ascension - Hour Angle. Star Formation and born - Main Sequence Stars - Stars and Their Fates- White Dwarfs- Novae - Supernovae Leave - Neutron Stars- Black Holes- Stellar Magnitudes- Stellar Spectra – classification and types of stars. Time estimation- Standard Time- Time and longitudinal - World Time Zones. The International Date Line- Solar Day - Sidereal Day - Tropical year - Sidereal Year - Animalistic Year- Ecliptic Year- Giuliani Calendar - Gregorian calendar- Hijri calendar. Greenwich Line - Civil Time - Local Time - Equation of Time. Solar system- Solar system bodies- CLASSIFICATION OF PLANETS- Kepler's Laws - Physical properties of planets- Some planetary positions as they orbit around the sun –

Elongation - Pairing - quadrature mode- Bode's law. Astronomical observations and monitoring- Function of the Telescope- Telescope components – Objective – Eyepiece – Amplification Power-Field of view - Optical System of trlescopes - Refractor – Reflector – Catadioptric - Chromatic Aberration- Spherical Aberration – Coma - Astigmatism

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Mat301: Numerical Analysis (1)

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.

Mat303: Group Theory

Normal subgroups and partition by cosets - Congruence Relations and Quotient groups - The three isomorphism Theorems - The 1-1 correspondence theorem - The automorphisms group and Cayley's Representation Theorem - Direct products and Finite Abelian groups - conjugacy and Sylow's Theorems - Solvable groups - Nilpotent groups - Free groups and Free Products.

Mat305: Statistical Mechanics

Probability: binomial, Poisson, and Gaussian distributions, central limit theorem, Thermodynamics: the zeroth law, the first law, the second law, Carnot engines, entropy, thermodynamic potentials, (Stability conditions, third law), Kinetic theory of gases: Liouville's theorem, BBGKY hierarchy, Boltzmann equation, H-theorem, equilibrium properties, conservation laws, Classical Statistical mechanics: microcanonical ensemble, two level systems, ideal gas, Gibbs' paradox, canonical and grand canonical ensemble, Quantum statistical Mechanics: dilute polyatomic gases, black-body radiation, vibrations of a sold, quantum Matcrostates and microstates, Ideal quantum gases: Hilbert space, grand canonical formulation, degenerate idea Fermi & Bose, Bose Einstein condensation.

Mat307: Real Analysis

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.

Mat309: Tensor analysis (MAT204)

Basic Tensor Algebra, Special Tensors, Exterior Algebras, Tensors over Linear Spaces with Inner Product, Classic Tensors in Geometry and Mechanics.

Mat311: Measure Theory

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).

Mat313: Transformation Geometry

Euclids axioms of geometry, Hirburt Axioms, Undefined terms, Incidence axioms, Ordering axioms, Axioms continuity, parallel axioms , Histort of parallel axioms, Consistency of axioms, Independence of axioms,, Categoricity of the systems of axioms and relation between axioms (including neutral, elliptic and hyperbolic geometries). Geometric Transformations, Mappings, reflection, transformations, relations, group of isometrics, transformations and Collineations - Groups of Transformations - Involutions - Translations and Halfturns - Reflections Congruences - Isometrics as products of Reflections - Translations and Rotations.

Mat315: Special relativity

Pre-relativity and Galilean Transformation, Michelson–Morley Experiment and Velocity of Light, Lorentz Transformations, Mathematical Properties of Lorentz Transformations, Geometric Interpretation of Space-time, Relativistic Velocity and Acceleration, Four Dimensional World, Mass in Relativity, relativistic Dynamics, Photon in Relativity, Relativistic Lagrangian and Hamiltonian, Electrodynamics in Relativity, relativistic Mechanics of Continua.

Mat317: Mathematical logic and Boolean Algebra

i) Math Logic: Format proofs- Syntax and semantics - Well Formed Formulas- Higher order logics - Format theories - Computational logic - Substitution and Unification - Theorem proving and Resolution.

ii) Boolean Algebra: Ordered Structures - Diagrams - Topological sorting - Down and upsets - Lattices - Lattice isomorphism - Types of lattices - Join irreducible elements - Boolean algebras and application - Atoms of Boolean algebra - Representation Theorem of finite Boolean algebras – Birkhoff's representation for finite distributive lattices - Staon's Representation theorem

Geo351: Environmental Geology

Philosophy and Fundamental Concepts, Ecology and Geology, Introduction to Natural Hazards, Water Resources, Water Pollution, Water Quality, Mineral Resources and the Environment, Energy Resources, Soils and Environment, Waste as a Resource, Waste Management, Global Climate Change, Geology, Society, and the Future, Field visits are needed to some hazardous and polluted areas.

Phy321: Introduction to Mathematical Physics

Fourier analysis, Laplace transforms, ordinary differential equations, series solutions of ordinary differential equations, partial differential equations.

Mat302: Analytical dynamics

Basic concepts in analytical dynamics- Lagrangian equations for the holonomic and holonomic conservation systems- Hamilton's equations for general systems- Cyclic (ignorable) coordinates and Routh equation- Calculus of variation and Hamilton's principal- Hamilton's Principle Hamilton– Jacobi theory and its application- Canonical transformations and generating functions- Hamilton-Jacobi theory-Theory of Poisson brackets and its applications.

Mat304: Topology (1)

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.

Mat306: Quantum Mechanics (1)
The Fundamental Assumptions of Quantum Mechanics, Review: Square Potentials, The WKB Approximation, Mathematical Foundations of Quantum Mechanics, The Postulates of Quantum Mechanics, Representations, The Density Matrix, The Harmonic Oscillator, Two-Level Systems (A Spin 1/2 particle), Two Spin 1/2 particles, Angular Momentum, Symmetries and Constants of Motion.

Mat308: Operations research (1)
Linear programming, Mathematical Formulation of Linear Programming Problem, Basic notion, Graphical Method for Solving Linear Programming Problems, The Standard Form of LP Problem, The Canonical Form of LP Problem, Simplex Method for LP problems, Phase II of simplex method, Type of optimal solution, Phase I of the method of simplex method, Duality in linear programming, Simplex Method for Dual LP, Applications on Linear Programming, Transportation Problem, Assignment problem, Theory of Games.

Mat310: Complex Analysis
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.

Mat312: Electrostatics and Magnetism
The electric field, Divergence and curl of electrostatics fields, Electric potential, Work and energy in electrostatics, Conductors, Boundary conditions and uniqueness theorem, The method of images, electric field in Matter, Magnetostatics, Magnetic field in Matter.

Mat314: Optimal control
Cost Function, Variational Inequality, Dual Problem, Singular Perturbation, Pseudo Differential Operator, Controllability, bang-bang principle, Linear time-optimal control, The Pontryagin Maximum Principle, Dynamic programming, Game theory, Introduction to stochastic control theory.

Mat316: Mathematical Modeling
An introduction to the science of Mathematical modeling, Microscopic scale models and ordinary differential equations, Macroscopic scale models and partial differential equations, Mathematical modelling by methods of kinetic theory.

Mat318: Celestial Mechanics
Introduction to spherical astronomy and its applications. The two-body problem. Kepler equation for elliptical motion. Numerical solutions for Kepler equation. Calculations of position coordinates from orbital elements. Calculations of orbital elements from observational data. Numerical calculations of orbits. Evolution of orbits for asteroids and comets. The restricted

three-body problem. Determination of Lagrangian liberation points. Elements of the perturbation theory. Lagrangian planetary equations and satellite motion.

Mat322: Chaos Theory
Dynamical systems definition, Chaos definition, Fixed points, Flow diagrams, Some kinds of Bifurcation diagrams, Linear stability, Liapunov function, Lorntz equations, Applications.

Mat401: Applied Field Training
Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Mat403: Fluid Mechanics (1)
Flows (Fluid particle and fields, Stream-line, particle-path, Streak-line), Fundamental equations of ideal fluids(Mass conservation, Equation of motion, Momentum flux, Energy flux, Dimensional and non-dimensional analysis), Flows of ideal fluids (Bernoulli's equation, Kelvin's circulation theorem, Flux of vortex lines, Potential flows, Kinetic energy), Two dimensional flow, Applications.

Mat405: Differential Geometry (1)
Concept of curve in E3; Matin 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 (K1 Kn, Kg, K, H); Gauss formula and applications; Classification of points on a surface; Geodesics (concept, examples).

Mat407: Functional Analysis (1)
Metric Spaces (Definition of metric space Cauchy inequality – Holder inequality- Minkow ski inequality Exampled- limit in metric spaces- cloare of a subset of metric space- Cauchy sequence- Complete metric spaces- Examples- Theorem of instead closed spheeles – Completion of metric space- Contraction Mappings fixed point theorem- Application of the prim aiple of contraction Mapping in Algebra and Analysis – Normal Spaces- Banach Spaces- Hilbert Spaces- Compactness in metric space- Examples and Application

Mat409: Partial Differential Equations and Special Functions
I) First order partial differential equations with applications ,linear second order equation and it's classification , the Cauchy –kovalevskaja theorem for the exiStence and uniqueness of the solution, separation variables, the boundary value problem for elliptic equations , Dirichlet and Neumann problems , the mixed problems for the parabolic and hyperbolic equations, green's function and eigenvalues with the Eigen functions technique , the orthogonal series expansions, the canonical transformation (triconi's equation) , Laplace's operator in spherical and cylindrical coordinates , the integral transformation actions and variational methods .

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

Mat411: Electrodynamics
Electromotive force, Electromagnetic induction, Maxwell's equations, Conservation laws, Electromagnetic waves, Potentials and fields, Radiation, Electrodynamics and relativity.

Mat413: Topology (2)
Separations Axioms; Hausdorff Topological spaces T1, T2, T3, T4. 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).

Mat415: Lattice Theory
Ordered sets- Two definitions of Lattices-Hasse diagrams- complete lattices- joint and meet irreducible elements- sublattics- homomorphisms- ideals and filters-prime and maximal ideals- congruence and lattices of congruencies- product and some of lattices- special types of lattices- pseudo complementations –modular and distributive lattices-Boolean algebras-representation of distributive lattice and atomic Boolean allergies- algebraic lattices.

Mat417: Graph Theory
Bipartite graphs. Directed a cyclic graph and tournament Matching, Gall's Theorem and Berge's theorem as well as shorts path algorithms of prime, Dijkstra, Kruskal, and Fard. Fulkerson. Trees connectivity and Menger's theorem. Planarity and chromatic number. Applications. Basic of combinatics.

Mat402: Graduation Project
This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Mat404: Rings and Fields Theory
Basics of Rings - Non commutative examples - Suprings - Ideals - Congruence relations - Quotient Rings - Homomorphisms - The classical Isomorphism Theorems - The correspondence Theorem - Certain special ideals in commutative rings - Radicals - Field of quotients of integral doMatin - Imbedding Theorems - Divisibility theory in integral doMatins- Polynomial rings - Irreducible polynomials unique factorization and ideal Structures - Field Extension and introduction to Galois Theory.

Mat406: Elasticity Theory
Introduction on solid mechanics- Stress and equilibrium- Deformation and Strain- Airy Stress function- Generalized Hook's law- Plain Stress and Plane Strain- Static and dynamic problems in elasticity.

Mat408: Numerical Analysis (2)
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.

Mat410: Fluid Mechanics (2)
Viscous fluids (Equation of motion of a viscous fluid, Energy equation, Reynolds similarity law, Low Reynolds number flows), Couette flow, Couette-Poiseuille flow, Hagen-Poiseuille flow, Blasius flow, Water waves, Boundary layers, Two-phase flow, The vortex motion.

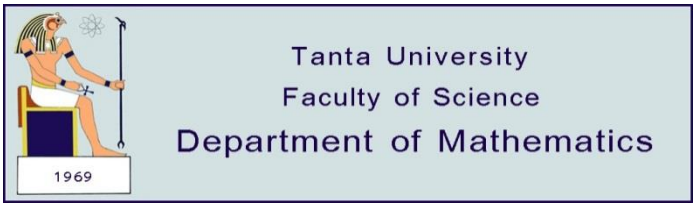
Mat412: Differential Geometry (2)
The definition of the gauss Map and its fundamental properties; The Gauss Map in local coordinates; vector Fields; Minimal surfaces; Isometric and conformal Maps; The exponential Map and Geodesic polar coordinates; Properties of Geodesics and convex neighborhoods.

Mat414: Functional Analysis (2)
Spectra and Resolment set, the Spectra of two particular transformation, Approximate proper values, Introduction to Banach Algebra, Analytic vector, Valued functions, Normal and Banach Algebras identity, Analytic function, The resolvent operator Spectral radius and the spectral mapping theorem, The Glfand theory weak topologies and the Glfand topological vector spaces and operator topologies Spectral theorem of bounded-self adjoint operator.

Mat416: General Relativity
Tensor Analysis- Re-general theory of relative - The assumptions and Theory - Planetary motion - Deviation of a ray of light - Red shift phenomenon.

Mat418: Quantum Mechanics (2)
A Particle in a Central Field, Hydrogenic Systems, Diatomic Molecules, Addition of Angular Momentum, Matrix Formulation of Quantum Mechanics, Advanced Study in quantum mechanics based on the Dirac formalism with bra and ket vectors, operators and observables, Position and momentum space representations. Schrödinger and Heisenberg pictures, Periodic Systems, Scattering (Applications in nuclear and particle physics), Approximation Methods for bound States, Time Dependent Perturbation Theory, Identical Particles.

Mat420: Operations Research (2)
Nonlinear programming (NLP), Convex sets, Convex and Concave Functions, Solving NLPs with One Variable, Golden Section Search, Un-constrained Minimization with Several Variables, The Method of Steepest Ascent, Lagrange Multipliers, The Kuhn–Tucker Conditions, Definition of Quadratic Programming, Wolfe's Method for Solving Quadratic Programming, The Method of Feasible Directions, Multiobjective NLP problem, Pareto Optimality and Trade-Off Curves, Scalaration of (MONLP), Parametric NLP and MONLP Optimization.



Program Title	**Statistics**
Program Type	**Single**
Department(s)	**Mathematics**

Sta201: Probability Theory (1)

The random experiment; Sample space; Types of sample space; The events; Space of events ; Operation on events ;Types of the events; Classical definition of probability ; Experimental definition of probability; Mathematical definition of probability; Types of probability spaces ; Geometric probability ; Combinatorial probability ; Conditional and total probability; Bayes Theorem ; Random variables :Types of random variable; the probability and cumulative distribution functions and the property of its; Expectation; The Variance; The moments; Skewness and Kurtosis; The moment generating function; Some discrete distributions (Bernouli distribution ,Binomial distribution,Possion distribution, geometric distribution); Some Continuous distribution (Uniform distribution ,Exponential distribution, Normal distribution).

Sta203: Sampling Theory

The population and the sample; The types of the populations; Types of samples; The sample and the statistic; Some description statistics; The sampling; The sampling from a specified population The types of random sample; The stratified random sample; Sampling with replacement and sampling without replacement; The distribution of the sample; the sampling distribution of the sample mean; The central limit theorem; The sampling distribution of the difference between two sample means; The sampling distribution of the sample proportion; The sampling distribution of the sample variance; The sampling distribution of the difference between two sample proportions; The error of the estimation; The estimation of the mean and the sample size; The estimation of the sample size.

Mat219: Abstract Algebra and Linear Algebra

Semigroups of mappings; Groups- permutation groups; Groups of symmetries structures; Subgroups; Cyclic groups; Lattice diagram of subgroups; Cosets Decomposition; Normal subgroups; Quotient groups and congruence relations on groups; Homorophism of groups; Preliminaries of rings and fields; Groups of symmetries Structures; Subgroups. Vector spaces and subspaces; Algebra of subspaces- Linear combinations; Bases and Dimension; Linear transformations; Operations on linear Transformations; Rank and range of linear Transformation; Matrix representation of linear transformations; System of Linear Equations; Eigen values and Eigen vectors; Diagonalizable matrix and Change of basis; The Jordan canonical form; Inner product space.

Mat221: Mathematical Analysis (1)

Function of several variables; Limits; Continuity; Differentiability; Applications of Partial differentiation; Integration; Double integration; Applications of Double integration; Differential equation of first order and first degree; Different methods for solving the differential equation of first order and first degree; Differential equation of first order and higher degree; Solution of nonhomogeneous ordinary differential equation.

Com213: Computer Programming

Overview of basic programming constructs; Functions, parameters passing and files data modeling with arrays; Structures and classes pointers and linked Recursion task; Program design and analysis; Testing and debugging techniques in C++; Programming development using modem APIs.

Sta205: Applied Statistics

Introduction to biostatistics-Descriptive statistical measures for ungrouped data and grouped data-Normal distribution and sampling theory and Inferential Statistics: Estimation and Hypothesis testing-point estimation and confidence intervals-The 5 steps of hypothesis testing-Z test- one sample t test-paired sample t test- Independent sample t test-correlation and regression test-ANOVA test.

Mat223: Discrete Mathematics

Inference Rules, Valid and Invalid arguments, Arguments of quantified statements, Rules of universal instantiation, Methods of proofs, Properties of set of integers, Sequences and Strings, Counting: Permutations, The Algebra of combinations, Pigeonhole Principle, Recursion, Boolean Matrices and representation of relations, Paths in relations and Digraphs, Closure of relations and Warshall's Algorithm, Partially ordered sets, Lattices, Applications of finite Boolean algebra.

Phy231: Introduction to Thermodynamics

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 temp. 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. Expansivety 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.

Chm271: Quality Control in Chemistry

This course describes: general concept of quality (products, services), quality parameters, customer International standardization, legislation models for quality assurance, quality policy and planning, management, organization and personnel, general terms used in quality management, elements of quality system: identity, impartiality, independence, integrity elements of quality system: quality manual, quality control, handling of test samples accreditation of testing laboratory, laboratory assessment, criteria and rules methods of QC: blanks, recovery, evaluation of repeatability, control charts validation of analytical methods, system suitability tests, calibration, traceability and reference materials; errors in analysis inter-laboratory test comparisons, proficiency testing, sampling of food commodities, environmental sampling, sampling plans interpretation of laboratory data, data validation, archiving and data accessibility.

Sta202: Statistical Inference (1)
The parameters of population; Estimation of unknown parameters; point estimation; A sufficient statistic for a parameter; Mean squared error The properties of estimator: Unbiasedness-efficiency-consistency-sufficiency-completeness; TheRao-Cramer inequality; Interval estimation; Confidence interval for: Means, Differences of two means and variances; Some methods of the estimations :Maximum likelihood , moments.

Sta204: Distribution Theory
Bivarite distributions ; The joint distribution function of two random variables; joint probability density function of two random variables ; the marginal and conditional distributions ; Covariance ; joint expectation ,Conditional expectation ;Bivariate normal distribution ;Bivariate binomial distribution; Moment generating function of two random variables and its application; Some methods of getting Distribution of functions of random variables ;Transformations of variables Technique ;the distribution function technique and Moment generating function technique ;Deriving distribution functions of Chi-square distribution, T– distribution and F–distribution.

Mat220: Mathematical Analysis (2)
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.

Mat202: Ordinary Differential Equations
Basic concepts definition of order, degree, solution of differential equation, formulation equation. Equation of the first order and first degree (separation verable, homogeneous, Exact equation, Integratory factor, Bernoulli equation). Equation of the first order and first but not the degree, Equation solvable for (x,y), Lagrangian,s, Clairaot,s equation. Linear rquatios with constant coefficients, Definition, Auxiliary equation complementary function, Determination of particular integeral (solution). System of differential equations. Applicxation and modeling (Population Dynamics, Chemical reaction, Orthogonal trajectories, Economics infected diseases.

Mat212: Number Theory
Divisibility - Division algorithm - The greatest common divisor - The least common multiple - Diophontine linear equation -The Fundamental Theorem of Arithmetic - The study of some numerical

functions and specific numbers - Congruences in Z - Fermat's Theorem - Euler's Theorem - A complete solution to the congruence ax ≡ c (mod b) - The Chinese Remainde Theorem - Wilson's Theorem - Congruences of Higher Degree - Quadratic Residue - Quadratic Reciprocity - Pythagorean Triples.

Mat216: Graph Theory and Combinators

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

Combinatory: pairing Skirling, formula Recurrence relation and generating functions. The inclusion exclusion principle.

Com214: Mathematical Packages

Matrices operations by Matlab, Eigenvalues, singular values, and polynomial roots by Matlab, Lie algebra computations in Maple, Linear and nonlinear programming by Matlab, Regularization tools in Matlab, Partial differential equations packages, Iterative linear solvers.

Com216: Data Structures and Algorithms

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 Implementation arrays, strings, structures and files Specification. Implementation and specification of stacks, queues, trees and graphs Searching and sorting algorithms.

Phy224: Introduction to Statistical Physics

What is statistical Mechanics? Ensembles and Definitions. Distribution law. Boltzmann statistics MBS. Problems in Derivation of MBS. Alternative Derivation of MBS. Examples of counting in statistical Mechanics. Fermi Dirac Statistics F.D.S, Bose- Einstein statics 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.

Phy228: Principles of Bioinformatics

Introduction to Bioinformatics, Biology and Bioinformatics, Genomics and Proteomics, Computers in Biology and Medicine, computer algorithms, Biological Macromolecules, Topics covered include: central dogma and introduction to macromolecular sequences; Genome Analysis, sequencing methods and physical mapping of genomes; genome data and databases, Databases and Search Tools, 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, Proteome Analysis, Recent issues in bioinformatics.

Sta301: Probability Theory (2)

Multivariate distribution ; Definition and elementary properties of Charactristic functions; The

characteristic functions of some bivariate and multivariate distributions' hnversion formula and uniqueness theorem; Helly's theorems; Limit theorems for characteristic functions; The law of large numbers ;Chebyshev's form of the law of large numbers ;De Moiver's theorem ; Central limit theorem ;The relation of the moments by the characteristic function.

Sta303: Order Statistics

What is order statistics; 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; Moment relations, bounds and approximations; types of order statistics data; order statistics in statistical inference; Asymptotic theory; Exponential order statistics; sample maximum, minimum and other extreme order statistics; Applications.

Sta305: Statistical Methods

Introduction to statistical methods: Descriptive and Inferential Methods -Review on statistical measures-principles of Testing of Hypothesis-Z-test-one sample test- homogeneity test : F test –Levene Test- Independent sample t test with equal variance- Welch test- ANOVA test -correlation test and regression test-Chi-Square test for dependency-Chi-Square test for Goodness of fit .

Sta307: Correlation Theory

Principles and definitions; Basic concepts; Multiple regression; Statistical Inference about the regression coefficient: Hypothesis testing; Types of regression models; The simple linear regression model; Normal regression analysis; Confidence and prediction intervals for the dependent variable; The multiple regression models; Nonlinear regression models; Regression transformations, extrapolation and outliers; Multiple regression by matrices; Variance covariance matrix.

Mat319: Real Analysis and Measure Theory

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. 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- Countably additive measured- Extensions of Measures). Integration (Measurable Functions- The Lebesgue integral- Fasters properties of the Legesgue integral).

Mat321: Partial Differential Equations

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.

Com315: Modeling and Simulation

This course introduces various system modeling and simulation techniques and highlights their

applications in different areas. This course begins by demonstrating the usefulness of simulation as a tool for problem solving in business, industry, government, and society. It includes modeling, design, simulation, planning, verification and validation. It discusses the fundamentals and techniques for designing and using simulation, modeling, and optimization algorithms with applications in system performance modeling, business infrastructure modeling, and distributed and parallel computing. It covers the topics: Basic Model Forms, Basic Simulation Approaches, Handling Stepped and Event-based Time in Simulations, Discrete versus Continuous Modelling, Numerical Techniques, and Sources and Propagation of Error. After learning the simulation techniques, the students are expected to be able to solve real world problems which cannot be solved strictly by mathematical approaches.

Com217: Design and Analysis of Algorithms
Principles and definitions; Basic concepts; Graph theory; Paths and circles, Connectivity; Directed graph, Reachability; Complementary graph; Bipartite graph; Complete Bipartite graph; Petri net math; Petri net graph, enabled (firable), Firing rule; Properties of Petri nets; Deadlock, Liveness; Conflict and Concurrency; Persistency; Boundedness; Modeling ties of Petri nets; Modeling with Petri nets; Extended Petri nets.

BPh315: Statistical Biophysics
Populations and samples. Population parameters and sample statistics. Compute a sample mean, sample variance, and sample standard deviation. Compute a population mean, population variance, and population standard deviation.

Phy329: Principles of Mathematical Physics
Fourier analysis, Laplace transforms, ordinary differential equations, series solutions of ordinary differential equations, partial differential equations.

Sta304: Multivariate Analysis
Matrices algebra; Multivariable normal distributions; The partial and multivariate correlation; Testing of hypothesis in the case of multivariate normal distribution (one sample); Testing of hypothesis in the case of multivariate normal distribution (two sample); Testing of hypothesis in the case of multivariate normal distribution (Several samples); T – Statistic; Categorical distribution (Several samples); T – Statistic; Categorical data; Applications.

Sta306: Stochastic Processes
Data collections with sampling. Parametric and Statistic, Data description using measures of central tendency (mean, median, Mode, Geometric mean, Harmonic mean weighted mean), measures of variation (Range, variance, coefficient of variation), Frequency distributions and graphs (like Histogram, Frequency polygon, Bar charts, Time series, Stem and leave) Cumulative frequency distribution, measures of skewness and kurtosis, measures of positions (e.g. quartiles, deciles). Exploratory data analysis using box plots. Simple correlation and regression and coefficient of determination.

Sta308: Statistical Packages (1)
This is a data analysis course that shows an introduction how to computational and statistical programs to understand their capabilities and learn how to perform simple mathematical tasks and generate plots for visualization.

Mat308: Operations Research (1)

Elements of convex analysis; Basic definitions and theorems in convex analysis; Extrema of functions; Formulation of linear programming problems; Graphical solution of linear programming problem; Canonical form of system of linear equations; Pivoting operation; Simplex method; Examples on simplex method; Duality of liner programming problems; Some theorems on duality; Transportation problem; Game theory.

Sta310: Statistical Quality Control

Use of statistics for quality control; Use of statistics for productivity improvement; Controichart calculation; Graphing, process control and specification; Sampling plans and reliability; Computer use for performing calculations and graphing

Sta312: Selected Topics in Statistics (1)

This module will provide an introduction to two or three advanced topics in modern statistics. The precise topics covered will vary from year to year, depending on teaching staff availability and research interests. Examples of topics might include bootstrap and related methods; extreme value theory; multivariate analysis; nonparametric smoothing; robust methods; spatial statistics; applied probability; and estimating functions. Where appropriate, the methods will be illustrated using software available in the R package.

Sta314: Regression Analysis

Principles and definitions; Basic concepts; Multiple regression; Statistical Inference about the regression coefficient: Hypothesis testing; Types of regression models; The simple linear regression model; Normal regression analysis; Confidence and prediction intervals for the dependent variable; The multiple regression models; Nonlinear regression models; Regression transformations, extrapolation and outliers; Multiple regression by matrices; Variance covariance matrix.

Mat324: Stochastic Differential Equation

Basic concepts in the probability theory, stochastic process in discrete and continuous time, the Brownian motion, wiener and Ornstein –Hollenbeck processes, Ito's integral formulae, the full liner stochastic equations, Equations of multiple noise sources, the Gaussian noise with selected numerical methods, Fokker –Planck equations and the reaction – diffusion systems.

Mat326: Topology

Topological spaces: Definitions, Accumulation on points, Closed sets, Closure of set, Interior and exterior boundary, Neighborhoods and neighborhood systems, Convergent sequences, Coarser and finnier topologies, Subspaces and relative of topologies, Equivalent definitions of topologies; Bases and Subbases: Base for a topology, Subbases, Topology generated by classes of sets, Local bases; Continuity and Topological Equivalence: Continuous functions, Equivalent definition of continuous functions, Continuity at point, Open and closed functions, Homeomorphic spaces, Topological properties, Topological induced by functions; Preopen sets and Precontinuity: Preopen sets, Preclosed sets, Precontinuous functions, Preopen functions, Preclosed functions.

Mat328: Special Functions

Gamma, Beta and Error functions ; Polygamma functions; Frebenius method for; solving the ordinary differential equations; Legendre's equation; Legendre's equation; Applications on Legendre's equation; Bessel equations; Bessel functions; Bessel polynomials; Applications on Bessel functions; Hypergeometric functions; Gauss theorem- Vandermond's theorem- Kummer's theorem; Hypergeometric functions; Hermit polynomials – Other orthogomial polynomials- Laguerre polynomials.

Sta401: Applied Field Training

Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Sta403: Queuing Theory

Some terminology of queuing theory; Description of the queuing systems; Arrival and service processes; Measures of effectiveness; Birth-Death process; Poisson process; Simple Markovian Queue M/M/1; Truncated simple Markovian Queue M/M/1/K; Infinite channel with infinite queue M/M/∞; Queues with blocking M/M/C/C; M/M/1 queue with additional servant for longer queus; M/M/1 with state dependent

Sta405: Statistical Inference (2)

Principles and definitions; Basic concepts: Statistical hypotheses-Simple and composite hypotheses- The Null and Alternative Hypotheses- Statistical test- Types of errors- Two independent and paired samples -The critical and Acceptance regions- The Power function of the test; Certain best tests; Uniformly most powerful tests; Likelihood ratio tests; Chi-square tests; A test of the equality of several means; Goodness- of- fit tests.

Sta407: Stochastic Inventory Systems

Fundamentals of the inventory system; Main definitions of the inventory models; Deterministic models; The EOQ model; The lot size model; The inventory models with shortages; A constraint models (Lagrange method – Geometric programming); Probabilistic single period inventory models (discrete and continuous); A stochastic continues review model.

Sta409: Time Series Analysis

Principles and definitions; Basic concepts; Types of Stationarity; The components of time series; Estimation of autocorrelation function and its properties; Linear models; Stationarity and inevitability; Autoregressive linear models; Yule-walker estimation; Order of autoregressive model; Moving Average models; Autoregressive moving average models; Non Stationary timer series models; Difference operator; ARIMA models, Explicit forms of ARIMA, Properties of spectral density, Spectral densities of ARMA models, Periodogram.

Mat421: Operation Research (2)

Nonlinear programming (NLP), Convex sets, Convex and Concave Functions, Solving NLPs with One Variable, Golden Section Search, Unconstrained Minimization with Several Variables, The Method of Steepest Ascent, Lagrange Multipliers, The Kuhn–Tucker Conditions, Definition of Quadratic

Programming, Wolfe's Method for Solving Quadratic Programming, The Method of Feasible Directions, Multiobjective NLP problem, Pareto Optimality and Trade-Off Curves, Scalaration of (MONLP), Parametric NLP and MONLP Optimization.

Mat423: Fuzzy Set Theory

FUZZY SET THEORY: Definition of Fuzzy Sets, Operations on Fuzzy Sets, Decomposition Theorem, Extension Principle, Fuzzy Numbers (Triangular and trapezoidal), Fuzzy Arithmetic, Possibility Theory, Fuzzification in Integrations, Applications in Operations Research (Fuzzy linear programming, Fuzzy nonlinear programming) and/or Data/Mining,

ROUGH SET THEORY: Definition of rough set, Operations on rough Sets, Definition of rough interval, Operations on rough interval, Definition of fuzzy rough and rough fuzzy sets, Arithmetic operation on fuzzy rough and rough fuzzy sets Indiscernibility relation, Equivalence class, Lower approximation of the set, Upper approximation of the set, Positive region of the set, Boundary region of the set, Negative region of the set, Exactly set, Definable set, Accuracy of an approximation of the set, Lower approximation of the family of sets, Upper approximation of the family of sets, Positive region of the family of sets, Boundary region of the family of sets, Negative region of the family of sets, Quality of approximation of the family of sets. Applications in Operations Research and/or Data/Mining.

Mat425: Numerical analysis

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.

Com419: Introduction to Data Mining

This course is an introductory course on data mining. It introduces the basic concepts, principles, methods, implementation techniques, and applications of data mining, with a focus on two major data mining functions: pattern discovery and cluster analysis. In pattern discovery, the course focuses on why pattern discovery is important, what the major tricks are for efficient pattern mining, and how to apply pattern discovery in some interesting applications. Also, it provides students the opportunity to learn concepts, principles, and skills to practice and engage in scalable pattern discovery methods on massive data; discuss pattern evaluation measures; study methods for mining diverse kinds of frequent patterns, sequential patterns, and sub-graph patterns; and study constraint-based pattern mining, pattern-based classification, and explore their applications. In cluster analysis, the course covers the basic concepts of cluster analysis (clustering) and then studies a set of typical clustering methodologies, algorithms, and applications. This includes partitioning methods, such as k-means, hierarchical methods, such as BIRCH, density-based methods, such as DBSCAN, and grid-based methods, such as CLIQUE.

Sta402: Graduation Project

This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Sta404: Non-Parametric Statistics

Principles and definitions; Basic concepts; 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; Test based on runs; The rank correlation coefficient; Testing for Non-Normality of Data.

Sta406: Statistical Decision Theory
Fundamentals of decision theory; The basic theorems which are used to make decision; Non baysien decision theory; Baysien decision theory; Randomized decision procedures; Problem of prior probability; Problem of posterior distribution; Testing of hypothesis for statistical decision; Games theory.

Sta408: Reliability Theory
Basic concepts of reliability and failure rate functions; Reliability; failure rate; MTTF and variance of lifetime distributions; Estimation of reliability of lifetime distributions; Classification of stochastic process; Basic concepts of availability; Reliability applications

Sta410: Statistical Packages (2)
This is a data analysis course that shows how to use the statistical packages in computational and statistical programs to help solve both simple and complex real-life data problems including one-, two-, and k- sample statistical problems. Basic concepts include data preparation, modification, analysis, and interpretation of results.

Sta412: Experimental Design
Introduction to design; Goodness of fit tests; Types of designs; Classifying experimental designs; Factorial designs; One-way ANOVA; Two-way ANOVA; Randomized block designs.

Sta414: Estimation Theory
Methods for system model estimation (system identification) and system states identification are elaborated. System identification based on deterministic excitation signals. Nonparametric system identification methods in time and frequency domain. Estimation of the system model parameters: least-squares method, instrumental variables method, maximal likelihood method. Selection of the model structure and verification of the obtained model. State estimation of the deterministic systems. State estimation of the stochastic systems: linear and nonlinear Kalman filters. Simultaneous estimation of system parameters and states. Examples of estimation techniques application to system control, system fault detection, signal processing etc.

Sta416 Searching Theory
A study of buyers and sellers who cannot instantly find a commerce partner. Search theory specifically seeks the optimal strategy for those choosing from various opportunities, assuming that there is a cost related to indecision. In other words, search theory attempts to find the optimal balance between the cost of a delayed decision and the value of trying again.

Sta418: Selected Topics in Statistics (2)

This module will provide an introduction to two or three advanced topics in modern statistics. The precise topics covered will vary from year to year, depending on teaching staff availability and research interests.

Examples: Multivariate Statistics, Sampling Design & Analysis, Modern Statistical Modeling, Selected Topics in Statistics, and Data Col lection & Analysis.

Mat422: Functional Analysis

Metric Spaces (Definition of metric space Cauchy inequality – Holder inequality- Minkow ski inequality Exampled- limit in metric spaces- cloare of a subset of metric space- Cauchy sequence- Complete metric spaces- Examples- Theorem of instead closed spheeles – Completion of metric space- Contraction mappings fixed point theorem- Application of the primaiple of contraction mapping in Algebra and Analysis – Normal Spaces- Banach Spaces- Hilbert Spaces- Compactness in metric space- Examples and Application.



Program Title	**Computer Science**
Program Type	**Single**
Department(s)	**Mathematics**

Com201: Computer Programming
This course has been designed to increase the skills of students in Object Oriented Programming. It covers basic topics like input/output streams, namespaces, data types, operators, operators overloading, loops, decisions, structures, functions, function overloading, function overriding, constrictors, classes and objects. It also gives an overview about some advanced topics such as Inheritance, Polymorphism, Templates, Exception handling, File handling.

Com203: Design and Analysis of Algorithms
The main purpose of this course is to provide a rigorous introduction to the design and analysis of algorithms and also to provide the students an understanding of the advanced concepts of algorithms design, data structures, and algorithms complexity and to prepare the students for related analysis and design of advanced algorithms including algorithms for specific problems, randomized algorithms, data compression and hard problems. On the other hand, students will learn about complexity and be able to compare complexities of different algorithms

Mat211: Linear algebra
Vector spaces and subspaces; Algebra of subspaces; Basis and dimensions of vector spaces; linear transformations, rank and nullity; change of basis; algebra of matrices; the matrix of linear transformation; solve systems of linear equations; eigenvalues and eigenvectors. Some applications in computer sciences.

Mat213: Discrete mathematics
The main purpose of this course is to introduce to the students the basic understanding and the use of discrete mathematics that are backbones of computer science.

This course will provide the basic principles in number theory, logic and proof, combinatorics, induction, Counting, sets, relations and graph theory
that are essential for computer science.
Cultivate clear thinking and creative problem solving, and thoroughly prepare the students for applying mathematical conception to every other course of computer science.

Com205: Files Systems
File processing environment: Overview of fiks, 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.

Com209: System Analysis and Design
This course introduces the students to the concepts and skills of system analysis and design. It includes expanded coverage of data flow diagrams, data dictionary, and process specifications. It covers several topics such as: introduction to Systems, data and information, system attributes, architecture of systems, systems development life cycle, system design, systems development methodologies, system analysis, system implementation, data-oriented systems design, object-oriented systems modelling, project team skills and roles, and systems analysis and design in the era of electronic commerce.

Mat215: Mathematical Methods
Fourier Series; Fourier Integration; Laplace Transform; Laplace Transform for solving the Ordinary differential equations; Using Laplace Transform of Derivatives and Integrals.

Mat217: Mathematics (1)
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

Phy203: Vibrations and Waves
Simple harmonic and 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- dimensions. Reflection of a 2- dimensional wave at rigid boundaries.

Geo251: Geographic Information System
Geographic Information Systems (GIS) is a computer-based tool that uses spatial (geographic) data to analyze and solve real-world problems. This course is designed to introduce the student to

the basic principles and techniques of GIS. The lab material will emphasize GIS data collection, entry, storage, analysis, and output using ArcGIS.

Com202: Data Structure

This course gives students strong foundation in the knowledge of data structures and some known algorithms (different searching and sorting algorithms). Then, students will be able to develop appreciation of the relationship between data structures and algorithms. This course covers the design, analysis, and implementation of data structures and algorithms to solve engineering problems using an object-oriented programming language. Topics include elementary data structures such as: arrays, stacks, queues,linked list and lists . It also covers some advanced data structures such as: trees and graphs. Also, students should identify the concept of an abstract data types (ADT) and the tradeoffs between different implementations of ADTs.

Com204: Data Base Systems

The main purpose of this course is to develop an appreciation of the role of database systems, and to distinguish between traditional file systems and database systems. It covers the topics such as: data models (ER, relational, and others); query languages (relational algebra, SQL, and others); implementation techniques of database management systems (index structures, concurrency control, recovery, and query processing); management of semistructured and complex data; and distributed and noSQL databases. Furthermore, student will be prepared to design database systems that meet systems requirements; practice the SQL to create and manipulate database; develop proficiency in designing, implementing, and testing small-scale software application that utilize databases.

Mat224: Mathematical Logic and Boolean Algebra

Math logic: Goals and methods. First order logic. First order recursive arithmetic. Arithmetization of syntax. Gödel's completeness and incompleteness theorem. Other application in computer science.

Boolean algebra: Axiomatic logic gates and other applications. Boolean rings. Fields of sets Representation of finite Boolean algebra. Stone's Representation of finite Boolean algebra.

Sta212: Probability Theory

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)

Com208: Data Communication

The course covers theory and concepts within data communications. It includes layered communication architectures, transmission techniques, protocol design, network organization,

security, implementation techniques and user-to-user data exchange principles. It covers the topics include introduction to data communications and networking, reference models for data communications, protocols at application level, internet programming, fundamental data communications, Local area networks (LAN), and TCP/IP internetworking. It also has practical assignments on network operation, protocol design and implementation.

Com210: Information systems
Information technology provides the tools that enable all organizational personnel to solve increasingly complex problems and to capitalize on opportunities that contribute to the success of the organization. This course is designed to provide students with a foundational understanding of Information Systems (IS) as they apply to the computer industry. It covers topics such as: Information Systems fundamentals, IS infrastructure, organizational and business strategies for Information Systems, Managing Information Systems, Information Systems for commerce and collaboration, business intelligence and Enterprise Information Systems, security, privacy and ethics for Information Systems.

Mat214: Mathematics (2)
Vector Algebra, Line, Surface and Volume Integrals, Gradient, Divergence and Curl, Suffix Notation and its Applications, Integral Theorems, Curvilinear Coordinates, Cartesian Tensors, Applications of Vector Calculus.

Mat216: Graph theory and combinatorics
Graph theory: Bipartite graphs. Directed a cyclic graph and tournament Matching, Gall's Theorem and Berge's theorem as well as algorithms of prime, Dijkstra, Kruskal, and Fard. Fulkerson. Trees connectivity and Menger's theorem. Planarity and chromatic number. Application.
Combinatory: pairing Skirling, formula Recurrence relation and generating functions. The inclusion exclusion principle.

BPh222: Introduction to Biometrics
Measurements of human characteristics to confirm identity, Photographic and video camera technology, Pressure measurement, Heat measurement, Speech recognition, Computer technology.

Bot212: Molecular Genetics
This module gives detailed studies on the molecular aspects of genetics, particularly gene structure, expression and regulation in prokaryotes and eukaryotes. Also, it covers mutations and will concentrate on types of gene mutations, mutants and causes of mutations. Special emphasis will be given to eukaryotic gene expression including details of the different RNA polymerases, mechanisms of RNA processing, and eukaryotic gene regulation emphasizing transcriptional control and transcription factors which interact to regulate gene expression in different tissues at different stages.

Com301: Artificial intelligence

This course is aimed to give an overview of the Human Intelligence System with respect to acquisition of Knowledge, organization of knowledge, analyzing problems, and usage of knowledge for solving problems. This course will enable the students to design computer programs with artificial intelligence. Various heuristic search algorithms are also introduced to solve AI problems.
Topics include elementary Intelligent Systems such as: AI methodology and fundamentals; intelligent agents; search algorithms; game playing; supervised and unsupervised learning; decision tree learning; nearest neighbour methods; dimensionality reduction; clustering; kernel machines; support vector machines; uncertainty and probability theory; probabilistic reasoning in AI.

Com303: Advanced Object-Oriented Programming
This course is to equip students with advanced design and programming techniques in the object-oriented programming paradigms. It continues the presentation object-oriented programming begun in Com201, with an emphasis on web programming, client-server processing and database utilization. It enhances the using of object-oriented features such as encapsulation, information hiding, inheritance and polymorphism in large projects.

Com305: Computer Organization and Architecture

The purpose of the course is to provide an understanding of the fundamentals of the computer organization and architecture knowledge area in order to prepare the students for related advanced courses and to prepare them for career in the design of computer systems.

Topics include elementary Computer organization and architecture such as: Overview of computer architecture and organization, Assemblers and Linkers, Instruction Set Architecture, Processor systems design, An Overview of Pipelining, Memory Technologies and Hierarchies, Interfacing and Communication with Input/Output devices.

Com307: Software Engineering
This course covers the software development process, from requirements elicitation and analysis, through specification and design, to implementation, integration, testing, and maintenance (evolution). Also, it investigates variety of concepts, principles, techniques, and tools are presented, encompassing topics such as software processes, project management, people management, software requirements, system models, architectural and detailed design, user interface design, programming practices, verification and validation, and software evolution.

Com309: Modeling and Simulation
This course introduces various system modeling and simulation techniques, and highlights their applications in different areas. This course begins by demonstrating the usefulness of simulation as a tool for problem solving in business, industry, government, and society. It includes modeling, design, simulation, planning, verification and validation. It discusses the fundamentals and techniques for designing and using simulation, modeling, and optimization algorithms with applications in system performance modeling, business infrastructure modeling, and distributed and parallel computing. It covers the topics: Basic Model Forms, Basic Simulation Approaches, Handling Stepped and Event-based Time in Simulations, Discrete versus Continuous Modelling, Numerical Techniques, and Sources and Propagation of Error. After learning the simulation

techniques, the students are expected to be able to solve real world problems which cannot be solved strictly by mathematical approaches.

Com311: Data Mining

This course is an introductory course on data mining. It introduces the basic concepts, principles, methods, implementation techniques, and applications of data mining, with a focus on two major data mining functions: pattern discovery and cluster analysis. In pattern discovery, the course focuses on why pattern discovery is important, what the major tricks are for efficient pattern mining, and how to apply pattern discovery in some interesting applications. Also, it provides students the opportunity to learn concepts, principles, and skills to practice and engage in scalable pattern discovery methods on massive data; discuss pattern evaluation measures; study methods for mining diverse kinds of frequent patterns, sequential patterns, and sub-graph patterns; and study constraint-based pattern mining, pattern-based classification, and explore their applications. In cluster analysis, the course covers the basic concepts of cluster analysis (clustering) and then studies a set of typical clustering methodologies, algorithms, and applications. This includes partitioning methods, such as k-means, hierarchical methods, such as BIRCH, density-based methods, such as DBSCAN, and grid-based methods, such as CLIQUE.

Mat313: Operation research

Nonlinear programming (NLP), Convex sets, Convex and Concave Functions, Solving NLPs with One Variable, Golden Section Search, Unconstrained Minimization with Several Variables, The Method of Steepest Ascent, Lagrange Multipliers, The Kuhn–Tucker Conditions, Definition of Quadratic Programming, Wolfe's Method for Solving Quadratic Programming, The Method of Feasible Directions, Multiobjective NLP problem, Pareto Optimality and Trade-Off Curves, Scalaration of (MONLP), Parametric NLP and MONLP Optimization.

Mat323: Mathematics (3)

Basic concepts definition of order, degree, solution of differential equation, formulation equation. Equation of the first order and first degree (separation variable, homogeneous, Exact equation, Integratory factor, Bernoulli equation). Equation of the first order and first but not the degree, Equation solvable for (x,y), Lagrangian,s, Clairaot,s equation. Linear equations with constant coefficients, Definition, Auxiliary equation complementary function, Determination of particular integeral (solution). System of differential equations. Application and modeling (Population Dynamics, Orthogonal trajectories, Economics infected diseases)

BPh327: Principle of Bioinformatics

Introduction to Bioinformatics, Biology and Bioinformatics, Genomics and Proteomics, Computers in Biology and Medicine, computer algorithms, Biological Macromolecules, Topics covered include: central dogma and introduction to macromolecular sequences; Genome Analysis, sequencing methods and physical mapping of genomes; genome data and databases, Databases and Search Tools, 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; amphipathic and hydrophobicity analysis and membrane structure, structure modeling with

PDFs; hidden homology in proteins using Markov models and hidden homology from structural criteria, Proteome Analysis, Recent issues in bioinformatics.

Phy327: Principle of Physical optics

Physical Optics. 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 - 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 - Nickol prism, Polarization and dispersion of light. Circular and elliptical polarization.

Com302: Operating Systems

This course provides an introduction to the internal operation of modern operating systems. The course covers the topics: overview of operating systems, functionalities and charateristics of OS, the concept of a process, operations on processes, process states, concurrent processes, process control block (PCB), interrupt processing, operating system organisation, scheduling algorithms, problems of concurrent processes, critical sections, mutual exclusion, synchronisation, deadlock: prevention, detection, avoidance, banker's algorithm. It also covers memory organisation and management, storage allocation, virtual memory concepts, paging and segmentation, address mapping, secondary storage management, disk components, disk scheduling.

Com304: Computer Networks

This course is an introduction to the theory, design, engineering, and installation of networks to connect digital computers. It explains the instructions in networking technologies and their implementation. It covers the topics include introduction to computer networks, the OSI reference model, network software and network standardization, data communications, physical layer, transmission medium, data link layer, medium access control sub-layer, network layer, transport layer, networking devices.

Com306: Machine learning

This course familiarizes students with a broad cross-section of models and algorithms for machine learning and prepare students for research or industry application of machine learning techniques. It covers the topics: supervised learning (generative/discriminative learning, parametric/nonparametric learning, neural networks, and support vector machines); unsupervised learning (clustering, dimensionality reduction, kernel methods); learning theory (bias/variance tradeoffs; VC theory; large margins); and reinforcement learning and adaptive control. The course also discusses recent applications of machine learning, such as to robotic control, data mining, autonomous navigation, bioinformatics, speech recognition, and text and web data processing.

Com308: Theory of Automata

This course introduces some fundamental concepts in automata theory and formal languages. It deals with the concept of computability and mathematical models, such as finite automata, grammars and Turing machines, and the relations between these models. The course covers topics: automata (finite automata, stack automata, Turing machines), determinism and non-determinism, regular expressions, transformation from regular expressions to finite automata and

conversely, minimization of deterministic finite automata, formal languages (grammars, Chomsky's hierarchy, in particular context-free grammars and regular grammars, closure properties), the relation between grammars and variants of automata, the pumping lemmas for regular and context-free languages, the universal machine, the halting problem and other undecidable problems, and Rice's theorem.

Com310: Web programming
This course provides an introduction of web-development techniques that use HTML, CSS and JavaScript as a web development essential including database connectivity (JDBC), Basics of PHP, Basics of Java for Web Development and Basics of Asp.Net as an advanced technique of web programming. This course enables students to learn about the relationship between clients and servers, how web pages are constructed, and how the internet works. It examines several technologies in depth: HyperText Markup Language (HTML) for authoring web pages, Cascading Style Sheets (CSS) for applying stylistic information to web pages, JavaScript for creating interactive web pages, Asynchronous JavaScript and XML (Ajax) for enhanced web interaction and applications, PHP Hypertext Processor for generating dynamic pages on a web server, and Structure Query Language (SQL) for interacting with databases.

Com312: Advanced database
This course builds on the introductory course in databases Com204. It intends to introduce more advanced topics in databases such as data mining and data warehousing, distributed databases and client server architecture after introducing the DBMS implementation. It may cover the topics: introduction (concepts and definitions), normalization techniques, data mining and data warehouse, transaction processing, concurrency control, distributed databases, database security, and temporal database.

Mat312: Numerical Analysis
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.

Sta314: Stochastic processes
Data collections with sampling. Parametric and Statistic, Data description using measures of central tendency (mean, median, Mode, Geometric mean, Harmonic mean weighted mean), measures of variation (Range, variance, coefficient of variation), Frequency distributions and graphs (like Histogram, Frequency polygon, Bar charts, Time series, Stem and leave) Cumulative frequency distribution, measures of skewedness and kurtosis, measures of positions (e.g. quartiles, decals). Exploratory data analysis using box plots. Simple correlation and regression and coefficient of determination.

Com401: Applied Field Training
Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the

industry and public sector and shall increase contact and acceptance between the university and industry.

Com403: Neural Networks
This course offers students an introduction to artificial neural networks. It covers models for various applications, how ANNs are trained and tested, and how they can be deployed in real-world applications. The course starts with the introduction of neural networks, and continue with Hebb and perceptron algorithms, which are fundamentals of classication in neural networks. Then it covers the topics: how neural networks learn, mathematical background, simple perceptrons, multi-layer feed forward networks, backpropagation learning, regression with neural networks, classification with neural networks, recurrent neural networks, deep learning systems, Hopfield netowrks and symmetrically connected networks, and Kohonen self-organizing maps. This course uses the Python programming language to build working models and classifier systems using the architectures discussed.

Com405: Computer Graphics
This course provides an introduction to the theory and practice of computer graphics. The course covers the topics: an introduction to the basic concepts; 2D/3D transformation including scaling, translation, shearing, reflection, and rotation; graphics pipeline; data structures for graphics; geometry representation; OpenGL programming; vertex processing; lighting and shading; rasterization including line drawing and line/polygon clipping; ray casting; ray tracing; computer graphics in games; and visualization.

Com407: Programming with JAVA
This course provides the students with a guide to developing applications using the Java programming language. Java can be used to build visually interesting graphical user interface (GUI) and Web based applications. This course covers all topics of fundamental programming. Concretely it covers: Creating Java Programs; Using Data; Using Methods, Classes, and Objects; Making Decisions; Looping; Characters and Strings; Arrays; Introduction to Inheritance; File Input and Output; Introduction to Swing Components; Graphics; and Advanced concepts (Threads, Processes).

Com409: Advanced Operating Systems
This course builds on the introductory course in operating systems Com302. This course aim to study, learn, and understand the main concepts of advanced operating systems: parallel processing systems, distributed systems, real time systems, network operating systems, and open-source operating systems. This course includes the following topics: Hardware concepts of distributed systems, Software concepts and design issues, Communication in distributed systems, Threads and thread usage, Multithreading operating system, Client-server model, Implementation of Client-server model, Remote procedure call, Implementation of remote procedure call, Synchronization in distributed systems, Clock synchronization, Mutual exclusion, Election algorithms, Transaction and concurrent control, Deadlock in distributed systems, Processor Allocation, Real-time distributed systems, Distributed file systems.

Com411: Expert Systems

This course is an introduction to expert systems. In this course the students will learn the methodology used to transfer the knowledge of a human expert into an intelligent program that can be used to solve problems or give advice. The course covers the topics: basic components of an expert system; techniques for the construction of expert systems including computer inference and knowledge acquisition; knowledge representation schemes; conceptual date analysis; plausible reasoning techniques; validation and measurement methods; production-rule programming.

Com413: Selected topics in Computer Science
This course will survey current areas where computer science approaches have been applied. It studies the selected topics in current research and recent developments in computer science.

Com415: Embedded systems
The course includes discussions of different types of embedded systems and their properties. It covers the following topics: characteristics of embedding computing applications; concept of real-time systems; challenges in embedded system design; design process; embedded system architecture; designing embedded computing platform; programming embedded systems; operating system; network based embedded applications; embedded control applications; and embedded system development.

Com402: Graduation Project
This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Com404: Image Processing
This course is designed to give undergraduate students all the fundamentals in 2D digital image processing with emphasis in image processing techniques, image filtering design and applications. It covers the topics: digital image fundamentals; image transforms; image representation; image enhancement in the spatial and frequency domains; image restoration; image compression; image segmentation; and object recognition;

Com406: Computer Security
This course provides basic knowledge about computer and network security. Students are expected to learn a brief knowledge about multiple topics in computer security that would help them to develop secure applications and familiarize them with the well-known security topics and terminology.
It covers the following topics: The meaning of computer security, Security models, Program security, Operating system security, Database security, Network security, Computer crime, Legal and ethical issues.

Com408: Compiler Design
The aim of this course is to show how to apply the theory of language translation to build compilers and interpreters. The construction of a compiler/interpreter for a small language is a necessary component of this course, so students can obtain the necessary skills. This course

introduces topics include: Introduction to Compilers, Lexical Analysis, Syntax Analysis, Parsers Implementation, Semantic Analysis, Intermediate Representation, Code generation and Code optimization, Error Detection and Recovery, Error Repair, Compiler Implementation, and Compiler design options and examples: C, C++, and Java Compilers.

Com410: Pattern Recognition

This course focuses on the underlying principles of pattern recognition and on the methods of machine intelligence used to develop and deploy pattern recognition applications in the real world. It covers the following topics: introduction to patterns and pattern recognition application development; Feature extraction (multivariate data - image data); Supervised pattern detection (Bayes classifiers, linear classifiers, non-linear classifiers, neural networks, support vector machines, and rule-based classifiers); Unsupervised pattern detection (clustering, self-organization, and competitive learning); Deep learning; convolutional neural networks; Fuzzy logic; genetic algorithms; and Sensor and data fusion.

Com412: Intelligent Systems

This course explores the essential theory behind methodologies for developing systems that demonstrate intelligent behavior including dealing with uncertainty, learning from experience and following problem solving strategies found in nature. It covers topics include introduction to knowledge based intelligent systems; Rule-based expert systems; Uncertainty management in rule-based expert systems; Fuzzy expert systems; Evolutionary computation; Hybrid intelligent systems; Knowledge engineering; and Data mining and knowledge discovery.

Com414: Advanced Programming with JAVA

This course is a continuation of Com407. It discusses advanced topics in Java SE (Standard Edition) including Graphical User Interface using Swing, event handling, file input/output, collections, multi-threaded applications, and database connectivity. Additionally, it covers the following major skills: Multi-threaded programs, Collections framework, User Events, Databases, and Connectivity.

Com416: Mobile Application Development

This course focuses on the creation of mobile solutions for various modern platforms, including major mobile operating systems. It explains major topics include mobile device architecture, programming languages, software engineering, user interface design, and application distribution. The topics to be covered in the course include: Client Hardware (Desktop vs. Mobile), Android Development w/ Java, iOS Development w/ Swift, RESTful and Non-RESTful apps, Creating and Incorporating Web/Cloud Services, Mobile Sensors, Security and Trust Management, Privacy and Ethics, Usability, and Accessibility.

Tanta University
Faculty of Science
Department of Physics

Program Title	**Physics**
Program Type	**Single**
Department(s)	**Physics**

Phy201: Experimental Physics (1)
Meld's Experiment -Discharge Curves of A capacitor. Moment of Inertia of A fly Wheel - Newton's Rings. Abbe Refractometer. The Photoelectric Cell- The Compound Pendulum- The Diffraction Grating. The Specific Rotatory Power. The Metallic Rectifier. The Spectrometer. Rayleigh's Potentiometer. Dielectric Constant. Damped oscillation.

Phy203: Vibrations and Waves
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- dimensions. Reflection of a 2- dimensional wave at rigid boundaries.

Phy205: Physical Optics
Physical Optics. 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 - 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 - Nickol prism, Polarization and dispersion of light. Circular and elliptical polarization.

Phy207: Electromagnetism (1)
Revision of scalars, vector quantities, scalar and vector fields. Mathematics of vector and their physical meanings. The three coordinate systems used in the course. Coulomb's law in vector

notation – problems on 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. Formulation of Gauss law. Applications of Gauss's law – problems. First Maxwell equation under static conditions–the divergence of the displacement vector. Work done to move a charge in an electric field, potential and potential difference in vector notation. Potential gradient.

Phy209: Analytical Mechanics

Gravity and gravitational force and energy. Kepler's laws of planetary motion and orbital energies. Dynamics of systems of particles. Motion of interacting bodies. Collisions and impulse in collision.

Motion of a body with variable mass – Rocket motion. Mechanics of rigid bodies and planar motion. Moment of inertia- Calculation of the moment of inertia. The "upside-down pendulum"- elliptic integral. A general theorem concerning angular momentum. Motion of rigid bodies in three dimensions. Lagrangian mechanics.

Phy211: Acoustics

ACOUSTIC WAVES, Waves, Plane Waves, Sound Pressure and Intensity, Reflection and Transmission at a Boundary, Wave Attenuation, Spherical Waves, Surface Waves on Water and solids. Scattering, Attenuation, Scattering by Solid Objects, Scattering by Bubbles. ACOUSTIC SOURCES AND RADIATION, Sound Generation, Simple Spherical Source, Mechanical and Acoustic Impedance, Source near a Reflector, Radiation from an Open Pipe, Acoustic Sources and Power. PIPES AND HORNS, Acoustic Elements, Pipes and Tubes, WaU Losses, Helmholtz Resonator, Simple Horns, Directionality of a Horn, Higher Modes in Horns. HIGH-FREQUENCY AUDITORY MODELS, High Frequencies, Horn-Loaded Simple Ear, Pipe-Coupled Ears, Complex Systems, THE INNER EAR, Neural Transducers, The Transduction Problem, A Frequency-Dispersive Membrane, Cochlear Mechanics, The Middle Ear, Active Cochlear Response. MECHANICALLY EXCITED SOUND GENERATORS, Sound Production, Impulsive Excitation, Frictional Excitation, Harmonics, Mode Locking, and Chaos. SIGNALS, NOISE, AND INFORMATION, Communication, Time and Frequency, Signals and Noise, Animal Sonar. Ultrasound waves medical imaging. Doppler Imaging Techniques. Exposimetry and sonoporation. Recent issues in acoustics.

Phy213: Applied Physics

Experimental techniques in solid state, material science laser, plasma, and medical applications.

Concepts of Measurement systems, Instrument transformation, potentiometers, power measurements, measurement of energy, cathode ray oscilloscope, sensors and transducers.

Phy215: Scientific Programming

Matrices and arrays, Variables, Calling functions, Programming and scripts, Expressions, Entering commands, Indexing, Types of arrays, Control flow, Scripts and functions, Basic plotting functions, 2D and 3D plotting, Creating mesh and surface plots, Plotting image data, Printing graphics, Handle graphics objects, applications: Linear Algebra, Operations on nonlinear functions, Multivariate data, and Data analysis.

Phy217: Mathematical Physics (1)

Matrices. Vector spaces. Normal modes. Vector calculus. Line integrals. Surface integrals. Volume integrals. Integral transforms. First order ordinary differential equations. Higher order ordinary differential equations.

Mat213: Differential Equations and Their Applications

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 (vibration of stretched and flexible string, D'Alembert solution of the wave equation.

Mat215: Space Geometry

Cartesian coordinates in space - cylindrical coordinates - spherical coordinates - Lines in space - the parametric and the symmetric equations of lines - angle between two lines - the perpendicular distance from a point to the line, equation of the plane - normal, symmetrical, and general equation of the plane, angle between two planes, the intersection of two planes - the perpendicular distance from a point to a plane - surface in space - quadratic surfaces in three variables - equation of the sphere, intersection of a sphere and a line - intersection of a sphere and a plane, intersection of two spheres - sphere through a given circle - tangent plane - condition for two sphere to be orthogonal, simplified form of the equation of two sphere - definition of a cone –vertex - guiding curve – generators - equation of the cone with a given vertex and guiding curve

Phy202: Experimental Physics (2)

Frequency of ac source -Impedance of a series circuit. Impedance of a parallel R.L.C circuit, Variation of Impedance and current of a series R.L.C circuit with frequency. Loss in capacitor, Hay Bridge. Energy gap of semiconductor. Resistivity of an electrolyte solution. Characteristics of P.N.P Transistor. Characteristics of a diode valve, Thermodynamic cycle. Verification of Malu´s law. e/m, magnetic field of paired coils. Fresnel´s biprism. Hysteresis loop of magnetic material.

Phy204: Thermodynamics

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 temp. 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. Expansivety 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.

Phy206: Electromagnetism (2)

Current - current density - Current continuity equation. Boundary conditions in a conductor. Properties of conductors - exponential decay of charge density in conductor. Boundary conditions for prefect dielectrics

Poisson's equation and Laplace's equation. Magnetic field Biot&Savart law. Ampere's law and their applications. 2nd Maxwell equations. 3rd Maxwell equations. Magnetic flux and magnetic flux density. Maxwell's fourth equation under static conditions

Phy208: Alternating Current and Electronics

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, equations of a circuit containing resistor and capacitor in series. Resistors, capacitors and inductors in series. Resonance in series connection circuits. Parallel connections (resistor and capacitor, resistor, capacitor and inductor). Multi- element circuits. Complex connection circuits (parallel- series). 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: - Zener diode approximation. Diode circuits: full and half - wave rectifiers' Zener diode regulator - voltage multipliers - voltage doublers and limiters.

Phy210: Modern Physics

Modern Physics. Fundamentals of the Special theory of Relativity. Black Body Radiation. Waves and Particles. Bohr model and Hydrogen atom. Some topics in solid state physics related to modern physics. Introduction to Lasers and Masers.

Phy212: Mathematical Physics (2)

Fourier analysis, Laplace transforms, ordinary differential equations, series solutions of ordinary differential equations, partial differential equations.

Phy214: Astronomy

Introduction – Astronomical unit-the light year- Parsec - Galaxies-Types of galaxies- spiral galaxies (normal and Barred spiral)- Elliptical galaxies-Lenticular galaxies- irregular galaxies- Galactic clusters and mergers- The principle parts of galaxies. Milky way galaxy. Celestial coordinates-Horizontal coordinates- Altitude – Azimuth - Equatorial Coordinates – Declination - Right Ascension - Hour Angle. Star Formation and born - Main Sequence Stars - Stars and Their Fates- White Dwarfs- Novae - Supernovae Leave - Neutron Stars- Black Holes- Stellar Magnitudes- Stellar Spectra – classification and types of stars. Time estimation- Standard Time- Time and longitudinal - World Time Zones. The International Date Line- Solar Day - Sidereal Day - Tropical year - Sidereal Year - Animalistic Year- Ecliptic Year- Giuliani Calendar - Gregorian calendar- Hijri calendar. Greenwich Line - Civil Time - Local Time - Equation of Time. Solar system- Solar system bodies- CLASSIFICATION OF PLANETS- Kepler's Laws - Physical properties of planets- Some planetary positions as they orbit around the sun – Elongation - Pairing - quadrature mode- Bode's law. Astronomical observations and monitoring- Function of the Telescope- Telescope components – Objective – Eyepiece – Amplification Power-Field of view - Optical System of trlescopes - Refractor – Reflector – Catadioptric - Chromatic Aberration- Spherical Aberration – Coma – Astigmatism.

BPh216: Introduction to Biophysics

Dynamics of extended bodies. Applications to Muscles and Joints. Elastic properties of material. The mechanics of non-viscous materials. Blood pressure measurement and continuity equation. Nerve conduction and properties of an Axon. Radiations and matter. Radioactive decay. Heat. Electric current. Applications. Practical experiments related to the course during the whole semester.

Chm226: Photochemistry

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.

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.

Chm228: Industrial Chemistry

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.

Phy301: Experimental Physics (3)

Transistors. Zener diode. Root mean square (RMS) of sine, square and sawtooth waves. Rectifiers Microwave wavelength polarization and diffraction of microwave. Low pass filter. High pass filter Geiger Muller counter. Electrostatic lenses.

Phy303: Statistical Physics

What is statistical Mechanics? Ensembles and Definitions. Distribution law. Boltzmann statistics MBS. Problems in Derivation of MBS. Alternative Derivation of MBS. Examples of counting in statistical Mechanics. Fermi Dirac Statistics F.D.S, Bose- Einstein statics 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.

Phy305: Quantum Mechanics (1)

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. Step potentials. Unbound states, Barrier problems. Tunneling. Harmonic oscillator. The wave function of normal state of H atom. The energy state of H atom and other application.

Phy307: Atomic Physics
Waves and Particle - De Brogile 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 equations 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. Alpha- particle scattering- Rutherford scattering formula. Bohr's atomic model – The three Bohr's Assumptions – Characteristics of the Bohr circular orbits. Atomic spectra – Wien's displacement law – the quantum theory. The spectrum- Spectroscopy- Spectrum analysis –Different types of spectra. Atomic spectral lines – absorption spectrum – spectrometers.

Phy309: Analogue Electronics
Semiconductors and their role in electronics. 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- examples). 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).

Phy311: Computational Physics
Solving non-linear equations, Eigenvalues and Eigenvectors, Fourier Methods, Numerical Differentiation, Numerical Integration, Ordinary Differential Equations: Initial-Value Problems, and Ordinary Differential Equations: Boundary-Value Problems.

Phy313: Introduction to Environmental Physics
Forces in nature, Elementary particles. Radiation Units and quantities, stopping power, Cavity theory. Hot Particles Problem: formation, release and health hazard. Radiation Dosimeters. General principles for the establishment of nuclear radiation detectors. Different types of energy resources. Earth Climate and Climate change. Radiation Safety Sound and noise & Heat and radiation. Environmental Problems: Air pollution, Water pollution. Global warming: causes global warming, greenhouse effect.

Phy317: Renewable Energy Physics
The energy problem- energy transformation. Power and energy- solar energy- balance equation. Global warming- green house gases- electrical energy- nuclear fission- nuclear fusion. Breeder reactor – nuclear fusion reactors- renewable energy. Solar energy- advantages of solar energy – reappraisal of solar energy- characteristics of Sun. The electromagnetic energy spectrum – spectral distribution of solar radiation. Solar collectors- flat plate collector – thermal losses and energy balance equation. Ways of decreasing losses in the solar collector-concentrating (focusing) collectors – the advantages of concentrators systems over flat plate type collectors. Other thermal applications of solar energy. Storage of solar energy. Photovoltaic principles - photovoltaic power generation. Wind energy- wind turbine setting. The types of wind turbines- advantages and disadvantages of wind turbines. Hydropower- biomass- geothermal energy.

GPh323: 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.

Geo315: Remote Sensing
Principals of remote sensing, Electromagnetic energy (sources and interaction), Spectral reflectance curves and libraries, Sensors and platforms, Airborne and Spaceborne, remote sensing, Multispectral scanners and missions, Different satellite data types and applications, Pre-processing techniques (Radiometric and Geometric corrections), Image Enhancement and visualization, Image color composites, Image Fusion, Visual image interpretation, Principal of digital image processing, Supervised and unsupervised image classification algorithms, Validation of the classified maps, Principal and interpretation of imaging radar, Remote sensing below the grounds surface, Geological remote sensing, Methods of rock units discriminations, Remote sensing geomorphological, structural and mineral exploration applications, Groundwater indicators by remote sensing.

Chm333: Physics of Polymers
General notions, classification criteria, structure of macromolecular compounds. Aggregation and phase states, transition temperatures. Elements of polymerization reaction thermodynamics. Physico-chemical properties of polymer materials of interest in applications. Polymer materials with special properties: intelligent composite materials, interpenetrated polymer networks, drug carrier polymers, metallocene, polymers with biomedical applications, polymer membranes, carbon fibers and carbon fiber composites, conductor and semiconductor polymers, polymer sensors, biodegradable polymers. |Techniques for complex polymer materials characterization. Applications in making of polymers with selected surface properties.

Phy302: Experimental Physics (4)
CRT experiment. Microwave. Phase angle. Voltage doublers. Determination of mass absorption coefficient of lead. Band pass filter. e/m experiment. Photoelectric effect.

Phy304: Crystallography
Introduction to crystallography and overview. Crystallographic calculations. Properties of crystal structures. The seven crystal systems. Crystal bonding. Defect in crystals. The theory of diffraction of X-ray in crystals. Determination of the direction and intensities of diffracted X-ray beams. Calculation of the structure factor and using it in diffraction problems. The reciprocal lattice and reciprocal space. The expression of diffraction phenomena in terms of the reciprocal lattice.

Phy306: Laser Physics
Introduction: 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.

Phy308: Electrodynamics (1)

Revision of Maxwell's equations in point form and in integral form under static conditions, The steady magnetic field – magnetic flux – the scalar and vector magnetic potentials, Magnetic forces – Torques, The nature of magnetic materials - Magnetization and permeability, Magnetic boundary conditions, Potential energy and forces on magnetic materials – Inductance, Time-varying fields (Faraday's law – displacement current), Maxwell's equations in point form and in integral form under time varying conditions, Wave motion in free space and in perfect dielectrics.

Phy310: Nuclear Physics

Basic properties of nucleus. The nuclear atom – stable nuclei. Properties of nuclear states. Nuclear structure – binding energy. Nuclear separation energy. Nuclear force – potential energy. Nuclear models – liquid drop model. Shell model – problems. Nuclear decay modes. Radioactive decay – problems. Nuclear reaction – cross section – kinematics. Types of nuclear reaction. Determination of excitation function and angular distribution.

Phy312: Detectors and Accelerators

DC accelerators – Linear accelerators – Circular accelerators – Accelerator components – Wave guides – Equation of motion – Particle trajectory and transfer matrices – Dispersion and momentum compaction – Beta function and betatron oscillation – Beam emittance - Phase space and Twiss parameters – Synchrotron oscillations - Synchrotron radiation – coherent and incoherent radiation – Insertion devices – Beam diagnostics.

General characteristics of detectors (Sensitivity, resolution, efficiency …..etc) – Ionization detectors (ionization chamber, proportional counter – Geiger counter) – Scintillation detectors (Scintillation mechanism, types of scintillation materials, operating parameters, noise) – Semiconductor detectors (semiconductor properties, doped semiconductors, depletion layer, compensation, diffused junction detector, silicon surface barrier detector and lithium drift silicon detector) – Neutron detectors (neutron classification, detection through nuclear reaction for slow neutrons, detectors based on Boron reaction, fast neutron detection)

Phy314: Reactor Physics

Types of nuclear energy (fission – fusion). Radio isotopes. Neutron classification. Interaction of neutrons with matter. Fission chain reaction. Reactor flux spectrum. Several types of reactors. General considerations for designing reactors.

BPh310: Medical Physics

Historical background; radiation interactions; general imaging concepts; and contrast mechanisms. Medical Imaging Methodology: For all clinically applicable imaging techniques, contrast mechanisms imaging with ionising radiation, including X-ray, CT, nuclear medicine,

SPECT and PET; imaging with non-ionising radiation, including MRI and ultrasound; and general principles of image reconstruction and registration of images over time and between modalities. Clinical Applications of Physics: Clinical examples of the utility of medical imaging in diagnosis and treatment of disease. Sensing applications of physics in hospitals, including patient monitoring, Therapeutic applications of physics, particularly radiotherapy in cancer patients: Historical background; radiation interactions; general imaging concepts; and contrast mechanisms. Recent issues in medical physics.

Phy320: Radiation Physics
Preliminary notions and definitions. Interaction of charged particles with matter. Energy loss of electrons and positrons, energy loss distribution. Interaction of photons with matter. Interaction of neutrons with matter. Environmental radioactivity. Cosmic radiation. Radiation Dosimetry – Assessment. Dose measurements – dose calculations – other dosimetric Quantities. Chemical effects of radiation. Biological effects of radiation. Radioactive dating methods. Radioisotopes in industry.

Phy401: Applied Field Training
Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Phy403: Experimental Physics (5)
The diode limiter, The solar cell: determination of the efficiency fill factor, Laser: Determination of wavelength, distances between gratings in a diffraction grating, Thermistor, X- ray: determination of lattice parameter of a crystal, De Sauté and Schering bridges, Revision and discussions, Assessment, Rejected T – filter, L- R- C filter, Two stage RC filter in cascade.

Phy405: Molecular Physics
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, Revision and assessment, 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.

Phy407: Plasma Physics
Fundamentals of plasma: introduction to gas discharges, Definition and 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. Plasma theories: Single Particle model,

Kinetic theory, and Fluid models. Plasma theories: Single Particle model, Kinetic theory, and Fluid models. Dusty Plasma.

Phy409: Electrodynamics (2)
Plane waves in lossy dielectrics – the Poynting vector and power consideration, Propagation in good conductors: skin effect, Transmission lines, Wave Guides: Introduction, Rectangular Waveguides, Transverse Magnetic (TM) Modes, Transverse Electric (TE) Modes, Wave Propagation in the Guide, Power Transmission and Attenuation, Waveguide Current and Mode Excitation, and Waveguide Resonators. Antenna. Electromagnetic theory and relativity: Brief introductions to Einstein postulates.

Phy411: Solid State Physics
Introduction to solid state physics - The free electron theory : Free levels in one dimension, Free electron gas in three dimensions, Electrical conductivity – Motion in magnetic field-Wiedemann-Franz law, Nearly free electron model - origin of the energy band, Bloch functions - Proof of Bloch's Theorem in 1-D- Kronig Penney model, Semiconductor materials: Bonding Forces and Energy Bands -Charge carriers in semiconductors -excess carriers in semiconductors, Dielectrics. Dielectric constant, Ferroelectrics: Ferroelectric crystals, Piezoelectricity.

Phy413: General Theory of Relativity
Tensor Analysis- General theory of relativity - The assumptions of the theory - Planetary motion - Deviation of a ray of light - Red shift phenomenon.

Phy415: Physical Properties of Solids
Introduction: Importance of studying physical properties of materials. Electric and ionic conduction – conductivity. Energy band structure and electronic mobility. Dielectric materials. Ferroelectricity – piezoelectricity. Magnetic classification of materials-Effect of temperature on magnetic properties- domains and hysteresis. Superconductivity. Optical properties (light interactions with solids- refraction and reflection-luminescence- photoconductivity- optical fibers).

Phy417: Special Functions
What are special functions? Bessel function- Legendre polynomials - Lagrange function- Fourier transform -Delta function. Their applications in physics problems.

Phy419: Cosmic Rays
An Overview of Multimessenger Astrophysics, Charged Cosmic Rays in Our Galaxy. Direct Cosmic Ray Detection. Indirect Cosmic Ray Detection. Diffusion of Cosmic Rays in the Galaxy. Galactic Accelerators and Acceleration Mechanisms. The Extragalactic Sources and UHECRs, The Sky Seen in gamma-rays. The TeV Sky and Multiwavelength Astrophysics. High-Energy Neutrino Astrophysics. Atmospheric Muons and Neutrinos. Low-Energy Neutrino Physics.

Phy402: Graduation Project
This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Phy404: Experimental Physics (6)
Audio frequency oscillator, High frequency oscillator, Crystal oscillator, the transistor as an AC amplifier, Transistor multivibrator, Schmitt trigger, Boltzmann constant, X- rays: Determination of linear absorption coefficient of materials.

Phy406: Quantum Mechanics (2)
Solving Schrödinger equation for a free particle in a box and for a 3D Harmonic oscillator; Angular momentum operators in Cartesian and Spherical coordinates, commutations, eigenvalues and eigenfunctions for central potentials; Solving Schrödinger equation for periodic potentials, Bloch wave-function, Hydrogen atom: eigenvalues, eigenfunctions, energy spectrum, Zymann effect, quantum numbers, Stern-Gerlach experiment. Time-independent, non-degenerate perturbation and Variational method, problems. Scattering: Partial wave analysis and Born-approximation, problems.

Phy408: Solar Energy Physics
Introduction : The sun as a source of clean and renewable energy source, Basic principles of heat transfer, Dimensionless numbers and their physical meanings, Nusselt Number , Reynolds Number, Prandtl Number , Rayleigh number and Fourier 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.

Phy410: Digital Electronics
Introduction: Binary numbers, Octal numbers & Hexadecimal numbers, Codes: Weighted binary codes and non-weighted binary codes, Basic logic gates: AND , OR, NOT, Electronic 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, Assessment, Addition and subtracting Digital 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 and 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, Different types of D/A and A/D converters , Applications and Revision.

Phy412: Laser Systems and their Applications
Laser systems and applications: Revision of basics of Laser physics – working principles- main components- Laser modes, Types of Laser: Solid state Laser- Ruby Laser Nd-Yag Laser- He-Ne Laser, Argon Laser- CO_2 Laser – semiconductor Laser, Application of Laser, Scientific research applications. Medical applications of Laser, Industry applications of Laser, Defense applications of Laser.

Phy414: Superconductors

Revision of fundamentals of solid state physics - Phenomenon of Superconductivity, Revision of basics of Electrodynamics and Thermodynamics, Thermodynamics of superconductors; the theory of diffusion in solids, Calculations in crystal structures- perovskite structure -close packing in solid crystals - packing and defects-Intermediate state of superconductors, Different types of superconductors, vortices ,the first and second critical magnetic fields, Microscopic - theory of superconductivity - thermoelectric effect, IR spectroscopy, Electronic spin resonance, Tunnel effect in superconductors, Josephson effect.

Phy416: High Energy Physics

Historical introduction to the elementary particles, Elementary particle dynamics I, Relativistic kinematics, Symmetries - Bound states, The Feynman calculus, Quantum electrodynamics: electrodynamics and chromodynamics of quarks I, Quantum electrodynamics: electrodynamics and chromodynamics of quarks II, Weak interactions – gauge theories, Neutrino oscillations, Revision and open discussion.

Phy418: Astrophysics

Solar System: An Introduction to Comparative Planetology, Earth: Our Home in Space, Moon and Mercury: Scorched and Battered Worlds, Venus: Earth's Sister Planet, Mars: A Near Miss for Life?, 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, The Sun: our parent star, Measuring the stars: giants, dwarfs and the main sequence, The solar neighborhood, Luminosity and apparent brightness, The interstellar medium and matter ; Gas and dust among the stars, Emission Nebulae, Star formation :A traumatic birth, Stellar evolution - Stellar explosions: Novae and supernovae and the formation of elements, Neutron stars and black holes, The milky way galaxy – galaxies and dark matter, Cosmology; The big bang and the fate of the universe.

Phy420: Condensed Matter Physics

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 eath 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, Binary and ternary systems, Some physico-chemical properties of some glasses, Magnetic, electrical and optical behavior of some chalcogenide glasses.

Tanta University
Faculty of Science
Department of Physics

Program Title	**Material Science**
Program Type	**Single**
Department(s)	**Physics**

MSc201: Material Science Lab (1)
Meld's Experiment -Discharge Curves of A capacitor. Moment of Inertia of A fly Wheel - Newton's Rings. Abbe Refractometer. The Photoelectric Cell- The Compound Pendulum- The Diffraction Grating. The Specific Rotatory Power. The Metallic Rectifier. The Spectrometer. Rayleigh's Potentiometer. Dielectric Constant. Damped oscillation.

Phy203: Vibrations and Waves
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- dimensions. Reflection of a 2- dimensional wave at rigid boundaries.

Phy205: Physical Optics
Physical Optics. 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 - 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 - Nickol prism, Polarization and dispersion of light. Circular and elliptical polarization.

Phy207: Electromagnetism (1)

Revision of scalars, vector quantities, scalar and vector fields. Mathematics of vector and their physical meanings. The three coordinate systems used in the course. Coulomb's law in vector notation – problems on 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. Formulation of Gauss law. Applications of Gauss's law – problems. First Maxwell equation under static conditions–the divergence of the displacement vector. Work done to move a charge in an electric field, potential and potential difference in vector notation. Potential gradient.

Phy209: Analytical Mechanics

Gravity and gravitational force and energy. Kepler's laws of planetary motion and orbital energies. Dynamics of systems of particles. Motion of interacting bodies. Collisions and impulse in collision. Motion of a body with variable mass – Rocket motion. Mechanics of rigid bodies and planar motion. Moment of inertia- Calculation of the moment of inertia. The "upside-down pendulum"- elliptic integral. A general theorem concerning angular momentum. Motion of rigid bodies in three dimensions. Lagrangian mechanics.

Phy211: Acoustics

ACOUSTIC WAVES, Waves, Plane Waves, Sound Pressure and Intensity, Reflection and Transmission at a Boundary, Wave Attenuation, Spherical Waves, Surface Waves on Water and solids. Scattering, Attenuation, Scattering by Solid Objects, Scattering by Bubbles. ACOUSTIC SOURCES AND RADIATION, Sound Generation, Simple Spherical Source, Mechanical and Acoustic Impedance, Source near a Reflector, Radiation from an Open Pipe, Acoustic Sources and Power. PIPES AND HORNS, Acoustic Elements, Pipes and Tubes, WaU Losses, Helmholtz Resonator, Simple Horns, Directionality of a Horn, Higher Modes in Horns. HIGH-FREQUENCY AUDITORY MODELS, High Frequencies, Horn-Loaded Simple Ear, Pipe-Coupled Ears, Complex Systems, THE INNER EAR, Neural Transducers, The Transduction Problem, A Frequency-Dispersive Membrane, Cochlear Mechanics, The Middle Ear, Active Cochlear Response. MECHANICALLY EXCITED SOUND GENERATORS, Sound Production, Impulsive Excitation, Frictional Excitation, Harmonics, Mode Locking, and Chaos. SIGNALS, NOISE, AND INFORMATION, Communication, Time and Frequency, Signals and Noise, Animal Sonar. Ultrasound waves Medical imaging. Doppler Imaging Techniques. Exposimetry and sonoporation. Recent issues in acoustics.

Phy215: Scientific Programming

Matrices and arrays, Variables, Calling functions, Programming and scripts, Expressions, Entering commands, Indexing, Types of arrays, Control flow, Scripts and functions, Basic plotting functions, 2D and 3D plotting, Creating mesh and surface plots, Plotting image data, Printing graphics, Handle graphics objects, applications: Linear Algebra, Operations on nonlinear functions, Multivariate data, and Data analysis.

Phy217: Mathematical Physics (1)

Matrices. Vector spaces. Normal modes. Vector calculus. Line integrals. Surface integrals. Volume integrals. Integral transforms. First order ordinary differential equations. Higher order ordinary differential equations.

Chm229: Transition Elements
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.

Chm231: Organic Chemistry
Benzene derivatives; Aromatic halogen compounds; Aromatic Nitro compounds; Aromatic Amino-compounds; Diazonium salts and related compounds; Aromatic Sulphonic acids; Phenols; Aromatic Alcohols, Aldehydes and Ketones; Aromatic Carboxylic acids.
Alkanes, alkenes, Alkynes and alkyl halides; alcohols; ethers; aldehydes; ketones; Optical isomerism. Practical, Aliphatic and Aromatic Carboxylic acids, Salts of acids, Amides and Imides; aniline salts; Carbohydrates; Phenols; General scheme.

MSc202: Material Science Lab (2)
Frequency of ac source -Impedance of a series circuit. Impedance of a parallel R.L.C circuit, Variation of Impedance and current of a series R.L.C circuit with frequency. Loss in capacitor, Hay Bridge. Energy gap of semiconductor. Resistivity of an electrolyte solution. Characteristics of P.N.P Transistor. Characteristics of a diode valve, Thermodynamic cycle. Verification of Malu´s law. e/m, magnetic field of paired coils. Fresnel´s biprism. Hysteresis loop of magnetic material.

Phy204: Thermodynamics
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 temp. 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. Expansivety 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.

Phy206: Electromagnetism (2)
Current - current density - Current continuity equation. Boundary conditions in a conductor. Properties of conductors - exponential decay of charge density in conductor. Boundary conditions for prefect dielectrics, Poisson's equation and Laplace's equation. Magnetic field Biot&Savart law. Ampere's law and their applications. 2nd Maxwell equations. 3rd Maxwell equations. Magnetic flux and magnetic flux density. Maxwell's fourth equation under static conditions.

Phy208: Alternating Current and Electronics
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, equations of a circuit containing resistor and capacitor in series. Resistors, capacitors and inductors in series. Resonance in series

connection circuits. Parallel connections (resistor and capacitor, resistor, capacitor and inductor). Multi- element circuits. Complex connection circuits (parallel- series). 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: - Zener diode approximation. Diode circuits: full and half - wave rectifiers' Zener diode regulator - voltage multipliers - voltage doublers and limiters.

Phy210: Modern Physics
Modern Physics. Fundamentals of the Special theory of Relativity. Black Body Radiation. Waves and Particles. Bohr model and Hydrogen atom. Some topics in solid state physics related to modern physics. Introduction to Lasers and Masers.

Phy212: Mathematical Physics (2)
Fourier analysis, Laplace transforms, ordinary differential equations, series solutions of ordinary differential equations, partial differential equations.

Phy214: Astronomy
Introduction – Astronomical unit-the light year- Parsec - Galaxies-Types of galaxies- spiral galaxies (normal and Barred spiral)- Elliptical galaxies-Lenticular galaxies- irregular galaxies- Galactic clusters and mergers- The principle parts of galaxies. Milky way galaxy. Celestial coordinates-Horizontal coordinates- Altitude – Azimuth - Equatorial Coordinates – Declination - Right Ascension - Hour Angle. Star Formation and born - Main Sequence Stars - Stars and Their Fates- White Dwarfs- Novae - Supernovae Leave - Neutron Stars- Black Holes- Stellar Magnitudes- Stellar Spectra – classification and types of stars. Time estimation- Standard Time- Time and longitudinal - World Time Zones. The International Date Line- Solar Day - Sidereal Day - Tropical year - Sidereal Year - Animalistic Year- Ecliptic Year- Giuliani Calendar - Gregorian calendar- Hijri calendar . Greenwich Line - Civil Time - Local Time - Equation of Time. Solar system- Solar system bodies- CLASSIFICATION OF PLANETS- Kepler's Laws - Physical properties of planets- Some planetary positions as they orbit around the sun – Elongation - Pairing - quadrature mode- Bode's law. Astronomical observations and monitoring- Function of the Telescope- Telescope components – Objective – Eyepiece – Amplification Power-Field of view - Optical System of trlescopes - Refractor – Reflector – Catadioptric - Chromatic Aberration- Spherical Aberration – Coma - Astigmatism

Bph216: Introduction to Biophysics
Dynamics of extended bodies. Applications to Muscles and Joints. Elastic properties of material. The mechanics of non-viscous materials. Blood pressure measurement and continuity equation. Nerve conduction and properties of an Axon .Radiations and matter. Radioactive decay. Heat. Electric current. Applications. Practical experiments related to the course during the whole semester.

Chm228: Industrial Chemistry
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.

Chm230: Photochemistry and Natural Products

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, benzylisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D….) and vitamins (vitamin B1, 2, 5, 6, E, K and A).Practical: Isolation and preparation of natural products.

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.

MSc301: Material Science Lab (3)

Transistors. Zener diode. Root mean square (RMS) of sine, square and sawtooth waves. Rectifiers. Microwave wavelength polarization and diffraction of microwave. Low pass filter. High pass filter. Geiger Muller counter. Electrostatic lenses.

Phy303: Statistical Physics

What is statistical Mechanics? Ensembles and Definitions. Distribution law. Boltzmann statistics MBS. Problems in Derivation of MBS. Alternative Derivation of MBS. Examples of counting in statistical Mechanics. Fermi Dirac Statistics F.D.S, Bose- Einstein statics 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.

MSc305: Quantum Mechanics (1)

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. Step potentials. Unbound states, Barrier problems. Tunneling. Harmonic oscillator. The wave function of normal state of H atom. The energy state of H atom and other application.

Phy307: Atomic Physics

Waves and Particle - De Brogile 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 equations 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. Alpha- particle scattering- Rutherford scattering formula. Bohr’s atomic model – The three Bohr’s Assumptions – Characteristics of the Bohr

circular orbits. Atomic spectra – Wien's displacement law – the quantum theory. The spectrum- Spectroscopy- Spectrum analysis –Different types of spectra. Atomic spectral lines – absorption spectrum – spectrometers.

Phy309: Analogue Electronics
Semiconductors and their role in electronics. 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- examples). 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).

Phy311: Computational Physics
Solving non-linear equations, Eigenvalues and Eigenvectors, Fourier Methods, Numerical Differentiation, Numerical Integration, Ordinary Differential Equations: Initial-Value Problems, and Ordinary Differential Equations: Boundary-Value Problems.

Phy317: Renewable Energy Physics
The energy problem- energy transformation. Power and energy- solar energy- balance equation. Global warming- green house gases- electrical energy- nuclear fission- nuclear fusion. Breeder reactor – nuclear fusion reactors- renewable energy. Solar energy- advantages of solar energy – reappraisal of solar energy- characteristics of Sun. The electromagnetic energy spectrum – spectral distribution of solar radiation. Solar collectors- flat plate collector – thermal losses and energy balance equation. Ways of decreasing losses in the solar collector-concentrating (focusing) collectors – the advantages of concentrators systems over flat plate type collectors. Other thermal applications of solar energy. Storage of solar energy. Photovoltaic principles - photovoltaic power generation. Wind energy- wind turbine setting. The types of wind turbines- advantages and disadvantages of wind turbines. Hydropower- biomass- geothermal energy.

GPh323: 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.

Geo315: Remote Sensing
Principals of remote sensing, Electromagnetic energy (sources and interaction), Spectral reflectance curves and libraries, Sensors and platforms, Airborne and Spaceborne, remote sensing, Multispectral scanners and missions, Different satellite data types and applications, Pre-processing techniques (Radiometric and Geometric corrections), Image Enhancement and visualization, Image color composites, Image Fusion, Visual image interpretation, Principal of digital image processing, Supervised and unsupervised image classification algorithms, Validation of the classified maps, Principal and interpretation of imaging radar, Remote sensing below the grounds surface, Geological remote sensing, Methods of rock units discriminations,

Remote sensing geomorphological, structural and mineral exploration applications, Groundwater indicators by remote sensing.

Chm333: Physical Polymers
General notions, classification criteria, structure of macromolecular compounds. Aggregation and phase states, transition temperatures. Elements of polymerization reaction thermodynamics. Physico-chemical properties of polymer materials of interest in applications. Polymer materials with special properties: intelligent composite materials, interpenetrated polymer networks, drug carrier polymers, metallocene, polymers with biomedical applications, polymer membranes, carbon fibers and carbon fiber composites, conductor and semiconductor polymers, polymer sensors, biodegradable polymers. |Techniques for complex polymer materials characterization. Applications in making of polymers with selected surface properties.

MSc302: Material Science Lab (4)
CRT experiment. Microwave. Phase angle. Voltage doublers. Determination of mass absorption coefficient of lead. Band pass filter. e/m experiment. Photoelectric effect.

MSc304 Solar Energy Fundamentals
Introduction to solar conversion devices. Heat transfer mechanisms. The Sun and solar radiation. Solar radiation measurements and calculations. Flat plate collectors. Concentrating collectors.

Phy304: Crystallography
Introduction to crystallography and overview. Crystallographic calculations. Properties of crystal structures. The seven crystal systems. Crystal bonding. Defect in crystals. The theory of diffraction of X-ray in crystals. Determination of the direction and intensities of diffracted X-ray beams. Calculation of the structure factor and using it in diffraction problems. The reciprocal lattice and reciprocal space. The expression of diffraction phenomena in terms of the reciprocal lattice.

Phy306: Laser Physics
Introduction: 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.

Phy308: Electrodynamics (1)
Revision of Maxwell's equations in point form and in integral form under static conditions, The steady magnetic field – magnetic flux – the scalar and vector magnetic potentials, Magnetic

forces – Torques, The nature of magnetic materials - Magnetization and permeability, Magnetic boundary conditions, Potential energy and forces on magnetic materials – Inductance, Time-varying fields (Faraday's law – displacement current), Maxwell's equations in point form and in integral form under time varying conditions, Wave motion in free space and in perfect dielectrics.

Phy312: Detectors and Accelerators

DC accelerators – Linear accelerators – Circular accelerators – Accelerator components – Wave guides – Equation of motion – Particle trajectory and transfer matrices – Dispersion and momentum compaction – Beta function and betatron oscillation – Beam emittance - Phase space and Twiss parameters – Synchrotron oscillations - Synchrotron radiation – coherent and incoherent radiation – Insertion devices – Beam diagnostics.

General characteristics of detectors (Sensitivity, resolution, efficiency …..etc) – Ionization detectors (ionization chamber, proportional counter – Geiger counter) – Scintillation detectors (Scintillation mechanism, types of scintillation materials, operating parameters, noise) – Semiconductor detectors (semiconductor properties, doped semiconductors, depletion layer, compensation, diffused junction detector, silicon surface barrier detector and lithium drift silicon detector) – Neutron detectors (neutron classification, detection through nuclear reaction for slow neutrons, detectors based on Boron reaction, fast neutron detection)

Phy314: Reactor Physics

Types of nuclear energy (fission – fusion). Radio isotopes. Neutron classification. Interaction of neutrons with matter. Fission chain reaction. Reactor flux spectrum. Several types of reactors. General considerations for designing reactors.

BPh310: Medical Physics

Historical background; radiation interactions; general imaging concepts; and contrast mechanisms. Medical Imaging Methodology: For all clinically applicable imaging techniques, contrast mechanisms imaging with ionising radiation, including X-ray, CT, nuclear medicine, SPECT and PET; imaging with non-ionising radiation, including MRI and ultrasound; and general principles of image reconstruction and registration of images over time and between modalities. Clinical Applications of Physics: Clinical examples of the utility of medical imaging in diagnosis and treatment of disease. Sensing applications of physics in hospitals, including patient monitoring, Therapeutic applications of physics, particularly radiotherapy in cancer patients: Historical background; radiation interactions; general imaging concepts; and contrast mechanisms. Recent issues in medical physics.

MSc306: Principles of Nuclear Physics

Basic properties of nucleus. The nuclear atom – stable nuclei. Properties of nuclear states. Nuclear structure – binding energy. Nuclear separation energy. Nuclear force. Nuclear decay modes. Radioactive decay – problems.

Phy320: Radiation Physics

Preliminary notions and definitions. Interaction of charged particles with matter. Energy loss of electrons and positrons, energy loss distribution. Interaction of photons with matter. Interaction of neutrons with matter. Environmental radioactivity. Cosmic radiation. Radiation Dosimetry –

Assessment. Dose measurements – dose calculations – other dosimetric Quantities. Chemical effects of radiation. Biological effects of radiation. Radioactive dating methods. Radioisotopes in industry.

MSc401: Applied Field Training

Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

MSc403: Material Science Lab (5)

The diode limiter, The solar cell: determination of the efficiency fill factor, Laser: Determination of wavelength, distances between gratings in a diffraction grating Thermistor, X- ray: determination of lattice parameter of a crystal, De Sauté and Schering bridges, Rejected T – filter, L- R- C filter, Two stage RC filter in cascade.

Phy405: Molecular Physics

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, Revision and assessment, 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.

Phy407: Plasma Physics

Fundamentals of plasma: introduction to gas discharges, Definition and 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. Plasma theories: Single Particle model, Kinetic theory, and Fluid models. Dusty Plasma.

Phy411: Solid State Physics

Introduction to solid state physics - The free electron theory : Free levels in one dimension, Free electron gas in three dimensions, Electrical conductivity – Motion in magnetic field- Wiedemann-Franz law, Nearly free electron model - origin of the energy band, Bloch functions - Proof of Bloch’s Theorem in 1-D- Kronig Penney model, Semiconductor materials: Bonding Forces and Energy Bands -Charge carriers in semiconductors -excess carriers in semiconductors, Dielectrics. Dielectric constant, Ferroelectrics: Ferroelectric crystals, Piezoelectricity.

MSc405: Solar Energy devices

Solar distillation systems. Solar cookers and solar ponds. Solar dryers and thermal energy storage. Photovoltaic devices: electronic charge separation, transportation and recombination. Introduction to the process and equipment for the manufacturing of various photovoltaic cells. The low-cost manufacturing of practical photovoltaic systems. Other renewable energy sources.

Chm433: Polymer Chemistry and their Applications

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.

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.

Phy409: Electrodynamics (2)

Plane waves in lossy dielectrics – the Poynting vector and power consideration, Propagation in good conductors: skin effect, Transmission lines, Wave Guides: Introduction, Rectangular Waveguides, Transverse Magnetic (TM) Modes, Transverse Electric (TE) Modes, Wave Propagation in the Guide, Power Transmission and Attenuation, Waveguide Current and Mode Excitation, and Waveguide Resonators. Antenna. Electromagnetic theory and relativity: Brief introductions to Einstein postulates.

Phy415: Physical Properties of Solids

Introduction: Importance of studying physical properties of materials. Electric and ionic conduction – conductivity. Energy band structure and electronic mobility. Dielectric materials. Ferroelectricity – piezoelectricity. Magnetic classification of materials-Effect of temperature on magnetic properties- domains and hysteresis. Superconductivity. Optical properties (light interactions with solids- refraction and reflection- luminescence- photoconductivity- optical fibers).

MSc407: Nanotechnology

Introduction to nanotechnology and a comparison with microtechnology, Fabrication of nanomaterials using different methods, The unique size-dependent properties of nanomaterials, Overview of nanomaterials, Methods of Characterization, Open discussion and assessment, Applications: Medicine, Applications: Environment, Applications: Energy Applications: Information and communications technologies.

MSc409: Glass and Ceramics

Ceramic structures : Crystal structures, Silicate ceramics - Glass, Carbon as a type of ceramic materials, Imperfections in ceramics, Ceramic phase diagrams, Crystallographic and microstructural aspects of the elastic properties and fracture characteristics, Thermal properties

of ceramic materials: Heat capacity, Heat of fusion, thermal conductivity, and thermal expansion, Basic atomic concepts applied to ceramic materials, Preparation and properties of ceramic semiconductors, dielectrics, and magnetic ceramics I.

MSc402: Graduation Project

This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

MSc404: Material Science Lab (6)

Audio frequency oscillator, High frequency oscillator, Crystal oscillator, the transistor as an AC amplifier, Transistor multivibrator, Schmitt trigger, Boltzmann constant, X- rays: Determination of linear absorption coefficient of materials

MSc406: Materials in Electronics

An overview on materials used in electronics, Semiconductors, Semiconductors in electronics industry, Magnetic materials: classification according to magnetic properties, Ferrites: Spinel, hexagonal and garnet ferrites, Perovskites, Magneto-resistance - giant magnetoresistance – colossal magnetoresistance materials, Polymers & Conducting polymers.

Phy406: Quantum Physics (2)

Solving Schrödinger equation for a free particle in a box and for a 3D Harmonic oscillator; Angular momentum operators in Cartesian and Spherical coordinates, commutations, eigenvalues and eigenfunctions for central potentials; Solving Schrödinger equation for periodic potentials, Bloch wave-function, Hydrogen atom: eigenvalues, eigenfunctions, energy spectrum, Zymann effect, quantum numbers, Stern-Gerlach experiment. Time-independent, non-degenerate perturbation and Variational method, problems. Scattering: Partial wave analysis and Born-approximation, problems.

Phy410: Digital Electronics

Introduction: Binary numbers, Octal numbers & Hexadecimal numbers, Codes: Weighted binary codes and non-weighted binary codes, Basic logic gates: AND , OR, NOT, Electronic 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, Assessment, Addition and subtracting Digital 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 and 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, Different types of D/A and A/D converters , Applications and Revision.

Phy412: Laser systems and Applications

Laser systems and applications: Revision of basics of Laser physics – working principles- main components- Laser modes, Types of Laser: Solid state Laser- Ruby Laser Nd-Yag Laser- He-Ne Laser, Argon Laser- CO2 Laser – semiconductor Laser, Application of Laser, Scientific research

applications. Medical applications of Laser, Industry applications of Laser, Defense applications of Laser.

Phy414: Superconductors

Fundamentals of solid state physics - Phenomenon of Superconductivity, Basis of Electrodynamics and thermodynamics, Thermodynamics of superconductors; the theory of diffusion in solids, Calculations in crystal structures- perovskite structure -close packing in solid crystals - packing and defects-Intermediate state of superconductors, Different types of superconductors, Type II superconductors, vortices ,the first and second critical magnetic fields, Microscopic theory of superconductivity - thermoelectric effect, IR spectroscopy, Electronic spin resonance, Tunnel effect in superconductors, Josephson effect.

Phy416: High Energy Physics

Historical introduction to the elementary particles, Elementary particle dynamics I, Relativistic kinematics, Symmetries - Bound states, The Feynman calculus, Quantum electrodynamics: electrodynamics and chromodynamics of quarks I, Quantum electrodynamics: electrodynamics and chromodynamics of quarks II, Weak interactions – gauge theories, Neutrino oscillations, Revision and open discussion.

Phy418: Astrophysics

Solar System: An Introduction to Comparative Planetology, Earth: Our Home in Space, Moon and Mercury: Scorched and Battered Worlds, Venus: Earth's Sister Planet, Mars: A Near Miss for Life?, 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, The Sun: our parent star, Measuring the stars: giants, dwarfs and the main sequence, The solar neighborhood, Luminosity and apparent brightness, The interstellar medium and matter ; Gas and dust among the stars, Emission Nebulae, Star formation :A traumatic birth, Stellar evolution - Stellar explosions: Novae and supernovae and the formation of elements, Neutron stars and black holes, The milky way galaxy – galaxies and dark matter, Cosmology; The big bang and the fate of the universe.

Phy420: Condensed Matter Physics

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 eath 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, Binary and ternary systems, Some physico chemical properties of some glasses, Magnetic, electrical and optical behavior of some chalcogenide glasses.

BPh422: Principles of Biophysics

Introduction to neurons and the brain (nerve cell - the nervous system - some features of cortex). Electrical properties of cells (the Nernst equation - the Goldeman equation - the Nernst _ Plank equation - the Hodgkin _ Katz experiments). The Hodgkin_ Huxley model action potentials (the

voltage clamp technique - two type of voltage potential ionic current spike propagation). Synapses (chemical synapses - the post synapses potential - stochastic PSPs - learning - long term potentiation).

MSc410: Solar Cell Technology

Introduction to the fast-growing field of Photovoltaic devices, Solar cells and solar modules, Design and performance factors of various PV devices, Monocrystalline Cells, Microcrystalline Cells, Amorphous cells, Nano-crystalline cells, the key concepts underlying all device operations, Applications.



Program Title	**Biophysics**
Program Type	**Single**
Department(s)	**Physics**

BPh201: Experimental Biophysics (1)
Melde's Experiment -Discharge Curves of A capacitor. Moment of Inertia of A fly Wheel - Newton's Rings. Abbe Refractometer. The Photoelectric Cell- The Compound Pendulum- The Diffraction Grating. The Specific Rotatory Power. The Metallic Rectifier. The Spectrometer. Rayleigh's Potentiometer. Dielectric Constant. Damped oscillation.

BPh203: General Biophysics
Introduction to neurons and the brain (nerve cell - the nervous system - some features of cortex). Electrical properties of cells (the Nernst equation - the Goldeman equation - the Nernst _ Plank equation - the Hodgkin _ Katz experiments). The Hodgkin_ Huxley model action potentials (the voltage clamp technique - two type of voltage potential ionic current spike propagation). Synapses (chemical synapses - the post synapses potential - stochastic PSPs - learning - long term potentiation).

Phy203: Vibrations and Waves
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- dimensions. Reflection of a 2- dimensional wave at rigid boundaries.

Phy205: Physical Optics

Physical Optics. 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 - 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 - Nickol prism, Polarization and dispersion of light. Circular and elliptical polarization.

BPh205: Classical Mechanics

Field Theory: Noether's Theorem cross products - Vector Operations -The gradient operator - Gradient in Spherical and cylindrical Coordinates. KINEMATICS: THE MATHEMATICAL DESCRIPTION OF MOTION - Motion in One Dimension - Acceleration. - Motion With Constant Acceleration - Motion in Two and Three - Circular Motion-Geometrical Method - Circular Motion: Analytic Method -Motion Of A Freely Falling Body - Kinematics Problems - One-Dimensional Motion -Two and Three Dimensional Motion - NEWTON'S FIRST AND THIRD LAWS: STATICS OF PARTICLES -Newton's First Law; - Inertial Frames =Quantitative Definition of Force; Statics of Particles- Examples of Static Equilibrium of Particles-Newton's Third Law –Friction- Kinetic Friction - Newton's First Law of Motion Problems-NEWTON'S SECOND LAW; DYNAMICS OF PARTICLES - Dynamics Of Particles -Motion of Planets and Satellites; Newton's Law of Gravitation -Newton's 2nd Law of Motion - CONSERVATION AND NON-CONSERVATION OF MOMENTUM -PRINCIPLE OF ONSERVATION OF MOMENTUM - Center of Mass -Time-Averaged Force - WORK AND ENERGY - Definition of Work -The Work-Energy Theorem -Potential Energy -More General Significance of Energy (Qualitative Discussion) - Elastic and Inelastic.

Phy211: Acoustics

ACOUSTIC WAVES, Waves, Plane Waves, Sound Pressure and Intensity, Reflection and Transmission at a Boundary, Wave Attenuation, Spherical Waves, Surface Waves on Water and solids. Scattering, Attenuation, Scattering by Solid Objects, Scattering by Bubbles. ACOUSTIC SOURCES AND RADIATION, Sound Generation, Simple Spherical Source, Mechanical and Acoustic Impedance, Source near a Reflector, Radiation from an Open Pipe, Acoustic Sources and Power. PIPES AND HORNS, Acoustic Elements, Pipes and Tubes, WaU Losses, Helmholtz Resonator, Simple Horns, Directionality of a Horn, Higher Modes in Horns. HIGH-FREQUENCY AUDITORY MODELS, High Frequencies, Horn-Loaded Simple Ear, Pipe-Coupled Ears, Complex Systems, THE INNER EAR, Neural Transducers, The Transduction Problem, A Frequency-Dispersive Membrane, Cochlear Mechanics, The Middle Ear, Active Cochlear Response. MECHANICALLY EXCITED SOUND GENERATORS, Sound Production, Impulsive Excitation, Frictional Excitation, Harmonics, Mode Locking, and Chaos. SIGNALS, NOISE, AND INFORMATION, Communication, Time and Frequency, Signals and Noise, Animal Sonar. Ultrasound waves Medical imaging. Doppler Imaging Techniques. Exposimetry and sonoporation. Recent issues in acoustics.

BPh207: Applications of Differential Equations

Series solutions of ordinary differential equations. Eigen function methods for differential equations. Special functions. Quantum operators. Partial differential equations: General and

particular solutions. Partial differential equations: Separation of variables. Calculus of variation. Examples of applications in Physics.

BPh211: Applied Biophysics
Experimental techniques in solid state, material science laser, plasma, and medical applications. Concepts of Measurement systems, Instrument transformation, potentiometers, power measurements, measurement of energy, cathode ray oscilloscope, sensors and transducers.

BPh213: Scientific Programming in Biology.
Matrices and arrays, Variables, calling functions, Programming and scripts, Expressions, entering commands, Indexing, Types of arrays, Control flow, Scripts and functions, Basic plotting functions, 2D and 3D plotting, creating mesh and surface plots, Plotting image data, Printing graphics, Handle graphics objects, applications: Linear Algebra, Operations on nonlinear functions, Multivariate data, and Data analysis. Numerical problems in Biophysics.

Zoo279: Cell Biology and Genetics
This course gives an introduction to animal cell structure and function including the chemical components of the cell, the structure and function of cell organelles and their role in development, differentiation, bioenergetics and cellular communication. Examples of relevant human disorders will be used. The various basic concepts in genetics and hereditary transmission leading to organismal variations will be discussed. The topics covered include; the structure and replication of DNA, chromosome organization, the molecular basis of gene expression and regulation and how they are tied to intracellular and extracellular factors by signal transduction pathways. DNA repair mechanisms, epigenetics, irregularities, all will be studied structurally and functionally. Students will also learn principles of genetic engineering to practice ability to applications of genetics in biotechnology. The laboratory part exposes students to an overview of modern cell-related techniques in genetic engineering and basic recombinant DNA techniques and hands on experience to classical cell biology experiments.

Zoo281: Immunology
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, Hypersenstivity, Autoimmunity, Antigen antibodies interactions, Monoclonal antibodies.

Zoo283: Tissue Culture Technique
Setting Up a Cell Culture Laboratory, The Physical Environment, Media, Standard Cell Culture Techniques, Looking at Cells, Contamination: How to Avoid It, Recognize It, and Get Rid of It, Serum-Free Culture, Primary Cultures, Establishing a Cell Line, Special Growth Conditions.

BPh202: Experimental Biophysics (2)
Frequency of ac source. Impedance of a series RC circuit. Variation of Impedance and current of a series. R.L.C circuit with frequency. Energy gap of semiconductor. Impedance of a parallel R.L.C circuit. Resistivity of an electrolyte solution. Loss in capacitor. Hay bridge. Verification of Malu´s law. Fresnel´s baptism. Characteristics of a diode valve.

BPh204: Biophysics (1)

UV/V spectroscopy - Circular Dichroism (CD) and Optical Rotatory Dispersion (ORD)- Fluorescence Spectroscopy. - Infrared Spectroscopy - Raman Spectroscopy - Electron Spin resonance. Elementary geometrical Optics - The limits of resolution - Different types of microscopies. Electron optics - transmission and scamming microscopes - preparation of the specimen for electron Microscopy.

Phy208: Alternating Current and Electronics

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, equations of a circuit containing resistor and capacitor in series. Resistors, capacitors and inductors in series. Resonance in series connection circuits. Parallel connections (resistor and capacitor, resistor, capacitor and inductor). Multi- element circuits. Complex connection circuits (parallel- series). 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: - Zener diode approximation. Diode circuits: full and half - wave rectifiers' Zener diode regulator - voltage multipliers - voltage doublers and limiters.

Phy210: Modern Physics

Modern Physics. Fundamentals of the Special theory of Relativity. Black Body Radiation. Waves and Particles. Bohr model and Hydrogen atom. Some topics in solid state physics related to modern physics. Introduction to Lasers and Masers.

BPh206: Thermodynamics in Biophysics

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 temp. 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. Expansivety 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 in Biological Systems. Maxwell's equations.

BPh208: Astronomy and Astrophysics

Astrodynamics and technological aspects of astrobiological missions in our Solar System. Prospects of life on Mars. Prospects for life elsewhere in the Solar System – Extrasolar planets: discovery of planets around other stars, summery of discovery to-date including limitations of these discoveries, future direct imaging of extrasolar terresteltrial planets and spectroscopic search for bio-signatures in the atmospheres of extrasolar planets. Extraterrestrial intelligence: prospects for intelligent life in the Universe, Dark Equation, SETI, Fermi Paradox.

BPh210: Biomathematical Physics
Matrices. Vector spaces. Normal modes. Vector calculus. Line integrals. Surface integrals. Volume integrals. Integral transforms. First order ordinary differential equations. Higher order ordinary differential equations.

Mic250: General Microbiology
Part one: This part deals with the occurrence and distribution of prokaryotic organisms and their structure, diversity and classification. Also, this part deals with the occurrence and distribution of bacteria and viruses 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 cyanobacteria and actinomycetes.
Part two: This part 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.
Part three: In this part 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.

Sat214: Introduction to Biostatistics
Populations and samples. Population parameters and sample statistics. Compute a sample mean, sample variance, and sample standard deviation. Compute a population mean, population variance, and population standard deviation. statistical inference. Graphs and functions, Functions and derivatives, Differentiation and its application in Biology: Enthalpy and Entropy of a chemical reaction, Growth curve, Idea of curvature, Curvature, Free energy, Energy of spring-like protein, Maxima and Minima of a function, Force and energy, DNA unzipping, Plotting mathematical functions. Integration and its application in Biology.

BCh226: Introduction to Biochemistry
Physical, chemical and microscopic examination of urine; Complete blood picture; Creatinine and urea clearance; Lipoprotein analysis; Estimation of serum iron, phosphorous, and calcium; Estimation of serum ALT, AST, total protein and albumin.

BPh301: Experimental Biophysics (3)
Transistors. Zener diode. Root mean square (RMS) of sine, square and sawtooth waves. Rectifiers. Microwave wavelength polarization and diffraction of microwave. Low pass filter. High pass filter. Geiger Muller counter. Electrostatic lenses.

BPh305: Bioinformatics
Introduction to Bioinformatics, Biology and Bioinformatics, Genomics and Proteomics, Computers in Biology and Medicine, computer algorithms, Biological Macromolecules, Topics covered include: central dogma and introduction to macromolecular sequences; Genome Analysis, sequencing methods and physical mapping of genomes; genome data and databases, Databases and Search Tools, 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, Proteome Analysis, Recent issues in bioinformatics

Phy305: Quantum Mechanics (1)
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. Step potentials. Unbound states, Barrier problems. Tunneling. Harmonic oscillator. The wave function of normal state of H atom. The energy state of H atom and other application.

Phy307: Atomic Physics
Waves and Particle - De Brogile 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 equations 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. Alpha- particle scattering- Rutherford scattering formula. Bohr's atomic model – The three Bohr's Assumptions – Characteristics of the Bohr circular orbits. Atomic spectra – Wien's displacement law – the quantum theory. The spectrum-Spectroscopy- Spectrum analysis –Different types of spectra. Atomic spectral lines – absorption spectrum – spectrometers.

Phy309: Analog Electronics
Semiconductors and their role in electronics. 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- examples). 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).

BPh307: Computational Physics for biological applications
Solving non-linear equations, Eigenvalues and Eigenvectors, Fourier Methods, Numerical Differentiation, Numerical Integration, Ordinary Differential Equations: Initial-Value Problems, and Ordinary Differential Equations: Boundary-Value Problems.

BPh309: Environmental Biophysics
Forces in nature, Elementary particles. Radiation Units and quantities, stopping power, Cavity theory. Hot Particles Problem: formation, release and health hazard. Radiation Dosimeters. General principles for the establishment of nuclear radiation detectors. Different types of energy

resources. Earth Climate and Climate change. Radiation Safety Sound and noise & Heat and radiation. Environmental Problems: Air pollution, Water pollution. Global warming: causes global warming, greenhouse effect.

BPh311: Biomechanics

Cellular biomechanics. Models of cellular biomechanical behavior. Optical trapping, Magnetic bead microrheometry, Micropipette aspiration. Cellular response to mechanical signals, Techniques for mechanical stimulation of cells, Compressive loading, Stretching, Fluid flow. Mechanotransduction, Mechanoreceptors, Intracellular signal transduction. The circulatory system, the heart, Qualitative description of cardiac pumping, Cardiac pumping power and ventricular function. Elastic waves, Pressure–flow relationships. Ocular biomechanics, Ocular anatomy, Biomechanics of glaucoma, Tonometry, Drainage of aqueous humor in normal and glaucomatous eyes, Aqueous humor circulation in the anterior chamber, The respiratory system, Gross anatomy, The conducting airways and pulmonary vasculature, Associated structures, Biomechanics of breathing. Muscles and movement, Skeletal muscle morphology and physiology, Isotonic versus isometric contraction, Muscle constitutive modeling, Whole muscle mechanics, Parallel versus pinnate muscle types, Muscle/bone interactions. Skeletal biomechanics, bone, Composition and structure of bone, Cortical bone, Trabecular bone, Biomechanical properties of cortical and trabecular bone, Cortical bone mechanics. The design of bone, Introduction to soft connective tissues, Structure of collagen, Structure of ligament, tendon, and cartilage, Ligament, Tendon, Cartilage, Biomechanical properties of ligament, tendon, and cartilage, Structural properties, tension, compression, viscoelasticity. Terrestrial locomotion, Jumping, standing jump, Running jumps, Description of walking and running, Walking, Running, Gait analysis, Kinematics, Anthropometry, Kinetics, Recent issues in modern biomechanics.

Zoo271: Neuro Comparative Anatomy

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. The central and peripheral nervous systems. Basic neuroanatomy, sensory pathways, motor pathways and the autonomic nervous system. How the entire body influences, and is influenced, by the nervous system.

Zoo273: Introduction to Neurophysiology

The aim of this course is to introduce the fundamental structures of the brain, spinal cord, and peripheral nervous system to better understand the amazing function of the nervous system. This course will include an understanding of how sensory information reaches the brain and how motor information leads to effective action. Neuroanatomy will be integrated into the functional aspects of the course. The nervous system, the functions of the sensory system, nerves

and cells, as well as the structure of the autonomic nervous system. Sight, hearing, balance, taste, and smell, Cells and muscle reflexes, Hypothalamus and brainstem. Synaptic Transmission, Synaptic Properties, Receptors, Sensory Modalities, Somatosensory System, Sensory Tract Lesion, Neurophysiology of Pain. Spinal Reflexes.

Chm333: Physical Polymers
General notions, classification criteria, structure of macromolecular compounds. Aggregation and phase states, transition temperatures. Elements of polymerization reaction thermodynamics. Physico-chemical properties of polymer materials of interest in applications. Polymer materials with special properties: intelligent composite materials, interpenetrated polymer networks, drug carrier polymers, metallocene, polymers with biomedical applications, polymer membranes, carbon fibers and carbon fiber composites, conductor and semiconductor polymers, polymer sensors, biodegradable polymers. |Techniques for complex polymer materials characterization. Applications in making of polymers with selected surface properties.

BPh302: Experimental Biophysics (4)
CRT experiment, Microwave, Phase angle, Resonance experiment, Voltage doublers, determination of mass absorption coefficient of lead, Band pass filter, e/m experiment, Photoelectric effect.

BPh304: Biomedical Instruments
Bioelectrical signals, electrodes and Transducers, Electrocardiograph, Pacemakers, Cardiac Defibrillators, Respirators and Ox-meters, Ventilator, Audiometer, Ultrasonic imaging instrumentation, Modern imaging systems, Haemodialysis.

Phy306: Laser Physics
Introduction: 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.

BPh306: Radiation Biophysics
Preliminary notions and definitions. Interaction of charged particles with matter. Energy loss of electrons and positrons, energy loss distribution. Interaction of photons with matter. Interaction of neutrons with matter. Environmental radioactivity. Cosmic radiation. Radiation Dosimetry – Assessment. Dose measurements – dose calculations – other dosimetric Quantities. Chemical effects of radiation. Biological effects of radiation. Radioactive dating methods. Radioisotopes in industry.

BPh308: Nuclear and Medical Physics
Basic properties of nucleus. The nuclear atom – stable nuclei. Properties of nuclear states. Nuclear structure – binding energy. Nuclear separation energy. Nuclear force. Nuclear decay modes- problems- Nuclear reaction – cross section. Types of nuclear reaction. Nuclear Medicine.

BPh310: Electromagnetism
Vectors and coordinates, Electrostatics laws (Couloms and Gauss law), Maxwells equations under statics conditions. Time Varying equations. Problems.

Phy312: Detectors and Accelerators
DC accelerators – Linear accelerators – Circular accelerators – Accelerator components – Wave guides – Equation of motion – Particle trajectory and transfer matrices – Dispersion and momentum compaction – Beta function and betatron oscillation – Beam emittance - Phase space and Twiss parameters – Synchrotron oscillations - Synchrotron radiation – coherent and incoherent radiation – Insertion devices – Beam diagnostics.
General characteristics of detectors (Sensitivity, resolution, efficiency …..etc) – Ionization detectors (ionization chamber, proportional counter – Geiger counter) – Scintillation detectors (Scintillation mechanism, types of scintillation materials, operating parameters, noise) – Semiconductor detectors (semiconductor properties, doped semiconductors, depletion layer, compensation, diffused junction detector, silicon surface barrier detector and lithium drift silicon detector) – Neutron detectors (neutron classification, detection through nuclear reaction for slow neutrons, detectors based on Boron reaction, fast neutron detection)

Phy324: Environmental Physics
Physical environments, microenvironments, environmental variables and biological effects, principles of energy and mass exchange, Temperature and living organisms, typical behavior of atmospheric and soil temperature, modeling of vertical variation in air temperature, air temperature diurnal and annual cycle, microenvironment temperatures, movement of eddies and their effects on mass and energy transfer through the atmosphere, temperature fluctuations and natural phenomena, Structure of soils, modeling of soil temperature, temperature of water reservoirs, temperature and biological development, growth and development, Atmospheric gases, importance of water vapor (moisture), gas concentration, saturation conditions, partial saturation, variables that measure moisture, saturation vapor pressure, the vapor pressure deficit, relative humidity, dew point and wet pulp temperatures, sling psychrometer, vapor densities in nature Water potential and water content, the gravitational potential, the osmotic potential, matric component of water potential, the pressure potential, relationship between water potential and humidity.

Zoo340: Molecular Enzymology
Enzyme classification and nomenclature, Enzyme kinetics with single and multiple substrates, Reversible, irreversible and product inhibition of enzymes, Enzyme catalysis: transition-state theory and activation energy, Catalytic principles and chemical mechanisms, Catalytic amino acids and pH-profiles of enzymes, Practical methods in enzymology: introduction to practical studies of enzyme kinetics, inhibition, reaction mechanisms, detection of intermediates, active-site titration, Linear and nonlinear curve fitting of experimental data to kinetic models,

Introduction to computer graphics as a tool to visualize enzyme structures, catalytic amino acids and enzyme-substrate/inhibitor complexes.

BPh312: Mechanics of Biofluids
Conservations' laws, mass continuity, momentum and energy conservations. Blood and water properties. Bubbles in fluids. Biofluid mechanics focuses on macrocirculation, microcirculation, and specialty circulation that flows through kidney, lungs, eyes, joints, diarthroses, and splanchnic circulation that are important in human body.

BPh401: Applied Field Training
Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector, and shall increase contact and acceptance between the university and industry.

BPh403: Experimental Biophysics (5)
The diode limiter, the solar cell: determination of the efficiency fill factor, Laser: Determination of wavelength, distances between gratings in a diffraction grating Thermistor, X- ray: determination of lattice parameter of a crystal, De Sauté and Schering bridges, Revision and discussions, Assessment, Rejected T – filter, L- R- C filter, two stage RC filter in cascade

Phy407: Plasma Physics
Fundamentals of plasma: introduction to gas discharges, Definition and 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. Plasma theories: Single Particle model, Kinetic theory, and Fluid models. Dusty Plasma.

Phy411: Solid State Physics
Introduction to solid state physics - The free electron theory: Free levels in one-dimension, Free electron gas in three dimensions, Electrical conductivity – Motion in magnetic field-Wiedemann-Franz law, nearly free electron model - origin of the energy band, Bloch functions - Proof of Bloch's Theorem in 1-D- Kronig Penney model, Semiconductor materials: Bonding Forces and Energy Bands -Charge carriers in semiconductors -excess carriers in semiconductors, Dielectrics. Dielectric constant, Ferroelectrics: Ferroelectric crystals, Piezoelectricity.

BPh405: Biophysics of Cell Membrane
Membrane Biophysics: An Overview, What is biophysics, What is life and its Origin? Relative sizes of biological molecules and cells ? What is a biomembrane ? What topics are covered in this course? An idealized living cell Signal transduction, Fundamental Aspects Of Biological,

Membranes, Origins of the Lipid Bilayer Concept, Experimental Evidence for the Lipid Bilayer, Composition of Biomembranes, Interface Approach to Membrane Lipid Chemistry, Elements of Membrane Proteins, Elements of Membrane Carbohydrates, Lipid-protein-carbohydrate Complexes, The Ultrastructure of Biomembranes, The 'Chop Suey' Model, Functions of Biomembranes, The Lipid Bilayer: Structure and Function, Membrane Biophysics--Basic Principles, Thermodynamics, Kinetics, Interfacial Chemistry, Bioelectrochemistry, Experimental Models of Biomembranes, Membrane Transport, Osmosis, Water Movement, and Ion Translocation, Theories of Membrane Transport, Basic Principles, Membrane Electrochemistry, Interfacial Electrochemistry, Electronic Processes in Membranes, Evidence for electronic processes, Electron-conducting BLMs, Membrane Physiology, Membrane Bioenergetics, Membrane Photobiophysics and Photobiology, Applications: BLMs in medicine, Immunology, Cancer, Drug testing, Apoptosis. Supported Bilayer Lipid Membranes as Sensors, BLMs on microporous filters and SnO2 glass, Metal-supported s-BLMs, Gel-supported sb-BLMs, BLMs on complex substrates, Liposomes, Liquid Crystals, and Nanoparticles, Solar Energy Transduction via SC-SEP cells, recent issues in Biophysics and cell membranes.

BPh407: Nanotechnology and Physics of Biomaterials
Introduction to nanotechnology, Interphase Systems, Protein-based Nanostructures, DNA-based Nanostructures, Nanoanalytics.

BPh409: Radiotherapy
Principles of radiotherapy planning, Radiobiology and treatment planning, Organs at risk and tolerance of normal tissues, Emergency and palliative radiotherapy, Dose Distribution and Scatter Analysis, A System of Dosimetric Calculations, Treatment Planning: Isodose Distributions- Patient Data, Corrections, and Setup, Field Shaping, Skin Dose, and Field Separation, Electron Beam Therapy, Intensity-Modulated Radiation Therapy, Proton Beam Therapy, Radiation Protection, Recent issues in Radiation treatment planning.

Phy415: Physical Properties of Solids
Introduction: Importance of studying physical properties of materials. Electric and ionic conduction – conductivity. Energy band structure and electronic mobility. Dielectric materials. Ferroelectricity – piezoelectricity. Magnetic classification of materials-Effect of temperature on magnetic properties- domains and hysteresis. Superconductivity. Optical properties (light interactions with solids- refraction and reflection-luminescence- photoconductivity- optical fibers).

Phy423: Introduction to Digital Electronics
Introduction: Binary numbers, Octal numbers & Hexadecimal numbers, Codes: Weighted binary codes and non-weighted binary codes, Basic logic gates: AND , OR, NOT, Electronic 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, Assessment, Addition and subtracting Digital 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 and 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, Different types of D/A and A/D converters , Applications and Revision.

BPh411: Biophysical Systems Control
Basics principles of feedback, control and communications theories, homeostasis and cellular signaling, hormonal control, approaches to studying the structure and function of sensory systems, principles of sensory processing and communication, optics and the eye, information processing in the retina. acoustics and the ear, transduction, tonotopic maps and the central auditory system, neuronal control of mood, emotion, and state of awareness, control of breathing, control mechanisms in circulatory function, body temperature regulation, recent issues in control in nervous system.

BPh402: Graduation Project
This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

BPh404: Experimental Biophysics (6)
Thermionic emission, Audio frequency oscillator, High frequency oscillator, Crystal oscillator. The transistor as an AC amplifier, Transistor multivibrator, Schmitt trigger, Boltzmann constant. X- rays: Determination of linear absorption coefficient of materials.

BCh418: Human Physiological Chemistry
Compositions and functions of blood, blood volume, haemopoiesis, haemostatisis,. 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.

BPh406: Biophysics(2)
X - ray crystallography (crystal and symmetry - crystal system s - point groups and space groups - growth of crystals of biological molecules - x-ray diffraction and data collection - structure solution). NNR spectroscopy (basic principles of NMR - NMR theory - classical description of NMR - NMR parameters - NMR application in chemistry, biophysics and medicine). Molecular modeling (building protein structure - building nucleic acids structure - the chemical structure of nucleic acids - the double helical structure of DNA).

BPh408: Molecular Biophysics and Spectroscopy
BIOMOLECULES, The Hierarchy of Living Things ,Information and Function, Information and Construction , Information Content, Biomolecules, Spin Glasses, Glasses, and Solids, Nucleic Acids, General Arrangement of Nucleic Acids, Mononucleotides—The Building Blocks Polynucleotides, The Double Helix, Some Properties of DNA, Replication , Storage and Retrieval of Information, The Genetic Code, Transcription and Translation, The Code, Codon and Anticodon , Lipids and Membranes , Lipids, Membranes, Biomembranes and Inclusions, SPATIAL STRUCTURE OF PROTEINS: MEASUREMENT AND CONSEQUENCE; The Secondary Structure, The Amino Acids , The Ramachandran Plot ,The alpha Helix, beta- Pleated

Sheets, Secondary Structure Prediction, Tertiary Structure of Proteins, Structural Patterns, Myoglobin and Hemoglobin , Ligand Binding to Myoglobin , Ligand Binding to Hemoglobin: The Case for Conformational Complexity, The Bohr Effect: Further Evidence for Conformational Changes. THE ENERGY LANDSCAPE AND DYNAMICS OF PROTEINS, Conformational Substates, States and Substates, Nonexponential Kinetics, The Debye-Waller Factor, Spectral Hole Burning , Substates Seen in Molecular Dynamics Simulations , The Organization of the Energy Landscape, The Energy Landscape in One Dimension , The Hierarchy of Substates, Taxonomic Substates , Statistical Substates ,Few-Level Substates Reaction Theory,Arrhenius Transitions and Tunneling , Transition State Theory (TST) , The Kramers Equation ,The Tunnel Effect, Barriers and Gates ,Electronically Controlled Reactions , Collective Effects. Supercooled Liquids and Glasses, Glass Structure, Energy Landscape, Specific Heat (Heat Capacity), Viscosity, Glass Transition, and Fragility, Fluctuation and Relaxation Processes, Fluctuation,Primary (alpha) and Secondary (beta) Relaxations, Low-Temperature Phenomena, FUNCTION AND DYNAMICS, Protein Dynamics, Equilibrium and Nonequilibrium Motions, Vibrations and Normal, Protein Quakes,Another Look at Protein Landscapes: Conformation, Structure, and Reaction , The Fluctuations and Slaving, Internal Motions, Hydration, and _ Fluctuations , Low-Temperature Dynamics, or Lost in the Energy Landscape, Protein Quantum Dynamics, Self-Trapped States, Classical and Quantum Mechanical, What Are the Experiments, Molecular Orbitals, Hybridization, Multiple Bonds, Delocalization and “Resonance”, The Peptide Bond,The Heme Group ,Energy Levels from Nuclei to Proteins, Interaction of Radiation with Molecules, Absorption and Emission, Recent issues in modern molecular biophysics. 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, Revision and assessment, 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.

BPh410: Biomedical Physics

Image production (radionuclide imaging - gamma camera - single photon emission tomography SPET - positron emission tomography PET). Ultrasonic imaging (pulse_ echo technique - ultrasound generation - tissue interaction with ultrasound - transducer arrays - application - Doppler imaging). Computer tomography CT (absorption of x _ray - data collection - image reconstruction - beam hardening - spiral CT). Magnetic resonance imaging (nuclear magnetic moment - precessing in the presence of magnetic field - T1 and T2 relaxation - the saturation recovery pulse sequence).

BPh412: Quantum Biophysics

Solving Schrödinger equation for a free particle in a box and for a 3D Harmonic oscillator; Angular momentum operators in Cartesian and Spherical coordinates, commutations, eigenvalues and eigenfunctions for central potentials; Solving Schrödinger equation for periodic potentials, Bloch wave-function, Hydrogen atom: eigenvalues, eigenfunctions, energy spectrum, Zymann effect, quantum numbers, Stern-Gerlach experiment. Time-independent, non-degenerate perturbation and Variational method, problems. Scattering: Partial wave analysis and Born-approximation, problems.

Phy412: Laser systems and Applications

Laser systems and applications: Revision of basics of Laser physics – working principles- main components- Laser modes, Types of Laser: Solid state Laser- Ruby Laser Nd-Yag Laser- He-Ne Laser, Argon Laser- CO2 Laser – semiconductor Laser, Application of Laser, Scientific research applications. Medical applications of Laser, Industry applications of Laser, Defense applications of Laser.

Phy414: Superconductors

Fundamentals of solid state physics - Phenomenon of Superconductivity, Basis of Electrodynamics and thermodynamics, Thermodynamics of superconductors; the theory of diffusion in solids, Calculations in crystal structures- perovskite structure -close packing in solid crystals - packing and defects-Intermediate state of superconductors, Different types of superconductors, Type II superconductors, vortices ,the first and second critical magnetic fields, Microscopic theory of superconductivity - thermoelectric effect, IR spectroscopy, Electronic spin resonance, Tunnel effect in superconductors, Josephson effect.

Phy420: Condensed Matter Physics

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 eath 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, Binary and ternary systems, Some physico chemical properties of some glasses, Magnetic, electrical and optical behavior of some chalcogenide glasses.

BPh414: Electronic Simulation of Biosystems

Specific topics include large scale parallel circuit simulation, industrial practice of fast SPICE simulation, structure-preserving model order reduction of interconnects, advanced simulation techniques for oscillator networks, dynamic stability of static memories and biological systems as well as verification of analog integrated circuits. Simulation and verification are fundamental enablers for understanding, analyzing and designing an extremely broad range of engineering and biological circuits and systems. The design of nanometer integrated electronic systems and emerging biomedical applications have stimulated the development of novel simulation and verification techniques and methodologies. Simulation and Verification of Electronic and Biological Systems provides a broad discussion of recent advances on simulation, modeling and verification of integrated circuits and biological systems and offers a basis for stimulating new innovations.

Tanta University
Faculty of Science
Department of Chemistry

Program Title	**Chemistry**
Program Type	**Single**
Department(s)	**Chemistry**

Chm201 Chemical Thermodynamics

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.

Chm203 Analytical Chemistry

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.

Chm 205 Chemistry of Main Elements

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, chalcogens, 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.

Chm207 Aliphatic Chemistry

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 alcohols, ethers, thio-compounds, aldehydes, ketones, carboxylic acids, and their derivatives, nitrogen compounds and its derivatives as well as monosaccharides.

Chm209 Aromatic Chemistry

The course will cover basic chemistry of aromatic compounds. The topics covered in this course include nomenclature, structure and reactions of aromatic hydrocarbons, phenols, aromatic aldehydes, ketones, acids, nitrogen compounds and their derivatives as well as thio-compounds.

Practical, 2hrs: study of the separation and detection oh a mixture of organic compounds as well as the scheme of identification organic liquids.

Sta225 Applied 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.

Phy229 Principles of Electronics and Semiconductors

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). 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.

Geo219 General Geology

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, mantle, and core. Introduction to Plate tectonic theory and Earth's material. 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, hand specimen description and simple classification of crystal models, minerals and rocks.

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.

Mic257 Introduction of Microbiology

This course offers a comprehensive study of the field of microbiology to science majors. The course will give detailed insights into the following major themes: Structure and function of microbes (cellular structures, metabolism, and growth), microbial ecology, microbial diversity including prokaryotes (bacteria), eukaryotes (fungi and microalgae), in addition to viruses, and finally clinical microbiology (immunity, pathogenicity, epidemiology, control of microbes, and diseases).

Ent213 Introduction of Entomology

This course will enable students to acquire knowledge and critical understanding of insect morphology, anatomy, taxonomy, physiology and ecological adaptations. The application of insect knowledge is taught in medical, forensic entomology and integrated pest management.

Chm 206 Surface Chemistry and Catalysis

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 micelle solutions, applications in biological and technological processes. Theories of catalysis, homogeneous and heterogeneous catalysis as well as enzyme catalyzed reactions are discussed.

Chm208 Instrumental Analysis (1)

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.

Chm210 Chemistry of Transition Elements

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.

Chm212 Chemistry of Solid State and Nuclear Chemistry

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.

This course will provide the fundamentals of nuclear chemistry including; nuclear structure, nuclear models (Fermi gas, liquid drop and nuclear shell models), isotopes Radioactivity and radioactive decay, 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.

Chm214 Stereochemistry and Bifunctional Organic Compounds

The course will cover description of structure, constitution, configuration and conformation of diastereomer

rs and enantiomers, formation of racemic mixtures (its formation, properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis.

This is a study of the properties and reactivity of carbon compounds containing more than one functional group 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.

Practical, 2hrs: study the quantitative estimation of several organic material and their solutions.

Chm216 Organic Reactions Mechanism

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

Chm220 Chemical Kinetics

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.

Chm301 Quantum Chemistry

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.

Chm303 Electrochemistry (1)
This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernest 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).

Chm307 Heterocyclic Compounds
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 such as N, O and S, and condensed systems containing such rings.

Chm309 Polynuclear Aromatic compounds and Alicyclic
The course provide a study of biphenyl and its derivatives, diphenyl methane, triphenyl methane and hexaphenyl ethane , Naphthalene , anthracene , phenanthaene and their derivatives. Also the chemistry of alicyclic compounds, Where study the nomenclatures, a synthesis and reaction of cycloalkanes, cycloalkyl halides, cycloalkyl alcohols, cycloalkanes and other recent topic in this field.

Chm311 Alkaloids, Terpenes, Steriod, and Vitamins
the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid such as indole, benzylisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids such as cholesterol, ergosterol vitamin D….) and vitamins (vitamin B1,2,5,6, E, K and A).

Chm313 Chemistry of Pesticides and Green Chemistry
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. The course also includes recent trends in pesticide chemistry via developments with polymeric materials to improve its properties and to safe use and applications of Pesticides.
This course is interested in the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Green chemistry applied across the life cycle of the chemical products including its design manufacture, use and ultimate disposal.

Chm315 Instrumental Analysis (2)
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, and thermo-mechanical and dynamic mechanical analysis) are included.

Chm317 Industrial Chemistry

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. Industrial chemistry has assisted in the discovery and development of new and improved synthetic fibers, paints, adhesives, drugs, cosmetics, electronic components, lubricants and thousands of other products, and improved processes for oil refining and petrochemical processing that saves energy and reduces pollution.

Chm319 Alloys and Thermal Analysis

Alloys in technology. they find applications in the construction of aircraft propulsion units turbo-superchargers and rochets sent to moon. Cobalt alloys is extensively used for high speed cutting tools and permanents magnets.

The most important alloy of cobalt is satellite, it finds application in automobile parts and surgical instruments. Ferrous alloys, finds application in the construction of bridges crankshafts, heavy guns, gears, etc.

Alloy's analysis can be carried out via various methods. zinc in zinc – ferrous. Alloy electroplating bath as example can determined by complex – formation titration employing EDTA. It has been observed that this technique can lack precision. Instrumental analysis has been employed in metal determination in alloys analysis via instrumental method in simple, fast and has low detection limits for several metals.

Thermal analysis provide introduction- thermal analysis techniques. types of thermal analysis (TGA – DTA-DSC) DEFINITION, apparatus and applications. thermochemical analysis

Chm331 Physical Biochemistry and Analytical Biochemistry

Physical properties of acid and base buffer. Physical chemistry of protein and amino acids. Blood buffering action. Biological membranes. Determination of macromolecules.

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.

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

Chm302 Molecular Spectroscopy

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.

Chm304 Photo and Laser Chemistry

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.

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.

Chm 306 Organic Spectroscopy

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.

Chm308 Natural products

A **natural product** is a chemical compound or substance produced by a living organism that is, found in nature. In the broadest sense, natural products include any substance produced by life. Natural products can also be prepared by chemical synthesis (both semi-synthesis and total synthesis) and have played a central role in the development of the field of organic chemistry by providing challenging synthetic targets. Topics cover concepts of natural product chemistry, carbohydrates, traditional and modern approaches to studying natural products. **Courses include Extraction and Isolation of Natural Products.** Extraction of Natural Products, Separation of Natural Products.

Chm310 Environmental Chemistry

Environmental chemistry is the study of the distribution and interactions of matter (chemicals) in the environment, which includes both the outdoors and the indoors. Environmental Chemistry is an application of chemical principles to the study of the environment. It includes natural processes and pollution problems related to air, water, and soil. In this course the emphasis is on how the specific discipline of chemistry can help us understand contemporary environmental issues, and what it tells us about possible solutions to environmental problems the world is facing.

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.

Chm 312 Biochemistry

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.

Chm314 Computational Chemistry and Catalytic Chemistry

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.

This course outlines the principles of green chemistry, catalysis and explains the connection between catalysis and sustainable development. it discusses the classification of catalysis , synthesis methods , characterization techniques, and the relationships between chemical composition and their activity, selectivity and stability . It introduces the reader to heterogeneous catalysis, homogeneous catalysis, and bio-catalysis, explaining what catalysis is and it is important. Also, it demonstrates the recent applications of catalysis in industrial processes.

Chm316 Inorganic reactions mechanism

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.

Chm318 Electrochemistry (2)

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernest-Plank 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).

Chm332 Materials Chemistry and Water Treatment

Materials chemistry involves the use of chemistry for the design and synthesis of materials. Special attention will be for nanomaterials. Through a case study approach, synthesis, properties, and applications of nanomaterials, as well as techniques used to study and characterize them, will be explored. Examples of topics likely to be included: metal nanowires, quantum dots, nanoparticles, gold nanomaterials, nanofibers, nanotubes, grapheme, mesoporous materials, block copolymer assemblies, photonic crystals, self- assembled monolayers, biomaterials, cellulose nanocrystals, magnetic nanoparticles, etc. Recent literature on the subject of nanomaterials will also be discussed.

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 contaminates to be treated and methods of water treatment including; ultraviolet light, filtration, water softening, reverse osmosis, ultra-filtration, deionization and powdered activated carbon treatment.

CHM401 Applied Field Training
Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Chm403 Coordination Chemistry
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.

Chm405 Polymer chemistry
This is introductory course to macromolecules and synthetic polymers including free radical, ionic polymerization, polycondensation, 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.

Chm407 Practical Physical Chemistry (1)
This course covers kinetic studies for different chemical reaction and factor affecting on there reaction rate. The course deals with determination of some physical parameter such as stability constant, heat of reaction, thermodynamics parameters.

Chm409 Practical Organic Chemistry and Physical Organic Chemistry 1
Synthesis and identification of various organic compounds. This course provides a study of chemical structure and reactivity correlation. Methods and Manipulation advances techniques of separation and purification, preparation of organic compounds, polymers. Solvent purification and reagent preparation. Purification, including crystallization and distillation. Reactions and Identification of organic compounds. Also, student should learn the Protection of the eyes. Safety goggles should always be worn over the eyes, especially when carrying out potentially dangerous operations, e.g., vacuum distillations, distillation of large volumes of inflammable liquids, and experiments requiring large quantities of metallic sodium. Also, to teach students how to avoid accidents in either case are avoided by careful working.

Chm 411 Selected Topics in Organic Chemistry
This is a study of new trends in organic chemistry such as recent research topics, applications of organic compounds in pharmaceutical applications, drug delivery and agricultural applications, and others recent fields. It will cover topics which is not covered in regularly scheduled courses presented to fit the interests of advanced students.

Chm413 Chemistry of Dyes

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.

Chm415 Petroleum Chemistry and Petrochemicals

The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes. It also concerned with current problems of petroleum chemistry and processing such as chemical composition of crude oils and natural gas liquids; petroleum refining (cracking, hydrocracking, and catalytic reforming); catalysts for petrochemical processes (hydrogenation, isomerization, oxidation, hydroformylation, etc.); activation and catalytic transformation of hydrocarbons and other components of petroleum, natural gas, and other complex organic mixtures; new petrochemicals including lubricants and additives.

Chm417 Electroanalysis

Electroanalysis plays avital role in many research areas in chemistry, biochemistry, biology and other sciences. Analytical chemistry is concerned with the separation , identification and determination of relative amounts of components making up a sample of matter . the principal topics covered in this course quantitative methods of analysis and separation. this course will provide insight into such diverse topics as potentiometry, electrogravimetry, coulometry, conductometric titration, polarography, voltammetry and amperometry methods and their application.

Chm419 Selected Topics of Inorganic Chemistry

The course may include Charge transfer complexes, Medicinal applications, Transition metal complexes, Application of transition metal complexes in catalysis, Biological applications of transition metal complexes.

Chm402 Graduation Project

This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Chm404 Practical Physical Chemistry (2)

This course deals with kinetics studies of click reaction and decolorization of methyle blue dye. Analysis of some industrial components. The course covers factors affection on the flourscene quenching. Also, covers determination of some physical parameters.

Chm406 Physical Polymer and Supramolecular

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.

The course also include 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, fibers, gels and polymers, applications of supramolecular chemistry in molecular devices and life.

Chm408 Organometallic Compounds

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.

Chm410 Practical Organic Chemistry and Physical Organic Chemistry (2)

Synthesis and identification of various organic compounds and polymers. Separation and extraction of some natural products. Characterization of organic materials by IR and UV.

The course provides a study of reactive intermediates, aromaticity and Taft equation and selected reactivity relationships.

Chm412 Applied polymers

This course emphasizes on the several applications of polymers in everyday life. This course covers a wide range of topics in applied polymer chemistry and will be a valuable resource to researchers working in the polymer, coating, materials, composites, and foam industries.

Couse will cover such as polymers in drug delivery systems (controlled Release), hydrogels applications in agriculture and in medicine, polymer additives, rubbersand silicone. Highlights will be to commodity and non-commodity plastics, biodegradable polymers and recent topics.

Chm414 Nucleic Acids

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.

Chm416 Textile Chemistry

Textile chemistry in the simplest of terms is a branch of applied chemistry that studies all about textiles and fabric, from their occurrence to their utilization. Textile Chemistry uses the fundamentals of chemistry as the basis for studying and digging into the manufacturing of textiles as well as the technical compositions of the smallest unit of textiles. Textile Chemistry has a huge scope in itself as it is limited regarding one domain but still advanced within that very domain. Pursuing a career in textile chemistry would mean staying updated with the changes taking place over the years in yarns, fibers, weaves, compositions, dying, quality checking, storage, etc. Apart from mainstream Fashion Technology, this course has gained popularity in recent years because of its curriculum. 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.

Chm422 Bioinorganic Chemistry

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.

Chm428 Nanoscience

This course includes the history of nanoscience, definition of nanoscience, and nanotechnology, classification of nanomaterials, methods of characterization of nanomaterials, synthesis approaches including Top down and down up approaches, general properties of nanomaterials, general applications of nanomaterials in energy, medicine and drugs, nanobiotechnology, cosmetics and bioengineering.

Tanta University
Faculty of Science
Department of Chemistry

Program Title	**Biochemistry**
Program Type	**Single**
Department(s)	**Chemistry**

Chm207 Aliphatic Chemistry
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 alcohols, ethers, thio-compounds, aldehydes, ketones, carboxylic acids, and their derivatives, nitrogen compounds and its derivatives as well as monosaccharides.

Chm211 Principles of Aromatic Chemistry
The chemistry of aromatic compounds. The topics covered in this course include nomenclature, structure and reactions of aromatic hydrocarbons, phenols aromatic aldehydes, ketones, acids m nitrogen compounds and their derivatives as well as thio-compounds.
Practical,2hrs: Study the separation and detection of a mixture of organic compounds as well as the scheme of organic liquids.

Chm221 Principles of Analytical Chemistry
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, 2 h: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation, and complex formation reactions.

Chm223 Chemical Thermodynamics and Surface Chemistry

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. Also, 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.

Chm259 Chemistry of Main Elements

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.

Sta227 Basics of 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.

Bot253 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, pseudo alleles, 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.

Zoo275 Cell Biology

This course gives an introduction to animal cell structure and function including the chemical components of the cell, the structure and function of cell organelles and their role in development, differentiation, bioenergetics and cellular communication. Examples of relevant human disorders will be used.

BPh227 Biophysics
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. 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.

Chm220 Chemical Kinetics
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.

Chm254 Introduction to Electrochemistry
This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernest 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).

Chm256 Instrumental Analysis (1)
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.

Chm258 Chemistry of Transition Elements and Coordination Chemistry
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. Also, 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.

Chm260 Stereochemistry

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

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.

BCh202 Chemistry of Carbohydrates and lipids

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

BCh204 Chemistry of Proteins and Amino Acids

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.

Mic250 General Microbiology

Part one: This part deals with the occurrence and distribution of prokaryotic organisms and their structure, diversity and classification. Also, this part deals with the occurrence and distribution of bacteria and viruses and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to cyanobacteria and actinomycetes.

Part two: This part will enable students to acquire knowledge about the science of mycology with special emphasis on nutrition, reproduction and classification of fungi. The course will cover reproduction in fungi (vegetative, asexual and sexual) and the life history and life cycles of representative taxa.

Part three: In this part 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.

Sta214 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).

Chm351 Instrumental analysis (2) and Organic Spectroscopy

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.
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.

BCh301 Carbohydrates Metabolism
Digestion and absorption of carbohydrate. Catabolism of carbohydrate: glycolysis, TCA cycle, pentose phosphate pathway, glycogenolysis. Anabolism of carbohydrate Gluconeogenesis, glycogenosis. Metabolism of fructose, galactose, lactose.

BCh303 Amino Acids and Nucleic Metabolism
Catabolism of the carbon skeletons of amino acids. Biosynthesis of non-essential and essential amino acids. Urea cycle, physiologically active amine (serotonin, histamine). Chemistry of nucleosides and nucleotides. Metabolism of purines and pyrimidines, nucleosides, and nucleotides; Abnormalities in nucleic acid metabolism; Xeroderma pigmentation and skin cancer.

BCh305 Vitamins and Inorganic metabolism
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.

BCh307 Protein and Lipid Metabolism
Introduction to metabolism Protein turnover. Catabolism of the carbon skeletons of amino acids. Biosynthesis of amino acid derived compounds Protein synthesis. Digestion of lipids. Catabolism of Fatty acids: Fatty acid oxidation. Anabolism of fatty acids: fatty acids synthesis.

Chm325 Heterocyclic Chemistry
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.

Chm 353 Photochemistry and Laser Chemistry
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. 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.

Chm355 Organic Reactions Mechanism and bifunctional Compounds
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.

BCh309 Physical Biochemistry and Bioinorganic
Physical properties of acid and base buffer. Physical chemistry of protein and amino acids. Blood buffering action. Biological membranes. Determination of macromolecules. 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 perspective. The importance of these is discussed regarding drug design and understanding of diseases resulting from mutations.

BPh313 Radiobiology
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.

BCh302 Enzymology (1)
Definition of enzymes, importance, classification. Kinetics of enzymes: activation energy, Km value, types of inhibition, Reaction with more than one substrate. RNA enzymes.

BCh304 Body Fluids and Biological Functions
Compositions and functions of blood, blood volume, hematopoiesis, hemostasis,. abnormal hemoglobin's. 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.

BCh306 Hormones
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.

BCh308 Molecular Biology

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.

BCh310 Practical Biochemistry (1)
The aim of this course is to study the practical details in analytical clinical chemistry as determination the chemical component in serum or plasma and urine and complete investigation of urine and blood.

Bot350 Introduction to 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 plants and algal systems.

Chm350 Natural Products
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, benzylisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D….) and vitamins (vitamin B1,2,5,6, E, K and A).

BCh312 Biological Membranes and Biological Separation
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. Also, Determination of macro-molecules. Separation of macromolecules by different methods chromatography, electrophoresis, Ultracentrifugation. Molecular weight determination.

BCh314 Drug Metabolism and Toxicology
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. 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.

BCh401 Applied Field Training

Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

BCh403 Practical Biochemistry (2)

This aim to study the practical enzyme purifications in different ways and also study microbial analysis and antibiotics include the biochemical substance in micro-organism.

BCh405 Genetic Engineering and Biotechnology (1)

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

BCh407 Immunology

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.

BCh409 Enzymology and Signal Transduction

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

BCh411 Tissue Chemistry

Mechanism of Collagen, elastin, fibrin and fibronectin proteoglycans in extracellular matrix. Role of bone as mineralized connective tissue. Many metabolic and genetic disorders involve bone. Muscle transduction actin and myosin as the major protein of muscle. Actin based regulation occurs in striated muscles.

BCh413 Nutrition and Disturbance Metabolism
Regulation of Carbohydrate, Lipid and protein. Hormonal action of metabolic control. Regulation of metabolism in starvation and obesity. An overview of nutrition, food choice and diet planning diets, diet and health, functional foods, antioxidants, food drugs interactions, genetically modified food.

BCh415 Clinical Biochemistry
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.

BCh402 Graduation Project
This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

BCh404 Practical Biochemistry (3)
Extraction and estimation of chlorophyll and Carotenoids in different sources in plants. Extraction and estimation of Poly phenolic compounds and antioxidants from different sources of plants. Estimation of Thiobarbituric reactive substance and antioxidants by using ox-brain. Isolation and estimation of glycogen from liver; Estimation of fructose and cellulose in plants. Isolation and estimation of casein, lactose and fat from dried milk. Isolation and estimation of lipids, cholesterol, lecithin (phospholipid) and fatty acid from egg. Separation of amino acids by paper chromatography. Extraction and estimation of plant DNA. Synthesis of acetyl salicylate (aspirin) and methyl acetate (oil of wintergreen). Extraction and estimation of caffeine from tea; estimation of Tannins, Isolation of red pigment from Paprika and estimation of capsaicin. Production of antiserum & immune-diffusion; oucterlony; double diffusion Radial immune-diffusion. Isolation of glycoprotein by electrophoresis from liver and staining glycoprotein.

BCh406 Cancer Biology
Definition, Nature of cancer, some terms frequently applied in cancer. Cancer metabolism. Cell cycle and apoptosis. Host tumor-relationship. Diagnosis and treatment of cancer.

BCh408 Chemotherapy and Gene Therapy
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.

BCh410 Bioinformatics
The course includes application of computer in nucleic acid and protein sequences, analysis of mass protein fragments.

BCh412 Environmental Biochemistry
Effects of trace element and pollution. carcinogen, phytotoxins, zootoxin and environmental toxicants. Food drug interactions. Relation between cancer and pollution.

BCh414 Tissue Culture and Microbial Biochemistry
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. 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 cover 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 emphasis on the production of haploid plants. Genetic variation of cells under tissue cultures conditions will also be covered in this module.

BCh416 Biotechnology (2)
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.

Zoo458 Histopathology
The aims of the histopathological course is to 1- study microscopic structural abnormalities in the tissue under the effect 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.

Tanta University
Faculty of Science
Department of Geology

Program Title	**Geology**
Program Type	**Single major**
Department(s)	**Geology**

Geo201 Structural Mineralogy
Introduction, Crystal chemistry: i- crystal lattice, lattice planes, glide planes, screw axis, fourteen bravais lattice, ii- Coordination and coordination number, 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; calculation of crystal lattice and coordination numbers of minerals.

Geo203 Optical Mineralogy
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 ordinary light; plane polarized light, methods of light polarization, and optical properties using polarized light; and Interference between crossed Nicols, optical properties between crossed Nicols (Interference and interference colours, birefringence, retardation, extinction and extinction angle); Convergent light and interference figures; Optical orientation.
Laboratory work: Optical properties and microscopic examination and description of selected minerals in thin sections.

Geo205 Stratigraphy
Introduction, strata and stratification, basic stratigraphic principles and laws, types of stratigraphic contacts, conformable and unconformable boundaries, geologic time units, relative and absolute ages, branches of stratigraphy, stratigraphic procedures, stratigraphic maps and diagrams, practical work includes determination of stratigraphic relationships and sequence of events, construction of different types of stratigraphic maps and diagrams, field trip: field stratigraphic relationships, verifying stratigraphic laws in the field.

Geo207 Principles of Paleontology
Introduction, biology of planktonic and benthonic foraminifera, morphological characteristics of foraminiferal tests, structure and arrangement of chambers, overall shape of the tests, aperture, suture, peripheral and umbilical characters, shell wall and surface ornamentation, taxonomic classification, ecology and significance of planktonic and benthonic foraminifera, practical work includes methods of preparation, examination, description and identification of planktonic and benthonic foraminifera.

Geo209 Macropaleontology
Introduction, Fossils and fossilization, Significance of fossils, types of fossils, Taxonomy and classification, Phylum Mollusca, Phylum: Bryozoa, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina, Trace fossils and Plants. Practical work includes examination, description, definition and classification and of some selected macro-invertebrate fossils, field trip: collection, mode of preservation, definition of macrofossils.

Gph213 Principles of 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.

Geo211 Gemstones
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.

Geo213 Geomorphology
This course focuses on the origin/evolution of landforms and the physical processes responsible for their creation and modification. Each topic will relate to the following recurring themes that we use as guiding principles for the course: laws of conservation, transport rules, and event magnitude/frequency. The course is structured to begin with the “big picture” view of geomorphology (whole-earth shape and the large-scale details of the continents and ocean basins), then move on to the tectonic construction of landscapes, thermally-driven processes including glacial/periglacial systems, transport of material through fluvial and hillslope systems, sediment entrainment and deposition, and landscapes at the coastal/marine interface.

Zoo235 Invertebrates-Forming Skeleton
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.

Chm221 Principles of Analytical Chemistry

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, 2 h: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Geo202 Rock-Forming Minerals

Introduction, general mineral classification and classification of rock-forming minerals; silicate structures; mineral structure, mineral composition and mineral classification of mineral groups; general optical properties of mineral groups and their occurrences. Mineral groups include: 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 feldspathoide group); Non-silicate minerals (carbonate minerals).

Practical work includes identification and descriptions of the rock-forming minerals in hand specimens; identification of the rock forming minerals and their optical properties using transmitted polarized microscope.

Geo204 Micropaleontoloy

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, Morphology, Wall structure and arrangement of some selected microflora including Pollen and Spores, and Diatoms. Ecology and significance of microflora, Practical work includes examination, classification and description of some selected microflora and microfauna fossils.

Geo206 Sedimentary Rocks

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.

Geo208 Field Geology, Trips and Survey

Survey: Introduction, traverse types, methods and techniques of geologic surveying, Laboratory and field training applying geologic traverses and preparation of topographic maps. Observing

and collecting data and samples, using geological 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. Field study of Igneous, sedimentary and metamorphic rocks, Field Study of Geologic Structures. Periodic field trips are needed to make student training in situ in the field, to activate the teamwork and student groups, to learn how to describe, to measure and to interpret in the field

Field Geology: 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. Detailed maping and sampling, Mapping and field geology of Igneous, Sedimentary and Metamorphic Rocks. Cross-sections. Preparing and writing a geologic report.

Laboratory and field training applying geologic traverses and preparation of topographic maps. Sampling and interpreting geologic maps, applied geologic problems, Stereonets and faults, Cross-sections.

Gph212 Potential Exploration and Interpretation

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.

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.

Geo210 Applied Mineralogy

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.

Geo212 Geographic Information System

What is GIS?, Characteristics of GIS, Spatial data types, Types of geographic phenomena, Computer representations of geographic information, Organizing and managing spatial data, Spatial referencing and positioning, Map projections, GIS data sources, Data management and processing systems, Data entry and preparation, Spatial data analysis, Raster based surface analysis, Network analysis, Geospatial analysis, advances of GIS softwares, Geomorphological and geological applications of GIS, Terrain and hydrological analyses, lineaments and structural elements automatic extraction.

Practical Course: include GIS different softwares, introduction to ArcGIS package, How to enter data (direct and indirect methods), Geo-referencing, Geocoding and registration, Map

projections and transformation, Editing in ArcMap, Introduction on Arc Catalog and Arc Toolbox, geo-statistical, surface analysis, network analyst, how to use open source data, how to download free GIS data, building geodatabase, application on geological and structural examples, Periodic field trips are needed to draw base maps, collecting ground control points and validation.

GPh206 Paleomagnetism
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.

Bot248 Introduction to Plant Taxonomy
This module introduces the students to the principles of plant taxonomy and the definitions and terms used in plant taxonomy and systematic, 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 Angiospermae, 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.

Chm232 Chemistry of Main and Transition Elements
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
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.

Bot250 Introduction to Soil Science
This part deals with soil ecology. 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, soil pollution and soil quality.

Chm274 Principles of Instrumental Analysis
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.

Geo301 Igneous Petrology

Introduction, Earth's interior, source of heat and heat transfer, melting and generation of magma, magma constituents and types of magma, composition of magma in different tectonic settings. Crystallization of magma and Bown's reaction series, and magmatic evolution (magmatic differentiation, magma mixing and magmatic assimilation) Forms of igneous bodies (plutonic and volcanic rocks), field relations, structures and textures. Chemical and mineralogical classifications of some igneous rocks. Petrology; distribution of igneous rocks in different tectonic.

Field trip and training: field observations; structures and collecting samples of igneous rocks.**Laboratory** study consists of hand specimens identification and petrographic identification and descriptions of igneous rocks under the microscope.

Geo303 Metamorphic Petrology

Introduction, definitions, metamorphic processes; factors of metamorphism; types of metamorphism; metamorphic grades, metamorphic zones and index minerals; metamorphic facies; metamorphic fabrics and textures; classification of metamorphic rocks. Metamorphism and plate tectonics and distribution of metamrohic rocks in different tectonic settings. Metamorphic mineral assemblages and their protoliths (Metaplites, Metabasites, Meta-carbonates and Calc-Silicates, meta-ultramafics).

Field trip and training: field observations of metamorphic rocks, structures and collecting samples.

Laboratory study consists of hand specimens identification and examination; and petrographic examination under the microscope; ACF, AFM and AKF diagrams plotting of metamorphic rocks; P and T conditions and calculations of metamorphic rocks using mineral assemblages and chemical analyses of minerals.

Geo305 Structural Geology

Introduction to structural Geology, measurements of attitudes of strata and bedding planes, primary sedimentary structures, primary igneous structures, stress and Strain, types of unconformities, folds and their types, faults and their classification, joints and their types, types of foliation, types of lineation and linear structures, shear zones and shear sense indicators. Strike-slip tectonics, fold and thrust belts, structural framework of Egypt. Practical Course: Reading structural maps of dipping beds, folded beds, faulted beds, folded and faulted beds. Plotting of planes, lines, Pole to a plane, trend and plunge on stereographic Determining the orientation of the intersection of two planes and Measuring the angle between two planes using stereographic projection. Drawing Rose Diagrams for Azimuthal Data. Software in structural geology. Periodic field trips are needed to make measurements, interpretation, and visualization of structural elements.

GPh315 Seismic Methods and Interpretation

Introduction, Basic reflection and refraction seismic theories: 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 equipment's 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.

Geo307 Non-metallic Deposits

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.

Geo309 Palynology

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.

Geo311 Seismic Stratigraphy

This course introduces the principles and disciplines of stratigraphy which include lithostratigraphy, magnetostratigraphy, biostratigraphy, chronostratigraphy, sequence stratigraphy, and seismic stratigraphy. This course also serves two other purposes. One is to bridge the undergraduate course "Sedimentary Geology" by teaching the marine sedimentary environments. The other purpose is to teach how to extract stratigraphic and structural information from reflection seismic data. People who are interested in how sedimentary basins are formed and evolved and the tectonics in lithospheric and crustal scale are advised to take the course "Basin Analysis".

This course will provide an introduction to the principles and methods of sequence stratigraphy as applied in subsurface prediction. The emphasis will be on selecting interpretation methods that are appropriate for particular data sets and purposes, in order to ensure that a sequence stratigraphic interpretation is meaningful and useful.

- Explain the concepts of sequence stratigraphy and their application to a wide range of subsurface data types (seismic, well-log, core, reservoir production data);
- Illustrate pragmatic, fit-for-purpose approaches to sequence stratigraphic interpretation.

Gph319 Gravity and Magnetic Methods

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. 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.

Bot359 Introduction to 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 of the Herbarium. Different field trips to different wild habitats to recognize the components of the Egyptian flora.

Zoo335 Fauna of Egypt and Zoogeography

This course introduces students to the breadth of diversity of the Egyptian fauna and investigates its origins and significance of this diversity. The adaptations of the fauna to the diversity of habitats available. Major lifestyle themes, life history adaptations, and habitat characteristics are explored. Study Zoogeography provide students with the basic concepts of the geographical distribution of animals. The study of the causes, effects, and other relations involved in such distributions.

Chm367 Petroleum Chemistry and Petrochemicals

The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes. It also concerned with current problems of petroleum chemistry and processing such as chemical composition of crude oils and natural gas liquids; petroleum refining (cracking, hydrocracking, and catalytic reforming); catalysts for petrochemical processes (hydrogenation, isomerization, oxidation, hydroformylation, etc.); activation and catalytic transformation of hydrocarbons and other components of petroleum, natural gas, and other complex organic mixtures; new petrochemicals including lubricants and additives.

Geo302 Tectonic Geology

General introduction, Outline of available theories, Continental drift, Sea- floor spreading; Geosynclinals theory, Wilson cycle. Plate tectonic theory; Major lithospheric plates of the Earth, forces and mechanism of plate tectonics; tectonic plate boundaries (constructive, destructive and

transform plate boundaries; Island arcs, tectonic basins; subduction zones, Transform fault. Global wrench tectonic; plate tectonics through time; mountain ranges and mountain belts; Shields, cartons. Rocks and plate tectonics. Egypt in the framework of global tectonics. **Practical and field visits**: Tectonic observations and measurements, identification of type of lithospheric plate, plate boundary, velocity of plate movements, distance and age of plate movements and transportation.

Geo304 Geochemistry

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.

Geo306 Subsurface Geology

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.

Geo308 Hydrogeology

Introduction, Hydrogeological cycle and water balance, Occurrence of groundwater, Types of aquifers, Darcy's law, Aquifer hydrologic properties, Field and lab techniques employed for aquifer test. Groundwater flow system and flow net, Water well design. Field visits are needed to groundwater wells.

Geo310 Geology of Ores

Introduction, economic terminology, wall-rock alteration and interaction, Mineral parageneses, geothermometry and zoning Classification of ore deposits, Magmatic ore deposits, pegmatites, contact metasomatism, hydrothermal deposits, Metamorphic ore seposits, evaporates, sedimentary ore deposits, residual concentrations and supergene sulphides enrcichments.

Field trip for mineral exploration and collecting samples, and Laboratory study consists of hand specimens examination (ornamental and building stones, nonmetallic and metallic ores) description and identification.

Geo312 Engineering Geology

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

Geo314 Well Logging

The course covers fundamental petrophysical concepts and equations. The following well logging measurements are discussed: resistivity, natural gamma radiation, neutron porosity,

density, photoelectric absorption, acoustic/sonic, nuclear magnetic resonance, and formation pressure. Further topics include the measurement environment, geometrical considerations in a borehole, environmental corrections, and the link between the measured parameters and the rock's porosity, permeability, fluid/gas saturation, lithology and clay content. Through exercises and projects the students will learn how to interpret well log data.
The course gives insights into the role of borehole measurements in the search for and evaluation of hydrocarbon reservoirs. The course covers a number of measurement methods, and how these are used to determine important rock parameters such as porosity, permeability, water saturation and the rock types along the borehole.

Gph302 Sequence stratigraphy
Introduction, Basic concepts, Accommodation, Stratal stacking patterns, Allogenic versus autogenic controls, Sequence stratigraphic units: Sequences, Definition, Types of sequence, Systems tracts, Definition, Shoreline-related systems tracts, Shoreline-independent systems tracts, Parasequences, Definition, Scale and stacking patterns, Sequence stratigraphic surfaces, Definition, Subaerial unconformity, Correlative conformities, Maximum flooding surface, Maximum regressive surface, Transgressive ravinement surfaces, Regressive surface of marine erosion.

Geo316 Quaternary Geology
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.

Geo401 Applied Field Training
Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Geo403 Geology of Egypt (Precambrian)
Introduction, Distribution and age of Precambrian rocks, Theories of rock evolution, Classifications of Precambrian rock units in Egypt, their field observations and relations, their tectonic settings and evolution. Precambrian rock units include: Gneisses and migmatites; Island-arc associations (metasediments and metavolcanics); Granites (older and younger granites), Dokhan volcanic; Gabbros; Hamamat molasse sediments; Natash volcanics and ring complexes. Proposed tectonic models of the evolution of the Precambrian rocks of Egypt.

Field trip and training: field observations, measurements and field relations of Precambrian rocks in the Eastern Desert and red sea hills of Egypt and in Sinai, Egypt; mapping of rock units and collecting samples.
Laboratory work: mapping and location plots of Precambrian rock units; Identification and descriptions of rock types of each unit in hand specimens and under polarized microscope.

GE405 Petroleum Geology
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.

Geo407 Environmental Geology
Philosophy and Fundamental Concepts, Ecology and Geology, Introduction to Natural Hazards, Water Resources, Water Pollution, Water Quality, Mineral Resources and the Environment, Energy Resources, Soils and Environment, Waste as a Resource, Waste Management, Global Climate Change, Geology, Society, and the Future, Field visits are needed to some hazardous and polluted areas

Geo409 Ore Mineralogy
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 element, solid solution in oxides and sulphides textures. Replacement and deformational textures.
Laboratory work: Identifications and descriptions of oxides and sulphides minerals under reflected microacope.

Geo411 Hydrogeochemistry
Principles of Aqueous chemistry, Hydrogeochemical processes affecting the groundwater chemistry, Graphical representation of the hydrochemical data, Groundwater quality, groundwater pollution, Isotope hydrology, Surface and subsurface exploration of groundwater hydrology of Egypt. Field visits are needed to groundwater geochemical analysis laboratories.

Geo413 Microstructures
Types of Deformation and Deformation Microstructures, Classification and characteristic of shear zones, Microstructural Shear Sense Criteria, Opposite shear senses, types of prophyroclasts, types of prophyreoblasts, Strain-Induced Grain-Boundary Migration, Deformation Microstructures in minerlas, Deformation Microstructures in rocks. Intracrystalline Plasticity, From Microstructures to Mountains: Deformation Microstructures and Tectonics

Geo415 Facies Analysis and Depositional Environments
Facies Analysis, Facies Model, Facies Patterns, Facies Types, Facies Migration, Marine Transgressions, Walther's Law of the Correlation of Facies, Facies Relationships, Sedimentary (litho) Facies and (litho) Facies Analysis, Paleocurrents and Paleocurrent Indicator Analysis, Facies Associations, Facies Sequences, Environments of Deposition (Continental, Marginal-Marine, Marine), Process/ Response Model, Physical Marine Process, Marine Facies & Depositional Environment, Shallow Marine Carbonate, Controls on carbonate sedimentation,

Carbonate grain types and assemblages, Coastal Carbonate and Evaporite Environments (Beaches, Beach barrier lagoons, Carbonate lagoons, Arid lagoons, Arid sabkha flats), Shallow Marine Environments (Carbonate sand shoals, Carbonate mud mounds, Reefs, Reef-forming organisms, Reef structures, Reef settings), Distinctive and Common Sedimentary Facies Associations (Alluvial Fan, River Channels, Meandering Stream Facies, Glaciers, Swamps, Deltas, Beaches and Barrier Islands, Dunes, Lagoons, Tidal Flats, Reefs, Continental shelf, slope, and rise)

Gph411 Electric Prospecting

Introduction, basic theories of electrical and electromagnetic methods, Electrical properties of rocks and minerals, Self-potential method and its applications, Induced polarization method and its applications, Instruments, Resistivity Field arrangements and measurements. Application of electrical methods.

Geo402 Graduation Project

This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Geo404 Phanerozoic Geology and Tectonics of Egypt

Introduction, Landmasses during the Phanerozoic, Pre-Cambrian/Cambrian Transition, Paleozoic Litho- and Biostrtigrphic units in the Eastern desert and Sinai, Subsurface Paleozoic rock units in the western desert, Palaeozoic Paleogeography and Economic aspects. The Mesozoic: The Triassic Litho- and Biostrtigrphic units in the Gulf of Suez, South Western Desert and Northeast Sinai (Arif El Naga). The Jurassic Litho- and Biostrtigrphic units in the Gulf of Suez and Gebel Maghara. The Cretaceous: Litho- and Biostrtigrphic units in Sinai, Ataqa, Galala, Nile Valley, Farafra – Bahariya and the Subsurface North Western Desert. The Cenozoic Litho- and Biostrtigrphic units in: The Nile Valley, Fayium, Bahariya – Farafra and Sinai. Oligocene stratigraphic units in Egypt, Miocene in Red Sea, Gulf of Suez, Weastern Desert and Delta. Pliocene sediments in Red Sea. Selected stratigraphic sections in Egypt. Practical work includes construction of stratigraphic sections, geological reports and correlation of different Phanerozoic outcrops, Field trips in Sinai, Eastern and western deserts. Tectonic framework of Egypt, Mesozoic to Cenozoic Tectonic events of Egypt.

Geo406 Introduction to Remote Sensing

Principals of remote sensing, Electromagnetic energy (sources and interaction), Spectral reflectance curves and libraries, Sensors and platforms, Airborne and Spaceborne, remote sensing, Multispectral scanners and missions, Different satellite data types and applications, Pre-processing techniques (Radiometric and Geometric corrections), Image Enhancement and visualization, Image color composites, Image Fusion, Visual image interpretation, Principal of digital image processing, Supervised and unsupervised image classification algorithms, Validation of the classified maps, Principal and interpretation of imaging radar, Remote sensing below the grounds surface, Geological remote sensing, Methods of rock units discriminations, Remote sensing geomorphological, structural and mineral exploration applications, Groundwater indicators by remote sensing.

Practical Course: Introduction and definitions, Visual image interpretation, Introduction to Whitebox and ENVI digital image processing softwares, pixel size and transformations data, remote sensing data download, image radiometric and atmospheric corrections, Image registration methods, Unsupervised and supervised image classification algorithms, change detection techniques, lithological discrimination methods, geological mapping, structural elements identification and extraction, Periodic field trips are needed to draw base maps, collecting ground control points and validation.

Geo408 Mining Geology

Introduction, mining terminology, stages of mine life, surface mining, subsurface mining, materials for underground support, explosives, mine transportation, mine gases and ventiliations, mine drainage, mine lights and ore reserves. 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.

Field trip and Practical works, laboratory examinations

Geo410 Isotope Geology

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.

Laboratory work and Exercisesinclude estimating the decay and fractionation of isotopes, age dating of rocks and minerals; interpreting the geological processes and origin of their formations.

Geo412 Basin Analysis

Definition, Examples, What are Sedimentary Basins?, Theory of basin formation, Sedimentary Basin Analysis, Tectonics and sedimentation, Questions about Sedimentary Basins, Methods of Formation of Sedimentary Basins, How to Study Sedimentary Basins?, Paleocurrents, Paleocurrent Indicators, Paleocurrent Analysis, How Basins are made?, Classification of sedimentary basins according to tectonic environment

Geo414 Geochemical Exploration

Overview of exploration geology, Exploration geochemistry., Exploration geology terminology, Dispersion halos, Geochemical sampling, Geochemical survey, Field analytical methods. Interpretation of geochemical data, statistical interpretation, univariate analysis, Interpretation of geochemical data, multivariate analysis.

Laboratory analytical methods: Treatment of geochemical data, geochemical map, Treatment of geochemical data, Geostatistics.

Geo416 Applied Paleontology

Introduction, morphological characteristics of foraminiferal tests, structure and arrangement of chambers, overall shape of the tests, aperture, suture, peripheral and umbilical characters, shell

wall and surface ornamentation, taxonomic classification, ecology and significance and application of planktonic and benthonic foraminifera, Applied Palynology and case studies from Egypt. Practical work includes methods of preparation, examination, description and identification of planktonic and benthonic foraminifera.

Tanta University
Faculty of Science
Department of Geology

Program Title	**Geophysics**
Program Type	**Single**
Department(s)	**Geology**

Gph201 Gravity Methods
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.

Gph203 Electrical Prospection
Introduction, basic theories of electrical and electromagnetic methods, Electrical properties of rocks and minerals, Self-potential method and its applications, Induced polarization method and its applications, Instruments, Resistivity Field arrangements and measurements. Application of electrical methods.

Gph205 Magnetic Prospecting
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.

Gph207 Principles of Stratigraphy
Introduction, strata and stratification, basic stratigraphic principles and laws, types of stratigraphic contacts, conformable and unconformable boundaries, geologic time units, relative and absolute ages, branches of stratigraphy, stratigraphic procedures, stratigraphic maps and diagrams, practical work includes determination of stratigraphic relationships and sequence of events, construction of different types of stratigraphic maps and diagrams, field trip: field stratigraphic relationships, verifying stratigraphic laws in the field.

Geo203 Optical Mineralogy

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 ordinary light; plane polarized light, methods of light polarization, and optical properties using polarized light; and Interference between crossed Nicols, optical properties between crossed Nicols (Interference and interference colours, birefringence, retardation, extinction and extinction angle); Convergent light and interference figures; Optical orientation.
Laboratory work: Optical properties and microscopic examination and description of selected minerals in thin sections.

Gph209 Seismic Waves and Velocities
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.

Geo211 Gemstones
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.

Gph211 Principles of Paleontology
Introduction, Fossils and fossilization, Significance of fossils, types of fossils, Taxonomy and classification, Phylum Mollusca, Phylum: Bryozoa, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina, Trace fossils and Plants. Practical work includes examination, description, definition and classification and of some selected macro-invertebrate fossils, field trip: collection, mode of preservation, definition of macrofossils.

Chm221 Principles of Analytical Chemistry
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, 2 h: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation, and complex formation reactions.

Zoo235 Invertebrates-Forming Skeleton
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.

Phy231 Introduction to Thermodynamics
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 temp. 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. Expansivety 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.

Gph202 Seismic Methods
Introduction, Basic reflection and refraction seismic theories: 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 equipment's 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.

Gph204 Radioactive and Geothermal Methods
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.

GPh206 Paleomagnetism
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.

GPh208 Electromagnetism
Revision of scalars, vector quantities, scalar and vector fields. Mathematics of vector and their physical meanings. The three coordinate systems used in the course. Coulomb's law in vector notation – problems on 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. Formulation of Gauss law. Applications of Gauss's law – problems. First Maxwell equation under static conditions–the divergence of the displacement vector. Work done to move a charge in an electric field, potential and potential difference in vector notation. Potential gradient.

Geo202 Rock-Forming Minerals
Introduction, general mineral classification and classification of rock-forming minerals; silicate structures; mineral structure, mineral composition and mineral classification of mineral groups; general optical properties of mineral groups and their occurrences. Mineral groups include: 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 feldspathoide group); Non-silicate minerals (carbonate minerals).
Practical workincludes identification and descriptions of the rock-forming minerals in hand specimens; identification of the rock forming minerals and their optical properties using transmitted polarized microscope.

Gph210 Microfossils
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, Morphology, Wall structure and arrangement of some selected microflora including Pollen and Spores, and Diatoms. Ecology and significance of microflora, Practical work includes examination, classification and description of some selected microflora and microfauna fossils.

Geo210 Applied Mineralogy
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.

Geo212 Geographic Information System
What is GIS?, Characteristics of GIS, Spatial data types, Types of geographic phenomena, Computer representations of geographic information, Organizing and managing spatial data, Spatial referencing and positioning, Map projections, GIS data sources, Data management and processing systems, Data entry and preparation, Spatial data analysis, Raster based surface analysis, Network analysis, Geospatial analysis, advances of GIS softwares, Geomorphological and geological applications of GIS, Terrain and hydrological analyses, lineaments and structural elements automatic extraction.
Practical Course: include GIS different softwares, introduction to ArcGIS package, How to enter data (direct and indirect methods), Geo-referencing, Geocoding and registration, Map projections and transformation, Editing in ArcMap, Introduction on Arc Catalog and Arc Toolbox, geo-statistical, surface analysis, network analyst, how to use open source data, how to download free GIS data, building geodatabase, application on geological and structural examples, Periodic field trips are needed to draw base maps, collecting ground control points and validation.

Sta206 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.

Phy230 Mathematical Physics
Fourier analysis, Laplace transforms, ordinary differential equations, series solutions of ordinary differential equations, partial differential equations.

Chm232 Chemistry of Main and Transition Elements
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
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.

Bot250 Introduction to Soil Science
This part deals with soil ecology. 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, soil pollution and soil quality.

Gph301 Igneous and Metamorphic Petrology
Igneous rocks: Introduction, generation of magma, magma constituents and types of magma. Crystallization of magma and Bown's reaction series, and magmatic evolution (magmatic differentiation, magma mixing and magmatic assimilation) Forms of igneous bodies (plutonic and volcanic rocks), field relations, structures and textures. Classifications of igneous rocks.
Metamorphic rocks: Introduction, definitions, metamorphic processes; factors of metamorphism; types of metamorphism; metamorphic grades, metamorphic zones and index minerals; metamorphic facies; metamorphic fabrics and textures; classification of metamorphic rocks. Metamorphism and plate tectonics.
Field trip and training: field observations; structures and collecting samples of igneous and metamorphic rocks.
Laboratory study consists of rocks in hand specimens; identification and petrographic descriptions of rocks under the microscope.

Gph303 Potential Exploration

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.
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.

Gph305 Earthquake Seismology

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.

GPh307 Principles of Structural Geology

Introduction to structural Geology, measurements of attitudes of strata and bedding planes, primary sedimentary structures, primary igneous structures, stress and Strain, types of unconformities, folds and their types, faults and their classification, joints and their types, types of foliation, types of lineation and linear structures, shear zones and shear sense indicators.
Practical Course: Reading structural maps of dipping beds, folded beds, faulted beds, folded and faulted beds. Plotting of planes, lines, Pole to a plane, trend and plunge on stereographic Determining the orientation of the intersection of two planes and Measuring the angle between two planes using stereographic projection. Drawing Rose Diagrams for Azimuthal Data. Softwares in structural geology. Periodic field trips are needed to make measurements, interpretation, and visualization of structural elements.

GPh309 Sedimentary Rocks

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.

GPh311 Field Geology and Field Trips

Detailed maping 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 includes sampling and interpreting geologic maps, applied geologic problems.

GPh313 Engineering Geophysics

Introduction, Uses of geophysical prospecting methods in engineering and its 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.

Geo309 Palynology
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.

Geo319 Sequence Stratigraphy
Introduction, Basic concepts, Accommodation, Stratal stacking patterns, Allogenic versus autogenic controls, Sequence stratigraphic units: Sequences, Definition, Types of sequence, Systems tracts, Definition, Shoreline-related systems tracts, Shoreline-independent systems tracts, Parasequences, Definition, Scale and stacking patterns, Sequence stratigraphic surfaces, Definition, Subaerial unconformity, Correlative conformities, Maximum flooding surface, Maximum regressive surface, Transgressive ravinement surfaces, Regressive surface of marine erosion.

Phy311 Computational Physics
Solving non-linear equations, Eigenvalues and Eigenvectors, Fourier Methods, Numerical Differentiation, Numerical Integration, Ordinary Differential Equations: Initial-Value Problems, and Ordinary Differential Equations: Boundary-Value Problems.

Bot359 Introduction to 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 of the Herbarium. Different field trips to different wild habitats to recognize the components of the Egyptian flora.

Zoo335 Fauna of Egypt and Zoogeography
This course introduces students to the breadth of diversity of the Egyptian fauna and investigates its origins and significance of this diversity. The adaptations of the fauna to the diversity of habitats available. Major lifestyle themes, life history adaptations, and habitat characteristics are explored. Study Zoogeography provide students with the basic concepts of the geographical distribution of animals. The study of the causes, effects, and other relations involved in such distributions.

Chm367 Petroleum Chemistry and Petrochemicals

The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes. It also concerned with current problems of petroleum chemistry and processing such as chemical composition of crude oils and natural gas liquids; petroleum refining (cracking, hydrocracking, and catalytic reforming); catalysts for petrochemical processes (hydrogenation, isomerization, oxidation, hydroformylation, etc.); activation and catalytic transformation of hydrocarbons and other components of petroleum, natural gas, and other complex organic mixtures; new petrochemicals including lubricants and additives.

Gph302 Seismic Stratigraphy
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.

Gph304 Petrophysics
Introduction, Physical properties of rocks, Porosity, Permeability, Relative permeability, Capillary pressure, Electrical properties of rocks, magnetic properties and petrophysics, 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.

Gph306 Global Tectonics
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. Field visits are needed to explore the geotectonic in the field

Gph308 Principles of Hydrogeology
Introduction, Hydrogeological cycle and water balance, Occurrence of groundwater, Types of aquifers, Darcy's law, Aquifer hydrologic properties, Field and lab techniques employed for aquifer test. Groundwater flow system and flow net, Water well design. Field visits are needed to groundwater wells

Geo306 Subsurface Geology
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.

Gph310 Environmental Geophysics
Introduction, Uses of geophysical prospecting methods in 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.

Geo310 Geology of Ores
Introduction, economic terminology, wall-rock alteration and interaction, Mineral parageneses, geothermometry and zoning Classification of ore deposits, Magmatic ore deposits, pegmatites, contact metasomatism, hydrothermal deposits, Metamorphic ore seposits, evaporates, sedimentary ore deposits, residual concentrations and supergene sulphides enrcichments.
Field trip for mineral exploration and collecting samples, and Laboratory study consists of hand specimens examination (ornamental and building stones, nonmetallic and metallic ores) description and identification.

Gph312 Geophysical Survey
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.

Geo304 Geochemistry
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.

Gph401 Applied Field Training
Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Gph403 Well Logging
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).

Geo403 Geology of Egypt (Precambrian)

Introduction, Distribution and age of Precambrian rocks, Theories of rock evolution, Classifications of Precambrian rock units in Egypt, their field observations and relations, their tectonic settings and evolution. Precambrian rock units include: Gneisses and migmatites; Island-arc associations (metasediments and metavolcanics); Granites (older and younger granites), Dokhan volcanic; Gabbros; Hamamat molasse sediments; Natash volcanics and ring complexes. Proposed tectonic models of the evolution of the Precambrian rocks of Egypt.

Geo405 Petroleum Geology

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.

Gph407 Hydrogeophysics

The field of hydrogeophysics seeks to estimate parameters that control groundwater flow, contaminant transport, spatial distribution of water and various other hydrologic properties using geophysical measurements. The course examines geophysical and hydrologic methods that are currently being developed in industry, government labs and academia. The relationships between geophysical and hydrologic properties of soils and sedimentary rocks is studied. The mathematical treatment is kept to a minimum: the dual emphasis here is on the conceptual basis of near-surface geophysics and on newly emergent hardware and software technologies, including those that integrate geophysical data with other types of information. The course will provide a hands-on introduction to collection, processing, and interpretation of the most frequently used geophysical and hydrological data. The geophysical component will cover seismic refraction, ground-penetrating radar, and electrical resistivity. The hydrological component will cover aquifer testing, stream velocity measurement, and the numerical modeling of ground-water flow.

Geo409 Ore Mineralogy

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 element, solid solution in oxides and sulphides textures. Replacement and deformational textures.

Laboratory work**:** Identifications and descriptions of oxides and sulphides minerals under reflected microscope.

Gph409 Mining Geophysics

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.

Geo413 Microstructures
Types of Deformation and Deformation Microstructures, Classification and characteristic of shear zones, Microstructural Shear Sense Criteria, Opposite shear senses, types of prophyroclasts, types of prophyreoblasts, Strain-Induced Grain-Boundary Migration, Deformation Microstructures in minerlas, Deformation Microstructures in rocks. Intracrystalline Plasticity, From Microstructures to Mountains: Deformation Microstructures and Tectonics.

Geo402 Graduation Project
This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Gph404 Stratigraphy and Tectonics of Egypt
Introduction, Landmasses during the Phanerozoic, Pre-Cambrian/Cambrian Transition, Paleozoic Litho- and Biostrtigrphic units in the Eastern desert and Sinai, Subsurface Paleozoic rock units in the western desert, Palaeozoic Paleogeography and Economic aspects. The Mesozoic: The Triassic Litho- and Biostrtigrphic units in the Gulf of Suez, South Western Desert and Northeast Sinai (Arif El Naga). The Jurassic Litho- and Biostrtigrphic units in the Gulf of Suez and Gebel Maghara. The Cretaceous: Litho- and Biostrtigrphic units in Sinai, Ataqa, Galala, Nile Valley, Farafra – Bahariya and the Subsurface North Western Desert. The Cenozoic Litho- and Biostrtigrphic units in: The Nile Valley, Fayium, Bahariya – Farafra and Sinai. Oligocene stratigraphic units in Egypt, Miocene in Red Sea, Gulf of Suez, Weastern Desert and Delta. Pliocene sediments in Red Sea. Selected stratigraphic sections in Egypt. Practical work includes construction of stratigraphic sections, geological reports and correlation of different Phanerozoic outcrops, Field trips in Sinai, Eastern and western deserts. Tectonic framework of Egypt, Mesozoic to Cenozoic Tectonic events of Egypt.

Gph406 Geophysical Data Integration
The goal of the course is to give the students advanced training in the interpretation of well logs and seismic attribute data as well as the coupling between these two data types. These are basic skills for further work in petroleum industry as well as in other industries and public resource management where subsurface data are central.
In the logging part of the course acquisition of log-data is presented, how the different logging tools work, what they measure and how log-data are used to interpret lithology, pore-fluid content, porosity and hydrocarbon contacts. In addition depositional environment interpretation, calculation of hydrocarbon volumes from well log data and tying between seismic and well data are covered. In the seismic part of the course, seismic interpretation techniques are presented with focus on visualization and interpretation of seismic attributes. The course makes use of the Petrel software. Understanding various data types and loading these into Petrel is included in this course.

Gph408 Reservoir Correlation and Production

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.

Gph410 Petroleum Evaluation and Economics

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.

Gph412 Principles of Remote Sensing

Principals of remote sensing, Electromagnetic energy (sources and interaction), Spectral reflectance curves and libraries, Sensors and platforms, Airborne and Spaceborne, remote sensing, Multispectral scanners and missions, Different satellite data types and applications, Pre-processing techniques (Radiometric and Geometric corrections), Image Enhancement and visualization, Image color composites, Image Fusion, Visual image interpretation, Principal of digital image processing, Supervised and unsupervised image classification algorithms, Validation of the classified maps, Principal and interpretation of imaging radar, Remote sensing below the grounds surface, Geological remote sensing, Methods of rock units discriminations, Remote sensing geomorphological, structural and mineral exploration applications, Groundwater indicators by remote sensing.

Practical Course: Introduction and definitions, Visual image interpretation, Introduction to Whitebox and ENVI digital image processing softwares, pixel size and transformations data, remote sensing data download, image radiometric and atmospheric corrections, Image registration methods, Unsupervised and supervised image classification algorithms, change detection techniques, lithological discrimination methods, geological mapping, structural elements identification and extraction, Periodic field trips are needed to draw base maps, collecting ground control points and validation

Gph414 Applied Microfossils

Introduction, morphological characteristics of foraminiferal tests, structure and arrangement of chambers, overall shape of the tests, aperture, suture, peripheral and umbilical characters, shell wall and surface ornamentation, taxonomic classification, ecology and significance and application of planktonic and benthonic foraminifera, Applied Palynology and case studies from Egypt. Practical work includes methods of preparation, examination, description and identification of planktonic and benthonic foraminifera.

Geo412 Basin Analysis

Definition, Examples, What are Sedimentary Basins?, Theory of basin formation, Sedimentary Basin Analysis, Tectonics and sedimentation, Questions about Sedimentary Basins, Methods of Formation of Sedimentary Basins, How to Study Sedimentary Basins?, Paleocurrents, Paleocurrent Indicators, Paleocurrent Analysis, How Basins are made?, Classification of sedimentary basins according to tectonic environment

Tanta University
Faculty of Science
Department of Botany

Program Title	**Botany**
Program Type	**Single**
Department(s)	**Botany and Microbiology**

Bot201 Ecology and Environmental Issues

First Part: This part 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). This part also 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.

Second part: This part 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.

Bot203 General Genetics and Plant Cytology

First part: This part 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, pseudo alleles, 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.

Second Part: The aim of this part 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. This course will also offer a solid foundation for understanding the structure and function of biological membranes, the main elements of the cytoskeleton and their functions; intercellular and intracellular communication.

Mic251Virology and Bacteriology

First part: 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.

Second part: 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 a major part of this course.

Chm221 Principles of Analytical Chemistry

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, 2 h: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation, and complex formation reactions.

Bot205 Soil Science
This part deals with soil ecology. 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, soil pollution and soil quality.

Bot207 Plant Cell Wall and Secondary Growth
First Part: Plant cell walls are complex, dynamic cellular structures essential for plant growth, development, physiology and adaptation. This course provides an in-depth and diverse view of the microanatomy of plant cell walls. Importantly, this course puts an emphasis on the details of the biosynthesis and the molecular physiology of cell walls. The course highlights the importance of plant cell walls both in the life of the plant and in their use for bio-products and biofuels.
Second Part: Plant Anatomy: This course covers the fundamental aspects of the structure and functions of the plant cells and tissues. The living and nonliving cell components will be described, and the different types of plants tissues studied in some detail. 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.

Mic253 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.

Zoo277 Animal Toxicology
The toxicological module will provide students with knowledge and skills that enable him/her to be aware of the basic concepts of toxicology; history, mechanisms of toxicity, factors affecting toxicity, different types of intoxication and different toxic episodes. Taking into consideration organ and tissue toxicological aspects, mutagenesis, carcinogenesis and teratogenesis. In addition, students should estimate the risk of different toxicities Specific organ toxicities. General management of toxicity with natural toxins, gases, animal and plant toxins, maternal, fetal and neonatal toxicity. The Pathology part of this course is designed to present students with essential concepts of pathological processes and altered health states. The course looks in depth at a wide variety of common pathological conditions and nomenclature. General topics covered include the nature and causes of cell injury and death; adaptive cellular changes; inflammation, healing and repair, thrombosis, blood disease, infarction and neoplasia. Clinical scenarios within each module correlate the anatomical pathology with major clinical symptoms and signs. In addition to lectures, small group tutorials provide an opportunity for students to examine macroscopic and microscopic specimens illustrating the pathology covered in lectures.

Bph223 Introduction to Radiobiology
Introduction to radiobiology, Initial physical effects of irradiation: dosimetry-micro dosimetry, radiation chemistry, Effects of radiation on DNA molecules and chromosomes, Cellular effects

of ionizing radiation, cell survival curves, Effects on normal tissues, The effects of radiation on tumors, the biological bases of radiotherapy, Hypoxic cells and their importance in radiotherapy, Time and fractionation in radiotherapy, Hyperthermia, Chemical modifiers of radiosensitivity, Neutrons and other heavy particles, Effects of irradiation on the human body, Recent issues in radiobiology.

Bot202 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 plants and algal systems.

Bot204 Plant Water Relations and Mineral Nutrition

First part: 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.

Second part: Introduction, Definition and classification of plant nutrients, Mechanisms of ion uptake by individual plant cells and root system as a whole, Influence of environmental factors nutrient uptake. Transport of nutrients by xylem and phloem and regulation of transport processes, Uptake and leaking of mineral elements through leaves and other above-ground.

Mic252 Mycology and Plant Pathology

First part: This part enables students to acquire more knowledge about fungi with special reproduction, nutrition, and classification (Tedersoo et. al. 2018) The course will also cover reproduction and life cycles (vegetative, asexual and sexual) and life history 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.

Second part: This part 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 biocontrol using natural enemies.

Chm274 Principles of Instrumental Analysis

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

Bot206 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 D_3 & D_4, 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.

Mic254 Introduction to Soil and Water Microbiology

First part: This part deals with soil ecology from 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.

Second part: This part 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.

Mic256 Biological Control

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.

Zoo234 Parasitology and Protozoa

This module will deal with the general concepts and terms of parasitology and provide knowledge on the types of 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, diagnosis, control and treatments, Protozoa.

Sta214 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).

Bot301 Enzymes and Plant Hormones

First part: This part 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, and 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

Second part: (Hormones) This part 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 topic of the course starts with the regions and phases of growth in plant bodies and the factors affecting growth. Detailed topics include the chemistry, biosynthesis, translocation, action and role of various plant hormones such as auxins, gibberellins, cytokinins, ethylene and abscisic acid in plant growth. Additional lectures will be devoted to photoperiodism and vernalization and the molecular biology aspects of seed embryogenesis, dormancy and germination.

Bot303 Molecular Biology and Tissue Culture

Part one: This part 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.

Part two: Tissue culture: This part 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 cover 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 emphasis on the production of haploid plants. Genetic variation of cells under tissue cultures conditions will also be covered in this module.

Bot305 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.

Chm371 Organic Chemistry
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 their derivatives. Also studying the properties and reactivity of carbon compounds containing more than one function.

Bot307 Economic and Medicinal Plants
First part: This part 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.
Second part: This part 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.

Bot309 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.

Bot311 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, Lycopedinae, Equisetinae and Filicinae) and Gymnospermae (Cycadophyta, Ginkgophyta, Coniferophyta and Genetophyta). Special emphasis will be given to the evolution of steel structure in the different nonflowering plants.

Zoo375 Immunochemistry
This course provides the ground knowledge and ability to give the student a broad understanding of the immune system and its functions. The course will emphasize the description of molecular and cellular elements of the immune system, and their basic function and in which these elements operate to provide immunity and how the impairments of their function may result in diseases. Topics include activation and regulation of innate and adaptive immunity and the principles governing vaccination; the molecular basis of antigen specificity; antibody structure and interaction with antigens; disorders of the immune system; tumor and transplantation

immunology; the application of laboratory immunological techniques for diseases diagnosis and monitoring.

Geo315 Remote Sensing

Principals of remote sensing, Electromagnetic energy (sources and interaction), Spectral reflectance curves and libraries, Sensors and platforms, Airborne and Spaceborne, remote sensing, Multispectral scanners and missions, Different satellite data types and applications, Pre-processing techniques (Radiometric and Geometric corrections), Image Enhancement and visualization, Image color composites, Image Fusion, Visual image interpretation, Principal of digital image processing, Supervised and unsupervised image classification algorithms, Validation of the classified maps, Principal and interpretation of imaging radar, Remote sensing below the grounds surface, Geological remote sensing, Methods of rock units discriminations, Remote sensing geomorphological, structural and mineral exploration applications, Groundwater indicators by remote sensing.

Practical Course: Introduction and definitions, Visual image interpretation, Introduction to Whitebox and ENVI digital image processing softwares, pixel size and transformations data, remote sensing data download, image radiometric and atmospheric corrections, Image registration methods, Unsupervised and supervised image classification algorithms, change detection techniques, lithological discrimination methods, geological mapping, structural elements identification and extraction, Periodic field trips are needed to draw base maps, collecting ground control points and validation.

Chm373 Introduction to Biopolymers

Biopolymers are natural polymers produced by the cells of living organisms. Biopolymers consist of monomeric units that are covalently bonded to form larger molecules. There are three main classes of biopolymers, classified according to the monomers used and the structure of the biopolymer formed: polynucleotides, polypeptides, and polysaccharides. Polynucleotides, such as RNA and DNA, are long polymers composed of 13 or more nucleotide monomers. Polypeptides and proteins are polymers of amino acids, and some major examples include collagen, actin, and fibrin. Polysaccharides are linear or branched polymeric carbohydrates and examples include starch, cellulose and alginate. Other examples of biopolymers include natural rubbers (polymers of isoprene), suberin and lignin (complex polyphenolic polymers), cutin and cutan (complex polymers of long-chain fatty acids) and melanin. Biopolymers have various applications such as in the food industry, manufacturing, packaging and biomedical engineering.

Bot302 Flora of Egypt and Wetland and Desert Ecology

First part**:** 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 of the

Herbarium. Different field trips to different wild habitats to recognize the components of the Egyptian flora.

Second part: This part will give knowledge about the following; 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. Different field trips to different wild habitats to recognize the components of Wetland and desert ecosystems. This part also deals with 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. Also, various concepts and categories of wetlands including 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. Different field trips to different wild habitats to recognize the components of Wetland and desert ecosystems.

Bot304 Plant Taxonomy

This module introduces the students to the principles of plant taxonomy and the definitions and terms used in plant taxonomy and systematic, 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 Angiospermae, 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.

Bot306 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 secondary metabolites in algal tolerance to the environment will be discussed.

Mic352 Microbial Physiology

First part: Physiology of Bacteria: This part in microbial physiology pays 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.

Second part: Physiology of Fungi: This part 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 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 fungicides and their mode of action.

BCh372 Fundamentals of Biochemistry (1)
Carbohydrate classification, derivatives and reactions, Lipid classification biological membrane and lipoprotein.

Bot312 Plant Genomics and Proteomics
This course provides knowledge and understanding of functional genomics and proteomics, with particular emphasis on techniques used in eukaryotes (specially plants) to understand the responses of these organisms at the 'whole genome' level to biotic and abiotic stresses. It also covers the topic of pharmacogenomics, and the implications of the application of basic research findings to add value for agricultural crops. The environmental, economic and ethical aspects of this emerging technology will be examined and discussed. Throughout the course, students will be well-informed about how to employ the different genomics and proteomics approaches in the field of biotechnology.

Bot314 Phytoremediation
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, biosenses 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.

Bot316 Gene Expression and Regulation
This module gives a broad overview of gene expression and regulation in prokaryotes and eukaryotes and looks 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.

Bot318 Computational Biology
This course provides a general introduction to computational tools for biology. The course is divided into two modules. Module 1 covers computational molecular biology/genomics. It examines important sources of biological data, how they are archived and made available to researchers, and what computational tools are available to use them effectively in research. In the process, it covers basic concepts in statistics, mathematics, and computer science needed to effectively use these resources and understand their results. Specific topics covered include sequence data, searching and alignment, structural data, genome sequencing, genome analysis, genetic variation, gene and protein expression, and biological networks and pathways. Module 2 covers computational cell biology, including biological modeling (systems biology). The modeling component includes computer models of biochemical kinetics, cell pathways, and stochastic simulations.

Organic and hydroponic agriculture (2-0-2)

The first part of this course will provide introduction to organic farming, with illustration of integrated farm management systems (rotation design), organic soil management and crop nutrition (composting), weed management, pest and disease management. The second part of this course will provide students with knowledge on how to grow plants using hydroponics, how to set up hydroponic systems and nutrient use in hydroponic system

Bot401 Applied Field Training

Applied Training is a joint program with seminar courses. It deals with any form of learning that takes place at the workplace the students have chosen. Experience can be obtained in the form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Bot403 Genetic Engineering and Plant Biotechnology

First part: 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 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.

Second part: Biotechnology: This part 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.

Bot405 Applications of Microorganisms and Algae

First part: The aim of this part 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.

Second part: This part gives an opportunity to explore the fundamental uses and economic importance of algae with reference to its application in food, industry, agriculture, pharmacy

and medicine. Also dealing with some details with the uses of algae and their products in human life, particularly their commercial applications of algal hydrocolloids, 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 polysaccharides from micro-algae, diatom's role in soil fertility, commercial applications of algal hydrocolloids. Thise 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.

Mic451 Fundamental of 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.

Bot407 Biological Membrane and Plant Cell Signaling

First part: Plant cell walls are complex, dynamic cellular structures essential for plant growth, development, physiology and adaptation. This course provides an in-depth and diverse view of the microanatomy of plant cell walls. Importantly, this course puts an emphasis on the details of biosynthesis and the molecular physiology of cell walls. The course highlights the importance of plant cell walls both in the life of the plant and in their use for bio-products and biofuels. Plant cell membranes: This course offers a solid foundation for understanding the structure and function of biological membranes. The course explores the composition and dynamics of cell membranes. The molecular and biological diversity of lipid and protein in cell membrane components will be discussed. The course will show how the interactions between lipids and proteins within the cell membrane explain the chemical, mechanical, and self-renewing properties of cell membranes. The signaling roles that the cell membrane plays in the communication between cells and the surrounding environment will be presented.

Second part: The growth, development, and environmental responses of even the simplest microorganism are determined by the programmed expression of its genes. Among multicellular organisms, turning genes on (gene expression) or off alters a cell's complement of enzymes and structural proteins, allowing cells to differentiate and respond properly to the surrounding environment. In this course, students will be exposed to the discussion of various aspects of the plant response to its environment in relation to the regulation of gene expression. The course will introduce various internal signals that are required for coordinating the expression of genes during development and for enabling the plant to respond to environmental signals through signal transduction pathways.

Bot409 Population Genetics and Molecular Plant Breeding

This module will concentrate on how the frequencies of different alleles are distributed and altered in populations. The emphasis will be on polymorphisms and 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 a single major gene, but by several too 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.

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**.**

Bot411 Hydroponic and Organic Agriculture

The first part of this course will provide an introduction to organic farming, with illustration of integrated farm management systems (rotation design), organic soil management and crop nutrition (composting), weed management, pest and disease management. The second part of this course will provide students with knowledge on how to grow plants using hydroponics, how to set up hydroponic systems and nutrient use in hydroponic systems.

Bot413: Algal Biochemistry and Algal Biohazards

First part: This part aims to develop an understanding the biochemical compounds such as the algal Polysaccharides, pigments (Chlorophyll, Carotenoids and phycobilins), proteins, carbohydrates, Fatty Acids and Saponifiable Lipids, Vitamins and Growth Regulators. Also, the students will gain the fundamentals of nucleic Acids and their Metabolism, Biotechnology of microalgae, based on molecular biology and biochemistry of eukaryotic algae and cyanobacteria.

Second Part: This part gives the student by the end of his/her study the knowledge and understanding of the harmful role of toxic algal blooms. It also provides students with the opportunity to explore the fundamentals of: Detection and characterization of harmful Algal Blooms, how can Algal Populations be Controlled? Prevention and mitigation of Harmful Algal Bloom Impacts. Control of harmful algal blooms. Algae can function as indicators of water.

Bot415 Current Topics in Botany

This course will introduce selected current key topics related to plant biology.

Bot402 Graduation Project

This course is given with no fixed content. It depends upon whether a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

BO404 Plant Sociology and Biodiversity

First part: This part 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.

Second part: This part will cover the ecological principles dealing with 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.

Bot406 Biotic and Abiotic Stress Physiology

First part: Biotic stress: plants experience in their natural habitats, subjected to a wide range of biotic stresses. This module will focus on the mechanisms used by plants to respond to and avoid the harmful effects of various biotic stresses imposed by pathogenic viruses, bacteria, fungi and bests. The modern molecular approaches to study the adaptations of plants to these stressful conditions will be stressed with an emphasis on the roles of plant hormones.

Second part: In addition to the biotic stresses that they are also Abiotic stress. Among multicellular organisms, turning genes on (gene expression) or off alters a cell's complement of enzymes and structural proteins, allowing cells to differentiate and respond properly to the surrounding environment. In this course, students will be exposed to the discussion of various aspects of cell signaling including the control layer of cell signaling and modifications in protein folding and binding mediating cell signaling. Importantly, the course will make an emphasis on the two-component signaling systems, and on signaling events regulating gene expression in eukaryotes and prokaryotes. Students will be, also, exposed to various signal transduction protocols applied in constructing cell signaling networks.

Bot408 Medicinal Algae and Ecosystem

First part: (Medicinal Algae). Algae are the chief primary producers of the globe. Besides photosynthesis, their role in the environment is enormous. They produce a vast array of compounds as they face various substrate and stress conditions. These compounds nowadays are being widely applied in many medicinal applications. Seaweed and macroalgae have been used for a long time in folk medicine, while using microalgae in this respect was absent. The aim of this subject is to cover screen different medical field in which algae are commonly used as: antioxidants, anticancer and antitumor agents, anticoagulant and antithrombic agents, as antioxidants, inflammatory compounds, antimicrobial and antiviral composites. In addition, the contribution of algae as sources of vitamins and minerals, nutraceuticals and food supplements,

as vermifuges and in biocosmetic and pharmaceutical drug combination, as well as in thalassotherapy and obstetrical uses…. etc.

Second part: This part gives the student by the end of his/her study the knowledge and understanding of the algal abundance and classification in the ecosystem according to their habitat and environmental conditions. This course also aims to give the student the opportunity to explore the ecological importance of algae as they are the beginning of the food chain for many animals in the aquatic ecosystems.

Bch 472 Fundamentals of Biochemistry (2)

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.

Bot412 Environmental Management and Impact Assessment

This module 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) understanding 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, networks, 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.

Bot414 Scientific Writing and Presentations

First part: Plant cell: The aim of this part 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 organelles; the main elements of the cytoskeleton and their functions; intercellular and intracellular b

Second part: Tissue culture: This part 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 cover 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 emphasis on the production of haploid plants. Genetic variation of cells under tissue cultures conditions will also be covered in this module.

Bot416 Bioethics and Biosafety

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.

Bot418 Economics and Marketing

The first part of this course provides the analytical skills necessary to understand forces that determine prices of financial and real assets. It also develops a system of tools to show how interest rates, prices of bonds, international capital flows, and exchange rates are simultaneously determined. It demonstrates how firms use financial derivatives, such as futures, options, and swaps to protect against risk. The second part of this course introduces students to the strategic and tactical approaches used in the marketing of biological products and services. The roles of managers and leaders within companies which 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.



Program Title	**Microbiology**
Program Type	**Single**
Department(s)	**Botany and Microbiology**

Mic201 Instruments and Methods of 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.

Mic203 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.

Mic205 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 a major part of this course.

Bot251 Genetics
This course 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, pseudo alleles, 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.

Chm221 Principles of Analytical Chemistry
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, 2 h: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation, and complex formation reactions.

Mic207 Actinomycetes

In this module special emphasis 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 detail.

Mic209 Bioremediation of Pollutions

This course deals with the applications of microorganisms in the treatment of polluted water with heavy metals, and other chemical and industrial wastes.

Mic211 Microbial Biodiversity and Environmental Microbiology

First part: This course will study the diversity of microorganisms in selected environments at an organism level, investigate the metabolic and enzymatic diversity in microbes that contribute to and thrive within these environments, and examine the methods used to study the relationships and evolution of microorganisms within an ecosystem.

Second part: This part concerns studying the biology and distribution of different microbial species in order to use them as bioindicators for contamination. In addition, it also describes the application of microorganisms in solving many environmental problems through bioremediation and other biological processes. Learning outcomes Studying the diversity in microbial community Evaluate the effect of different microorganisms on the global environment. The use of microorganisms in remediation of many environmental contaminants and other environmental impacts.

Zoo277 Animal Toxicology

The toxicological module will provide students with knowledge and skills that enable him/her to be aware of the basic concepts of toxicology; history, mechanisms of toxicity, factors affecting toxicity, different types of intoxication and different toxic episodes. Taking into consideration organ and tissue toxicological aspects, mutagenesis, carcinogenesis and teratogenesis. In addition, students should estimate the risk of different toxicities Specific organ toxicities. General management of toxicity with natural toxins, gases, animal and plant toxins, maternal, fetal and neonatal toxicity. The Pathology part of this course is designed to present students with essential concepts of pathological processes and altered health states. The course looks in depth at a wide variety of common pathological conditions and nomenclature. General topics covered include the nature and causes of cell injury and death; adaptive cellular changes; inflammation, healing and repair, thrombosis, blood disease, infarction and neoplasia. Clinical scenarios within each module correlate the anatomical pathology with major clinical symptoms and signs. In addition to lectures, small group tutorials provide an opportunity for students to examine macroscopic and microscopic specimens illustrating the pathology covered in lectures.

Bph223 Introduction to Radiobiology

Introduction to radiobiology, Initial physical effects of irradiation: dosimetry-micro dosimetry, radiation chemistry, Effects of radiation on DNA molecules and chromosomes, Cellular effects of ionizing radiation, cell survival curves, Effects on normal tissues, The effects of radiation on tumors, the biological bases of radiotherapy, Hypoxic cells and their importance in radiotherapy, Time and fractionation in radiotherapy, Hyperthermia, Chemical modifiers of radiosensitivity, Neutrons and other heavy particles, Effects of irradiation on the human body, Recent issues in radiobiology.

Mic202 Mycology

This module enables students to acquire more knowledge about fungi with special reproduction, nutrition, and classification (Tedersoo *et al*. 2018) The course will also cover reproduction and life cycles (vegetative, asexual and sexual) and life history 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.

Mic204 Enzymes

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: factors affecting enzymatic reactions, the type of inhibition, regulatory enzymes, multi-enzyme system and prosthetic groups. 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.

Mic206 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.

Bot252 Plant Ecology and Environmental Issues

First Part: This part introduces the students to plant ecology and covers several topics. 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.

Second part: This part 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.

Chm274 Principles of Instrumental Analysis

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.

Mic208 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.

Mic212 Microbial Toxins

Microbial toxins: This course will give a spot on the severity of microbial toxins produced in contaminated food, textile, and paper industry; and their characterization, detection methods, and expected hazards.

Bot254 Medicinal Plants

First part: This part 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.

Second part: This part 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.

Zoo234 Parasitology and Protozoa

This module will deal with the general concepts and terms of parasitology and provide knowledge on the types of 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, diagnosis, control and treatments, Protozoa.

Sta214 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).

Mic301 Water and Soil Microbiology

First part: This part 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.

Second part: This part deals with soil ecology from 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.

Mic303 Phytopathology and Biological Control

First part: This Part 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 biocontrol using natural enemies.

Second part: 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.

Bot351 Principles of 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.

Chm361 Stereochemistry and Bifunctional Organic Compounds

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

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.

Mic305 Advanced Bacteriology

This course dealing with Bacterial evolution, systematics and diversity-Structure and function of the bacterial cell-Metabolic diversity- Bacterial symbionts in animals and plants- Bacterial habitats and nutrient cycling-Brief knowledge on bacterial disease mechanisms and infectious in humans of selected bacteria and immunity- Antibiotics, antibiotic resistance and multi-drug resistance- Samples of applied aspects of bacteriology

Bot353 Soil Ecology and Biodiversity

Part one: This part deals with soil ecology. 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, soil pollution and soil quality.

Part Two: This Part will cover the ecological principles 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.

Bot355 Phytoremediation and Plant Hormones

First part: 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, biosenses 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.
Second part: (Hormones) This part 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 topic of the course starts with the regions and phases of growth in plant bodies and the factors affecting growth. Detailed topics include the chemistry, biosynthesis, translocation, action and role of various plant hormones such as auxins, gibberellins, cytokinins, ethylene and abscisic acid in plant growth. Additional lectures will be devoted to photoperiodism and vernalization and the molecular biology aspects of seed embryogenesis, dormancy and germination.

Zoo375 Immunochemistry
This course provides the ground knowledge and ability to give the student a broad understanding of the immune system and its functions. The course will emphasize the description of molecular and cellular elements of the immune system, and their basic function and in which these elements operate to provide immunity and how the impairments of their function may result in diseases. Topics include activation and regulation of innate and adaptive immunity and the principles governing vaccination; the molecular basis of antigen specificity; antibody structure and interaction with antigens; disorders of the immune system; tumor and transplantation immunology; the application of laboratory immunological techniques for diseases diagnosis and monitoring.

Geo315 Remote Sensing
Principals of remote sensing, Electromagnetic energy (sources and interaction), Spectral reflectance curves and libraries, Sensors and platforms, Airborne and Spaceborne, remote sensing, Multispectral scanners and missions, Different satellite data types and applications, Pre-processing techniques (Radiometric and Geometric corrections), Image Enhancement and visualization, Image color composites, Image Fusion, Visual image interpretation, Principal of digital image processing, Supervised and unsupervised image classification algorithms, Validation of the classified maps, Principal and interpretation of imaging radar, Remote sensing below the grounds surface, Geological remote sensing, Methods of rock units discriminations, Remote sensing geomorphological, structural and mineral exploration applications, Groundwater indicators by remote sensing.
Practical Course: Introduction and definitions, Visual image interpretation, Introduction to Whitebox and ENVI digital image processing softwares, pixel size and transformations data, remote sensing data download, image radiometric and atmospheric corrections, Image registration methods, Unsupervised and supervised image classification algorithms, change detection techniques, lithological discrimination methods, geological mapping, structural elements identification and extraction, Periodic field trips are needed to draw base maps, collecting ground control points and validation.

Chm373 Introduction to Biopolymers
Biopolymers are natural polymers produced by the cells of living organisms. Biopolymers consist of monomeric units that are covalently bonded to form larger molecules. There are three main classes of biopolymers, classified according to the monomers used and the structure of the

biopolymer formed: polynucleotides, polypeptides, and polysaccharides. Polynucleotides, such as RNA and DNA, are long polymers composed of 13 or more nucleotide monomers. Polypeptides and proteins are polymers of amino acids, and some major examples include collagen, actin, and fibrin. Polysaccharides are linear or branched polymeric carbohydrates and examples include starch, cellulose and alginate. Other examples of biopolymers include natural rubbers (polymers of isoprene), suberin and lignin (complex polyphenolic polymers), cutin and cutan (complex polymers of long-chain fatty acids) and melanin. Biopolymers have various applications such as in the food industry, manufacturing, packaging and biomedical engineering.

Mic302 Physiology of Microorganisms

First part: Physiology of Bacteria: This part in microbial physiology pays 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.

Second part: Physiology of Fungi: This part 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 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 fungicides and their mode of action.

Mic304 Medical and Food Microbiology

First Part: This Part 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.

Second part: 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.

Bot372 Photosynthesis and Stress Physiology

First part: The aim of this part 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 plants and algal systems.

Second part: (Stress physiology), plants experience in their natural habitats, subjected to a wide range of biotic stresses. This module will focus on the mechanisms used by plants to respond to and avoid the harmful effects of various biotic stresses imposed by pathogenic viruses, bacteria, fungi and bests. The modern molecular approaches to study the adaptations

of plants to these stressful conditions will be stressed with an emphasis on the roles of plant hormones.
In addition to the biotic stresses that they are also Abiotic stress. Among multicellular organisms, turning genes on (gene expression) or off alters a cell's complement of enzymes and structural proteins, allowing cells to differentiate and respond properly to the surrounding environment. In this course, students will be exposed to the discussion of various aspects of cell signaling including the control layer of cell signaling and modifications in protein folding and binding mediating cell signaling. Importantly, the course will make an emphasis on the two-component signaling systems, and on signaling events regulating gene expression in eukaryotes and prokaryotes. Students will be, also, exposed to various signal transduction protocols applied in constructing cell signaling networks.

Chm360 Thermodynamics and Surface Chemistry
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.
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.

Mic306 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 detail.

Mic312 Microbiome and Archaea
First part: The part should provide knowledge about the microbes that live within the host (ex; microbiota of oral cavity, skin, gut ..etc.), understand the complexity of the microbiome, and how it can impact on disease and wellbeing. Moreover, studying the modification of microbiomes thorough our host life and the effect of other factors such as antibiotics, probiotics and prebiotics.
Second part: This part will study origin and evolution of Archaea, general characteristics and classification of Archaea, investigate their habitat and their interactions with other organisms, diversity of Bacteria and Archaea in selected environments at an organismal level, investigate their metabolic and enzymatic diversity, study their uses and applications.

Mic314 Bioreactors
This course will discuss the key engineering issues in bioreactor design and operation. The course will introduce the main three basic processes that contribute to production of biological products via bioreactors including; 1) Processes in which the product is produced by the cells

is either extracellular (e.g., alcohols), or intracellular (e.g., a metabolite or enzyme), 2) Processes that produce a cell mass, Bakers' yeast, is an example of a produced cell mass, others include single-cell proteins for food sources, 3) Processes that modify a compound and are referred to as biotransformations (where cells of all types can be employed to biocatalyze a transformation of certain compounds via dehydration, oxidation, hydroxylation, amination or isomerization). Also, this course will give an emphasis on the bioreaction parameters that need to be considered when operating bioreactors, including controlled temperature, optimum pH, water availability, salts for nutrition, vitamins, oxygen (for aerobic processes), gas evolution and product and byproduct removal. The various types of bioreaction systems will be covered in this course including; batch, continuous, semi-continuous, surface/tray, submerged, and air-lift loop bioreactors. Finally, technologies under development will be referred to here, as well.
Practical: This course will include laboratory sessions covering the the bioreaction parameters that need to be considered when operating bioreactors, including controlled temperature, optimum pH, water availability, salts for nutrition, vitamins, oxygen (for aerobic processes), gas evolution and product and byproduct removal. The practical part of this course will include several visits to factories that use bioreactors for the production of their products to make students familiar with different types of bioreactors.

Mic316 Current Topic in Microbiology (1)
This course will introduce selected current key topics related to Microbiology.

Mic401 Applied Field Training
Applied Training is a joint program with seminar courses. It deals with any form of learning that takes place at the workplace the students have chosen. Experience can be obtained in the form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Mic403 Yeast 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.

Mic405 Biofertilizers
This course gives detailed information about algalization technology. Use of cyanobacteria, micro and macroalgae as agricultural biofertilizers, and benefits of algalization on crops, soil characteristics and aggregation will be considered. The application of bacteria in fertilizers industry will be presented as well. Also, this course will give students general knowledge of biofertilizers including N-fixing microorganisms (blue green algae, Azotobacter, Azospirillum, Rhizobium and Azolla). Phosphate soulubilizers and mobilizing (Fungi, Bacteria, Actinomycetes and Mycorrhizae). Compost making microorganisms (cellulotic and lignolytic). Biofertilizers for rice crops (Azolla, blue green algae, Azopirillum).)

Bot451 Molecular Biology and Genetic Engineering

First part: This Part 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.

Second part: 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 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.

Mic407 Microbial Cell Signaling and Biological Membranes

First part: Cell signaling: Aim: The growth, development, and environmental responses of even the simplest microorganism are determined by the programmed expression of its genes. Among multicellular organisms, turning genes on (gene expression) or off alters a cell's complement of enzymes and structural proteins, allowing cells to differentiate and respond properly to the surrounding environment. In this course, students will be exposed to the discussion of various aspects of cell signaling including the control layer of cell signaling and modifications in protein folding and binding mediating cell signaling. Importantly, the course will make an emphasis on the two-component signaling systems, and on signaling events regulating gene expression in eukaryotes and prokaryotes. The course will discuss various aspects of the biotic and abiotic stress signaling in plants with an emphasis on the roles of plant hormones. Students will be, also, exposed to various signal transduction protocols applied in constructing cell signaling networks.

Second part: The aim of this part 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.

Mic409 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

Mic411 Current Topics in Microbiology (2)
This course will introduce selected current key topics related to Microbiology.

Bot453 Algal Biochemistry and Algal Biohazards
First part: This part aims to develop an understanding the biochemical compounds such as the algal Polysaccharides, pigments (Chlorophyll, Carotenoids and Phycobilins), proteins, carbohydrates, Fatty Acids and Saponifiable Lipids, Vitamins and Growth Regulators. Also, the students will gain the fundamentals of nucleic Acids and their Metabolism, Biotechnology of microalgae, based on molecular biology and biochemistry of eukaryotic algae and cyanobacteria.
Second Part: This part gives the student by the end of his/her study the knowledge and understanding of the harmful role of toxic algal blooms. It also provides students with the opportunity to explore the fundamentals of: Detection and characterization of harmful Algal Blooms, how can Algal Populations be Controlled? Prevention and mitigation of Harmful Algal Bloom Impacts. Control of harmful algal blooms. Algae can function as indicators of water.

Mic402 Graduation Project
This course is given with no fixed content. It depends upon whether a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Mic404 Microbe-Host Interactions
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 biocontrol using natural enemies.

Mic406 Fundamentals of 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 detail.

Bot452 Algal Physiology and Biotechnology
First part: This part 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 secondary metabolites in algal tolerance to the environment will be discussed.
Second part: This part gives an opportunity to explore the fundamental uses and economic importance of algae with reference to its application in food, industry, agriculture, pharmacy

and medicine. Also dealing with some details with the uses of algae and their products in human life, particularly their commercial applications of algal hydrocolloids, 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 polysaccharides from micro-algae, diatom's role in soil fertility, commercial applications of algal hydrocolloids. Thise 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.

BCh472 Fundamentals of Biochemistry (2)

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.

Bot412 Environmental Management and Impact Assessment

This module 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) understanding 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, networks, 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.

Bot414 Scientific Writing and Presentations

First part: Plant cell: The aim of this part 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 organelles; the main elements of the cytoskeleton and their functions; intercellular and intracellular b

Second part: Tissue culture: This part 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 cover 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 emphasis on the production of haploid plants. Genetic variation of cells under tissue cultures conditions will also be covered in this module.

Bot416 Bioethics and Biosafety

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.

Bot418 Economics and Marketing

The first part of this course provides the analytical skills necessary to understand forces that determine prices of financial and real assets. It also develops a system of tools to show how interest rates, prices of bonds, international capital flows, and exchange rates are simultaneously determined. It demonstrates how firms use financial derivatives, such as futures, options, and swaps to protect against risk. The second part of this course introduces students to the strategic and tactical approaches used in the marketing of biological products and services. The roles of managers and leaders within companies which 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.



Program Title	**Biotechnology**
Program Type	**Single**
Department(s)	**Botany and Microbiology**

BTe201 Instrumentation Biotechnology
This module will consider the methods used to study biotechnology, particularly the laboratory equipment and other apparatus used to upscale the lab level experiments to semi-industrial.

BTe203 Introduction to Biotechnology

This module covers a comprehensive panorama of biotechnology and describes in sufficient detail 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

BTe205 Plant Ecology

This course 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.

BTe207 Virology and Immunology

First part: This part 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.

Second part: This part 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.

Chm221 Principles of Analytical Chemistry

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, 2 h: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation, and complex formation reactions.

BTe209 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 D_3 & D_4, 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.

BTe211 Introduction to Bioreactors

This course will discuss the key engineering issues in bioreactor design and operation. The course will introduce the main three basic processes that contribute to production of biological products via bioreactors including; 1) Processes in which the product is produced by the cells is either extracellular (e.g., alcohols), or intracellular (e.g., a metabolite or enzyme), 2) Processes that produce a cell mass, Bakers' yeast, is an example of a produced cell mass, others include single-cell proteins for food sources, 3) Processes that modify a compound and are referred to as biotransformations (where cells of all types can be employed to biocatalyze a transformation of certain compounds via dehydration, oxidation, hydroxylation, amination or isomerization). Also, this course will give an emphasis on the bioreaction parameters that need to be considered when operating bioreactors, including controlled temperature, optimum pH, water availability, salts for nutrition, vitamins, oxygen (for aerobic processes), gas evolution and product and byproduct removal. The various types of bioreaction systems will be covered in this course including; batch, continuous, semi-continuous, surface/tray, submerged, and air-lift loop bioreactors. Finally, technologies under development will be referred to here, as well.
Practical: This course will include laboratory sessions covering the the bioreaction parameters that need to be considered when operating bioreactors, including controlled temperature, optimum pH, water availability, salts for nutrition, vitamins, oxygen (for aerobic processes), gas evolution and product and byproduct removal. The practical part of this course will include several visits to factories that use bioreactors for the production of their products to make students familiar with different types of bioreactors.

BTe213 Introduction to Hydroponic and Organic Agriculture

The first part of this course will provide an introduction to organic farming, with illustration of integrated farm management systems (rotation design), organic soil management and crop nutrition (composting), weed management, pest and disease management. The second part of this course will provide students with knowledge on how to grow plants using hydroponics, how to set up hydroponic systems and nutrient use in hydroponic systems.

Zoo277 Animal Toxicology

The toxicological module will provide students with knowledge and skills that enable him/her to be aware of the basic concepts of toxicology; history, mechanisms of toxicity, factors affecting toxicity, different types of intoxication and different toxic episodes. Taking into consideration organ and tissue toxicological aspects, mutagenesis, carcinogenesis and teratogenesis. In addition, students should estimate the risk of different toxicities Specific organ toxicities. General management of toxicity with natural toxins, gases, animal and plant toxins, maternal, fetal and neonatal toxicity. The Pathology part of this course is designed to present students with essential concepts of pathological processes and altered health states. The course looks in depth at a wide variety of common pathological conditions and nomenclature. General topics covered

include the nature and causes of cell injury and death; adaptive cellular changes; inflammation, healing and repair, thrombosis, blood disease, infarction and neoplasia. Clinical scenarios within each module correlate the anatomical pathology with major clinical symptoms and signs. In addition to lectures, small group tutorials provide an opportunity for students to examine macroscopic and microscopic specimens illustrating the pathology covered in lectures.

Bph223 Introduction to Radiobiology

Introduction to radiobiology, Initial physical effects of irradiation: dosimetry-micro dosimetry, radiation chemistry, Effects of radiation on DNA molecules and chromosomes, Cellular effects of ionizing radiation, cell survival curves, Effects on normal tissues, The effects of radiation on tumors, the biological bases of radiotherapy, Hypoxic cells and their importance in radiotherapy, Time and fractionation in radiotherapy, Hyperthermia, Chemical modifiers of radiosensitivity, Neutrons and other heavy particles, Effects of irradiation on the human body, Recent issues in radiobiology.

BTe202 Fundamental of 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, pseudo alleles, 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.

Mic204 Fundamental 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 a major part of this course.

BTe206 Enzymes

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, and 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

BTe208 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.

Chm234 Introduction to Instrumental Chemistry

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.

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

BTe212 Yeast Biotechnology

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.

BTe214 Plant Biological Membrane and Cell Signaling

First part: Plant cell walls are complex, dynamic cellular structures essential for plant growth, development, physiology and adaptation. This course provides an in-depth and diverse view of the microanatomy of plant cell walls. Importantly, this course puts an emphasis on the details of biosynthesis and the molecular physiology of cell walls. The course highlights the importance of plant cell walls both in the life of the plant and in their use for bio-products and biofuels. Plant cell membranes: This course offers a solid foundation for understanding the structure and function of biological membranes. The course explores the composition and dynamics of cell membranes. The molecular and biological diversity of lipid and protein in cell membrane components will be discussed. The course will show how the interactions between lipids and proteins within the cell membrane explain the chemical, mechanical, and self-renewing properties of cell membranes. The signaling roles that the cell membrane plays in the communication between cells and the surrounding environment will be presented.

Second part: The growth, development, and environmental responses of even the simplest microorganism are determined by the programmed expression of its genes. Among multicellular organisms, turning genes on (gene expression) or off alters a cell's complement of enzymes and structural proteins, allowing cells to differentiate and respond properly to the surrounding environment. In this course, students will be exposed to the discussion of various aspects of the plant response to its environment in relation to the regulation of gene expression. The course will introduce various internal signals that are required for coordinating the

expression of genes during development and for enabling the plant to respond to environmental signals through signal transduction pathways.

BTe216 Economic and Medicinal 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.

Zoo234 Parasitology and Protozoa

This module will deal with the general concepts and terms of parasitology and provide knowledge on the types of 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, diagnosis, control and treatments, Protozoa.

Sta214 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).

BTe301 Microbial Biotechnology

The aim of this module 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.

BTe303 Genomics and Proteomics

This course provides knowledge and understanding of functional genomics and proteomics, with particular emphasis on techniques used in eukaryotes (specially plants) to understand the responses of these organisms at the 'whole genome' level to biotic and abiotic stresses. It also covers the topic of pharmacogenomics, and the implications of the application of basic research findings to add value for agricultural crops. The environmental, economic and ethical aspects of this emerging technology will be examined and discussed. Throughout the course, students will be well-informed about how to employ the different genomics and proteomics approaches in the field of biotechnology.

BTe305 Hormones and Photosynthesis

First part: The aim of this part 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 plants and algal systems.

Second part: This part 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 topic of the course starts with the regions and phases of growth in plant bodies and the factors affecting growth. Detailed topics include the chemistry, biosynthesis, translocation, action and role of various plant hormones such as auxins, gibberellins, cytokinins, ethylene and abscisic acid in plant growth. Additional lectures will be devoted to photoperiodism and vernalization and the molecular biology aspects of seed embryogenesis, dormancy and germination.

BTe307 Fungi and Plant Pathology

First part: This part enables students to acquire more knowledge about fungi with special reproduction, nutrition, and classification (Tedersoo et. al. 2018) The course will also cover reproduction and life cycles (vegetative, asexual and sexual) and life history 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.

Second part: This part 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 biocontrol using natural enemies

Chm371 Organic Chemistry

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 their derivatives. Also studying of the properties and reactivity of carbon compounds containing more than one function.

BTe309 Microbial Growth and Industrial Applications

First part: This part 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 emphasis on its economic role. In both parts the principles and concepts of fermentation will be covered.

Second part: The aim of this part 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.

BTe311 Environmental Issues

This part will be focused on current ecological and environmental problems that may include the threats to natural resources, energy problems, food problems, desertification, grazing problems 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.

BTe313 Algal Biochemistry and Algal Hazards

First part: This part aims to develop an understanding the biochemical compounds such as the algal Polysaccharides, pigments (Chlorophyll, Carotenoids and phycobilins), proteins, carbohydrates, Fatty Acids and Saponifiable Lipids, Vitamins and Growth Regulators. Also, the students will gain the fundamentals of nucleic Acids and their Metabolism, Biotechnology of microalgae, based on molecular biology and biochemistry of eukaryotic algae and cyanobacteria.

Second Part: This part gives the student by the end of his/her study the knowledge and understanding of the harmful role of toxic algal blooms. It also provides students with the opportunity to explore the fundamentals of: Detection and characterization of harmful Algal Blooms, how can Algal Populations be Controlled? Prevention and mitigation of Harmful Algal Bloom Impacts. Control of harmful algal blooms. Algae can function as indicators of water.

Zoo375 Immunochemistry

This course provides the ground knowledge and ability to give the student a broad understanding of the immune system and its functions. The course will emphasize the description of molecular and cellular elements of the immune system, and their basic function and in which these elements operate to provide immunity and how the impairments of their function may result in diseases. Topics include activation and regulation of innate and adaptive immunity and the principles governing vaccination; the molecular basis of antigen specificity; antibody structure and interaction with antigens; disorders of the immune system; tumor and transplantation immunology; the application of laboratory immunological techniques for diseases diagnosis and monitoring.

Geo315 Remote Sensing

Principals of remote sensing, Electromagnetic energy (sources and interaction), Spectral reflectance curves and libraries, Sensors and platforms, Airborne and Spaceborne, remote sensing, Multispectral scanners and missions, Different satellite data types and applications, Pre-processing techniques (Radiometric and Geometric corrections), Image Enhancement and

visualization, Image color composites, Image Fusion, Visual image interpretation, Principal of digital image processing, Supervised and unsupervised image classification algorithms, Validation of the classified maps, Principal and interpretation of imaging radar, Remote sensing below the grounds surface, Geological remote sensing, Methods of rock units discriminations, Remote sensing geomorphological, structural and mineral exploration applications, Groundwater indicators by remote sensing.

Practical Course: Introduction and definitions, Visual image interpretation, Introduction to Whitebox and ENVI digital image processing softwares, pixel size and transformations data, remote sensing data download, image radiometric and atmospheric corrections, Image registration methods, Unsupervised and supervised image classification algorithms, change detection techniques, lithological discrimination methods, geological mapping, structural elements identification and extraction, Periodic field trips are needed to draw base maps, collecting ground control points and validation.

Chm373 Introduction to Biopolymers

Biopolymers are natural polymers produced by the cells of living organisms. Biopolymers consist of monomeric units that are covalently bonded to form larger molecules. There are three main classes of biopolymers, classified according to the monomers used and the structure of the biopolymer formed: polynucleotides, polypeptides, and polysaccharides. Polynucleotides, such as RNA and DNA, are long polymers composed of 13 or more nucleotide monomers. Polypeptides and proteins are polymers of amino acids, and some major examples include collagen, actin, and fibrin. Polysaccharides are linear or branched polymeric carbohydrates and examples include starch, cellulose and alginate. Other examples of biopolymers include natural rubbers (polymers of isoprene), suberin and lignin (complex polyphenolic polymers), cutin and cutan (complex polymers of long-chain fatty acids) and melanin. Biopolymers have various applications such as in the food industry, manufacturing, packaging and biomedical engineering.

BTe302 Bioremediation

Bioremediation is the use of plants and microorganisms to combat pollution. The aim of this course 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, biosenses 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.

BTe304 Algal Biotechnology

This course gives an opportunity to explore the fundamental uses and economic importance of algae with reference to its application in food, industry, agriculture, pharmacy and medicine. Also dealing with some details with the uses of algae and their products in human life, particularly their commercial applications of algal hydrocolloids, 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 polysaccharides from micro-algae, diatom's role in soil fertility, commercial applications of algal hydrocolloids. Thise 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.

BTe306 Genome Technology and Plant Molecular Diagnosis

First part: This part provides the details of various techniques and approaches used as well as its applications in the generation of commercial products of multiple use. These techniques will include genetic engineering, genome and gene editing applicable in different organisms as well as platforms for DNA sequencing, genome and transcriptome analysis.

Second part: (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.

Bot308 Biodiversity and Natural Reserves

Second part: This part will cover the ecological principles 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.

BCh372 Fundamentals of Biochemistry (1)

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

BTe312 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.

BTe314 Pharmaceutical Biotechnology

This module will cover the actual status of biotechnology and its applications in the 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 nutraceuticals 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.

BTe316 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 cover 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 emphasis on the production of haploid plants. Genetic variation of cells under tissue cultures conditions will also be covered in this module.

BTe318 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 covers 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.

BTe401 Applied Field Training

Applied Training is a joint program with seminar courses. It deals with any form of learning that takes place at the workplace the students have chosen. Experience can be obtained in the form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

BTe403 Molecular Stress Physiology

This course aims to provide students with comprehensive knowledge and understanding of the molecular bases of various biotic and abiotic stresses that would help them apply various strategies of biotechnology to improve the productivity of crop plants. At the molecular level, the course will discuss the plant response to different pathogens (bacteria and fungi) and to different abiotic stresses including drought, extreme temperatures, salinity and heavy metal pollution. The course will make emphasis to the involvement of different stress signaling

messengers in modulating expression of relevant genes to build adaptive responses to different environmental challenges. The studied signaling messengers will include plant Phyto-hormones (ABA, SA, JA and Ethylene), reactive oxygen species, calcium etc. Examples for marker genes used in engineering stress resistant crop plants will be presented.

BTe405 Food Biotechnology

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.

BTe407 Bioreactors

This course will discuss the key engineering issues in bioreactor design and operation. The course will introduce the main three basic processes that contribute to production of biological products via bioreactors including; 1) Processes in which the product is produced by the cells is either extracellular (e.g., alcohols), or intracellular (e.g., a metabolite or enzyme), 2) Processes that produce a cell mass, Bakers' yeast, is an example of a produced cell mass, others include single-cell proteins for food sources, 3) Processes that modify a compound and are referred to as biotransformations (where cells of all types can be employed to biocatalyze a transformation of certain compounds via dehydration, oxidation, hydroxylation, amination or isomerization). Also, this course will give an emphasis on the bioreaction parameters that need to be considered when operating bioreactors, including controlled temperature, optimum pH, water availability, salts for nutrition, vitamins, oxygen (for aerobic processes), gas evolution and product and byproduct removal. The various types of bioreaction systems will be covered in this course including; batch, continuous, semi-continuous, surface/tray, submerged, and air-lift loop bioreactors. Finally, technologies under development will be referred to here, as well.

BTe409 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.

BTe411 Gene Expression and Regulation

This module gives a broad overview of gene expression and regulation in prokaryotes and eukaryotes and looks 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.

BTe413 Soil and Soil Quality
This course deals with soil ecology. 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, soil pollution and soil quality.

BTe415 Forensic Biotechnology
This course aims to provide students with information about various fingerprinting techniques that are used for 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 molecular 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.

BTe402 Graduation Project
This course is given with no fixed content. It depends upon whether a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

BTe404 Genetic Resources and Nano-Biotechnology
First part: This part covers types of genetic resources and conservation modes, genetic resources maintained in Situ and genetic resources-maintained ex Situ. In addition, strategies for using PGR in breeding, origin of agriculture, crop domestication and origin of selected crops are to be discussed.
Second part: This part considers the application of the newly emerging science of nanotechnology 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.

BTe406 Biofertilizers and Biofuel Production
First part: This Part gives detailed information about algalization technology. Use of cyanobacteria, micro and macroalgae as agricultural biofertilizers, and benefits of algalization on crops, soil characteristics and aggregation will be considered. The application of bacteria in fertilizers industry will be presented as well. Also, this course will give students general knowledge of biological control of different plant pests such as viral, microbial, nematode, weeds and vertebrate pests. The course will introduce the investigation the effective means of reducing or mitigating pests and pest effects through the use of natural enemies

Second part: The aim of this part 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. This part covers the fermentation processes currently utilized in the pharmaceutical and food industries, based on microbial fermentation and illustrates the range of

BTe408 Plant Genetic Engineering and Biotechnology

First part: 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 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.

Second part: Biotechnology: This part 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.

BCh472 Fundamentals of Biochemistry (2)

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.

Bot412 Environmental Management and Impact Assessment

This module 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) understanding 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, networks, 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.

Bot414 Scientific Writing and Presentations

First part: Plant cell: The aim of this part 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 organelles; the main elements of the cytoskeleton and their functions; intercellular and intracellular b

Second part: Tissue culture: This part 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 cover 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 emphasis on the production of haploid plants. Genetic variation of cells under tissue cultures conditions will also be covered in this module.

Bot416 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

Bot418 Economics and Marketing

The first part of this course provides the analytical skills necessary to understand forces that determine prices of financial and real assets. It also develops a system of tools to show how interest rates, prices of bonds, international capital flows, and exchange rates are simultaneously determined. It demonstrates how firms use financial derivatives, such as futures, options, and swaps to protect against risk. The second part of this course introduces students to the strategic and tactical approaches used in the marketing of biological products and services. The roles of managers and leaders within companies which 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.



Program Title	**Zoology**
Program Type	**Single**
Department(s)	**Zoology**

Zoo201 Cell Biology and Genetics

This course gives an introduction to animal cell structure and function including the chemical components of the cell, the structure and function of cell organelles and their role in development, differentiation, bioenergetics and cellular communication. Examples of relevant human disorders will be used. The various basic concepts in genetics and hereditary transmission leading to organismal variations will be discussed. The topics covered include; the structure and replication of DNA, chromosome organization, the molecular basis of gene expression and regulation and how they are tied to intracellular and extracellular factors by signal transduction pathways. DNA repair mechanisms, epigenetics, irregularities, all will be studied structurally and functionally. Students will also learn principles of genetic engineering to practice ability to applications of genetics in biotechnology. The laboratory part exposes students to an overview of modern cell-related techniques in genetic engineering and basic recombinant DNA techniques and hands on experience to classical cell biology experiments.

Zoo203 Population and Community Ecology

This course provides an advanced view of the major processes governing population dynamics, species interactions, and community structure. Topics to be covered will include population growth and regulation, species interactions, Eco-evolutionary dynamics, food webs, patterns of diversity, stability, and sustainability of communities., with skills in using mathematical models as tools to understand the development of populations and community ecology processes.

Zoo205 Biotechnology and Bioinformatics

This cutting-edge course provides students with hands-on experience and knowledge of the latest techniques in biotechnology and bioinformatics research as well as nanotechnology and bio-processing technologies. Students will gain experience in the use of various molecular biology techniques and bioinformatics tools, along with the opportunity to operate analytical equipment similar to those used in industrial scale production facilities. Student will gain skills in the applications of computational methods to biological data analysis and for discovery as in Genomics analysis. Genomics, computational methods will include DNA sequencing and fragment assembly, identification of genes in DNA, gene regulation, expression, large data arrays, and methods to study genetic diversity and In Proteomics, computational methods will embrace similarity, homology and analogy, protein folding and protein structure.

Zoo207 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.

Chm221 Principles of Analytical Chemistry

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, 2 h: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation, and complex formation reactions.

Zoo209 Molecular Biology
Molecular biology is the study of biological systems at the molecular level. It deals with nucleic acids and proteins and how these molecules interact within the cell function to promote proper growth, division, and development. Study of molecular biology will be based on the classical knowledge of transcription, translation, and gene expression in both prokaryotes and eukaryotes. Students will learn how advances in molecular biology have led to the completion of several large genome projects that are changing the face of modern biology especially in the areas of medicine, agriculture and biotechnology and to understand the molecular basis of illnesses and use of genetic manipulation in biotechnology. Practically, students will learn concepts of experimental research levels for gene cloning, protein blotting, PCR, and assays of gene expression, recombinant DNA methodologies, DNA sequencing and in vitro mutagenesis.

Ent261 Entomology
This course will enable students to acquire knowledge and critical understanding of the principles of internal and external features of insects; insect development and compare between different insects in different orders.

Zoo211 Fisheries and Aquaculture
This course is designed to deal with several topics in Fish Biology, Fish Physiology, 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.
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.

Sta215 Introduction to 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).

Bph223 Introduction to Radiobiology
Introduction to radiobiology, Initial physical effects of irradiation: dosimetry-micro dosimetry, radiation chemistry, Effects of radiation on DNA molecules and chromosomes, Cellular effects of ionizing radiation, cell survival curves, Effects on normal tissues, The effects of radiation on tumors, the biological bases of radiotherapy, Hypoxic cells and their importance in radiotherapy, Time and fractionation in radiotherapy, Hyperthermia, Chemical modifiers of radiosensitivity, Neutrons and other heavy particles, Effects of irradiation on the human body, Recent issues in radiobiology.

Zoo202 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 invertebrates.

Zoo204 Immunology
This course provides the ground knowledge and ability to give the student a broad understanding of the immune system and its functions. The course will emphasizes the description of molecular and cellular elements of the immune system, and their basic function and in which these elements operate to provide immunity and how the impairments of their function may result in diseases. Topics include: activation and regulation of innate and adaptive immunity and the principles governing vaccination; the molecular basis of antigen specificity; antibody structure and interaction with antigens; disorders of the immune system; tumor and transplantation immunology; the application of laboratory immunological techniques for diseases diagnosis and monitoring.

Zoo206 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 protozoology 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.

Zoo208 Functional Histology

This course enables students to be familiar with the histology of all organ systems of the body (e.g. Integumentary, Circulatory systems system Digestive, Endocrine, Respiratory, Urinary and Reproductive systems) and to acquire basic understanding of at the practical level, 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 and adaptation of the organ.

Chm234 Introduction to Instrumental Chemistry

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.

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.

Zoo212 Animal Products and Human Health

Animal products and human health course will provide students with basics principles of animal biological products and human health Sciences. This course divides into three equally modules: 1) Biological identification of animal of medically importance; 2) Immunological responses of animal product; 3) Physiological responses of different animal products. The first module provides student with fundamental knowledge in general biology and identification of different animal groups, specifically invertebrates, which have human medical importance. The second and third modules provide students with the following: 1) immunological and physiological detection of dangerous animals causing poisoning and toxic responses to physiological and immunological compartments, 2) The nature of animal products such as venoms and other biological toxins and their immunological and physiological aspects of envenomation, 3) In cases of accidents, advice for first aid and treatment of bites, stings and other intoxication signs, 4) Animals contain substances of interest to the recombinant pharmaceuticals industry as bio-medicine for human health, 5) Signs of human health and disease related-to different biological toxins, immune competence vs tolerance, vaccination and immunization principles; monitoring disease incidence using biotechnological techniques will be delivered.

Zoo214 Toxicology and Pathology

The toxicological module will provide students with knowledge and skills that enable him/her to be aware of the basic concepts of toxicology; history, mechanisms of toxicity, factors affecting toxicity, different types of intoxication and different toxic episodes. Taking into consideration organ and tissue toxicological aspects, mutagenesis, carcinogenesis and teratogenesis. In addition, students should estimate the risk of different toxicities Specific organ toxicities. General management of toxicity with natural toxins, gases, animals and plant toxins, maternal, fetal and neonatal toxicity. The Pathology part of this course is designed to present students with essential concepts of pathological processes and altered health states. The course looks in depth at a wide variety of common pathological conditions and nomenclature. General topics covered

include the nature and causes of cell injury and death; adaptive cellular changes; inflammation, healing and repair, thrombosis, blood disease, infarction and neoplasia. Clinical scenarios within each module correlate the anatomical pathology with major clinical symptoms and signs. In addition to lectures, small group tutorials provide an opportunity for students to examine macroscopic and microscopic specimens illustrating the pathology covered in lectures.

Zoo244 Introduction to Fauna of Egypt and Zoogeography

This course introduces students to the breadth of diversity of the Egyptian fauna and investigates its origins and significance of this diversity. The adaptations of the fauna to the diversity of habitats available. Major lifestyle themes, life history adaptations, and habitat characteristics are explored. Study Zoogeography provide students with the basic concepts of the geographical distribution of animals. The study of the causes, effects, and other relations involved in such distributions.

Mic248 General Microbiology

This course offers a comprehensive study of the field of microbiology to science majors. The course will give detailed insights into the following major themes: Structure and function of microbes (cellular structures, metabolism, and growth), microbial ecology, microbial diversity including prokaryotes (bacteria), eukaryotes (fungi and microalgae), in addition to viruses, and finally clinical microbiology (immunity, pathogenicity, epidemiology, control of microbes, and diseases).

Geo220 Macrofossils

Importance of fossils, fossilization, Body and trace fossils. Morphology and geological history of some selected fossil groups. Phylum Mollusca, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina. Practical work includes examination, description, definition and classification and of some selected macro -invertebrate fossils, field trip: collection, mode of preservation, definition of macrofossils.

Zoo301 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.

Zoo303 Helminthology

The course is intended for students interested in pursuing a professional career in the fields of Helminthology, 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, diagnosis, treatment and modern trends in helminthology 3- develop intellectual and practical skills to develop professional competence in the fields related to helminthology.

Zoo305 Ecological Adaptations and Animal Behaviour

This course deals with the 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, theoretical basis and the empirical evidence for ecological adaptation. Students learn how an animal's behaviour affects its ability to survive and reproduce in its environment. Course topics, such as foraging behavior, sexual selection, parental care, etc., represent the interface of ecology, evolution, and behaviour.

Zoo307 Embryology and 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.

Chm371 Organic chemistry

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. Also studying of the properties and reactivity of carbon compounds containing more than one functional.

Zoo309 Invertebrate aquaculture

The main objective of this 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.

Zoo311 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.

Zoo313 Immunology and Infectious Diseases

The course covers specialized aspects of Pathogens causing disease in mammals, their transmission & pathogenesis. Innate, humoral & cellular immune systems in health & disease. Interaction between immune system & infectious agents, including vaccines. The module will cover aspects of molecular approaches to the study and understanding of immunology and infectious diseases at an advanced level presented in a modular form. Modules include immunology, mechanisms of bacterial pathogenesis, viral infectious diseases and immunity, and parasitic diseases and immunity. This course explores the basic principles of host defense against pathogens, including evolutionary aspects of innate and adaptive immunity and immune evasion strategies. Specific examples of viral and bacterial interactions with their hosts are studied in depth. A review of immunological mechanisms involved in specific cases is incorporated in this course.

BTe315 Introduction to Bioremediation

This course deals with the applications of microorganisms in the treatment of polluted water with heavy metals, and other chemical and industrial wastes.

Chm359 Chromatographic Analysis

Chm359 Introduction to Instrumental Analysis

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.

Zo302 Physiology 1 (Feeding, digestion and metabolism)

The course will focus, in details, on the aspects of physiology of metabolism, intermediary metabolism, intermediary metabolism modifications. The course will include physiology of digestive system, nutrition, digestion, absorption, and feeding methods. Cellular and molecular mechanisms will have discussed to present a current view of physiological principles in this area.

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.

Zoo304 Functional Ecology (Ecosystem and Energetics)

The course will describe different aspects and methods in the field of functional ecology, combining theoretical lessons with hands-on real data. Lectures will provide the theoretical and mathematical basis for different applications of functional traits at organismal, community and ecosystem levels, with examples across different trophic levels including ecosystem energetics and biogeochemical cycles. It examines the relations between environmental resistance and biotic potential of animals. investigations of the production, transfer and transformation of energy or energy-containing materials between and within organisms and populations in different ecosystems.

Zoo306 Epidemiology, Immunoparasitology, and Control

The course is intended for students interested in pursuing a professional career in the fields of parasitology, such as medical and veterinary health centers, environmental researches centers and diagnostic parasitology laboratories and therapeutic companies. The course aims to: 1-provide students with the basic epidemiology concepts and principles that are of particular relevance to infectious diseases. It focuses on the application of epidemiologic methods and surveillance to clinical health issues. 2-provide students with skills in applications of descriptive and analytic epidemiology and practice of surveillance for parasitic infection, pathogenic potential of the parasitic agents and prevention and control in various settings and 3-use immunoparasitology in developing the student's intellectual and practical skills to plan alternative control strategies and to use immunoparasitological techniques in the diagnostic and epidemiological approaches to control parasitic infections, 4- focus on the host innate and acquired immune defense mechanisms against different parasitic infections and the evasion mechanisms developed by these parasites to evade such responses and recognize the current and potential approaches in the control strategies of protozoan and helminthic parasitic infections using vaccines.

Zoo308 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.

BCh336 Biochemistry (1)

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

Zoo312 Laboratory Techniques

This course will enable students to gain knowledge about the theory and practice of important laboratory techniques and divides into three modules: 1) Biotechnological and immunological techniques; 2) Macro

techniques and 3) Micro techniques. The first module will introduce: nucleic acids isolation, gel electrophoresis and documentation, spectroscopy, chromatography, rDNA technology, DNA fingerprinting, gene cloning, delivery and transferring, genomic and cDNA libraries, DNA sequencing, genome sequencing and mapping, blotting methods, cell and tissue culture, ELISA assays, antibody production, immune- Blotting assays and bioinformatics databases. The second module will provide students with basic and advanced methods for different preparations of parasites and invertebrates (stained and unstained whole mount techniques, hand cut sections, enface methods, egg count….etc). The third module provides students with theory and hands-on experience in microscopic, cytological, histochemical, immunohistochemical, immunofluorescence, computerized image analysis, cell structure techniques includes preparation of tissues and small specimens. Permanent slide such as paraffin slide, maturation slide in addition to preparations of microscopic sections (tissues fixation and processing), smears of soft tissues, histochemical techniques, immunohistochemical techniques cell biology and genetics methods.

Zoo314 Invertebrate Pathology

The main objective of this course is the study of diseases affecting invertebrate animals,
including etiology, pathogenesis,
symptomatology, pathology, histopathology, physiopathology, and epizootiology.
Interactions between invertebrates and their diverse pathogens, such as bacteria, viruses, and protozoa, ra nge from obligate parasitism to various associations that may result in disease.

Zoo316 Field Studies

Field Studies course combine classroom-based instruction with field-based experience for unique learning experiences focuses on the theoretical models of population ecology; population density, dispersion, population growth and demography. Students learn a variety of field techniques for field experimental design, animal sampling techniques, measuring population density and distribution. Labs include extensive field work at a variety of local sites. Students write their own lab reports with emphasis on the appropriate choice of statistical inference for the analysis of ecological data.

Zoo318 Experimental Design

This is a basic course in designing experiments and analyzing the resulting data. The course objective is to learn how to plan, design and conduct experiments efficiently and effectively, and analyze the resulting data to obtain objective conclusions. Both design and statistical analysis issues are discussed.

Zoo401 Applied Field Training

Applied Training is a joint program with seminar courses. It deals with Any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Zoo405 Physiology (2) (Blood and Body Fluids)

This course will focus, in details, on the aspects of physiology of blood respiratory function (gases transport, buffering action, and acid-base balance), excretion, osmoregulation, circulation, as well as defensive mechanisms. The course will include the basic physiological processes of circulatory and

excretory systems. It also familiarizes students with laboratory techniques and equipment used in the acquisition of physiological data and in the development of their investigative skills in this area.

Zoo407 Scientific Writing and Presentations

This module aims to give the students the experience in: 1-analysis and interpretation of scientific data, 2-handling the biotechnological information,3-developing research skills (experimental design, laboratory safety, literature searching, research ethics and statistical analyses) , 4-writing sections of research papers (introduction, material and methods, literature review, discussion, references, summaries), 5- in addition to prepare and present scientific data (tables, maps, histograms, graphs, micrographs) in oral and poster presentations.

Zoo411 Histopathology

The aims of the histopathological course are to: 1- Study microscopic structural abnormalities in the tissue under the effect 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.

Zoo409 Cancer Immunology and vaccinology

Cancer immunology module will first provide a basic understanding of cancer immunology, giving an overview of the components of the immune system and evidence that the immune system can mount potent and potentially curative responses against cancer. This course is designed to provide students an understanding of the interplay between tumors and the immune system, as well as current therapies that use the immune system in the setting of oncology. The course will be broken up into three main sections. The first section will cover basic immunology and tumor biology, the second will address the interplay between the immune system and tumors, and the third will discuss current immunological therapies. At the conclusion of the course, participants should understand how the immune system functions, how genesis of cancer and its progression, and the links between these two systems. These strategies will include antibody therapies, checkpoint blockade strategies, T cell /chimeric antigen receptor adoptive therapy, and cancer vaccines. Vaccinology module aims to promote an appreciation of the development and application of vaccines as well as the benefits and constraints of vaccination as a component of integrated disease control. The vaccinology course aims to provide a comprehensive and integrated overview in the important field of vaccinology, from immunology to all types of vaccine development, production, delivery and effect evaluation.

Zoo413 Ecological Pollution

This course deals with major problems of pollution of the atmosphere, water, the land surface and the food chain. It covers processes responsible for the occurrence and release of pollutants in the environment, dispersion mechanisms, the hazards associated with different types of pollutant, problems of accumulation of toxic substances on living organisms and ecosystem health, and procedures for the reduction of emissions and remediation of contaminated environments.

Zoo415 Experimental design

This is a basic course in designing experiments and analyzing the resulting data. The course objective is to learn how to plan, design and conduct experiments efficiently and effectively, and analyze the resulting data to obtain objective conclusions. Both design and statistical analysis issues are discussed.

Zoo402 Graduation Project

This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Zoo404 Histochemistry

The course aims to study the identification and localization of different chemical components within and around the microstructure of cells and tissues using suitable fixation and specific staining techniques for different cell components; enzymes, lipids, carbohydrates, proteins, nucleic acids, cytoskeleton and pigments……etc. The course throws light on the role they play in the general metabolic activities of the body. During the course the students will gain experience in new approaches in histochemical staining mechanism including DNA ploidy staining, immunohistochemistry (IHC) and Fluorescence in situ Hybridization (FISH) techniques as well as interpretation and analysis of stained sections in both normal and abnormal conditions to detect the diagnostic status.

Zoo406 Physiology (3) (Hormones and Coordinations)

The aim of this course is to introduce the physiological aspects of the nervous, muscular, endocrine and reproductive systems. This module examines the structures and functions of the various divisions of the nervous system and related sense organs, the muscles and neuromuscular junctions as well. Several important endocrine processes, including how hormones control growth, metabolism and other vital processes be included. During this course, students become able to acquire laboratory techniques, methods and equipment used in the investment of physiological data in this area.

Zoo474 Introduction to 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, bio fouling 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.

BCh430 Biochemistry (2)

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.

Zoo408 Toxicology

Molecular and cellular toxicology course will cover the fundamental concepts of cellular and molecular toxicology including cellular responses to toxic insults involving integrated biological processes such as the activation of signaling pathways, the regulation of gene expression and cell division, and programmed cell death. This course will unravel the key processes in this cellular drama and discuss the scientific uncertainty in the measurement and in the data. The goal is to introduce cellular and molecular principles and the key biochemical players to foster a deeper understanding of the molecular basis of toxicology. This course emphasis area focuses on investigating how, why, and when chemicals cause harm to life, such as affecting cellular and molecular processes that lead to toxicity or cancer. This course provides students with the skills and knowledge necessary to investigate and elucidate how environmental toxicants/cellular stressors contribute to toxicity and influence human disease outcomes. This course aimed at understanding the deleterious effect of environmental factors on human health and disease.

Zoo412 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 digestive system will be studied to show the structure and function of its different parts. Study of the structure and function of the exocrine and endocrine portions of the pancreas and its diseases. The circulatory system and its role in energy production. Nervous system and the endocrine system and their role in controlling the body functions will be studied in details. 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.

Zoo414 Clinical and Molecular Parasitology

The course is designed to throw light on the field of diagnostic parasitology laboratories and health centers and for the students 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 concepts and information about clinical and veterinary parasitology, including classification and characteristics of pathogenic protozoa, helminths medical insects, life cycles of these agents, host parasite relationship, and pathogenic effects on the host, 2- 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. 3-develop intellectual and technical skills to use laboratory methods for clinical diagnosis.4-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.



Program Title	**Entomology**
Program Type	**Single**
Department(s)	**Zoology**

Ent201 Insect Morphology

The course is designed to gain knowledge on the external morphology of the insect's body.

Ent203 Economic Entomology
This course introduces students to the economically important insects with specific emphasis on those beneficial and harmful to agricultural and horticultural crops, livestock, pets, and food products. The course includes distribution, habit, biology and life history, host and types of damages.

Ent205 Insect Anatomy and Histology
The course is designed to gain knowledge on the internal anatomy of the insect's body and histology of organs in different systems.

Chm221 Principles of Analytical Chemistry
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, 2 h: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation, and complex formation reactions.

Ent207 Insects and Plant Pollination
This course provides students with a fundamental understanding of insect-mediated pollination, focusing on plant and pollinator diversity, biology, and natural history, the ecology and evolution of plant-pollinator relationships .

Ent209 Honeybee and Apiculture
The biology of honeybees and the craft of apiculture will be examined by exploring the natural history, biogeography and ecology of honeybees. Honeybee anatomy, physiology, colony social structure, pests/diseases, pollination ecology, management and current topics in beekeeping will be discussed.

Ent211 Insect Pests of Field Crops
Detailed coverage of the insects and mites attacking crops to familiarize the students with nature of the damage and seasonal incidence of insect pests that cause loss to major field crops and their effective management by different methods.

Sta215 Introduction to 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).

BPh223 Introduction to Radiobiology
Introduction to radiobiology, Initial physical effects of irradiation: dosimetry-micro dosimetry, radiation chemistry, Effects of radiation on DNA molecules and chromosomes, Cellular effects of ionizing radiation, cell survival curves, Effects on normal tissues, The effects of radiation on tumors, the biological bases of radiotherapy, Hypoxic cells and their importance in radiotherapy, Time and fractionation in radiotherapy, Hyperthermia, Chemical modifiers of radiosensitivity, Neutrons and other heavy particles, Effects of irradiation on the human body, Recent issues in radiobiology.

Ent202 Insect Taxonomy and Evolution
This course is designed to teach students the fundamentals of insect taxonomy. Students will learn how to identify a diverse array of adult insects. Students will also be introduced to the International Code of Zoological Nomenclature and understand the basic phylogenetic theory and how it impacts classification.

Ent204 Insect Ecology
The course introduces students to the concepts of ecology, principles of distribution and abundance of insects and their causes. The course focuses on basic ecological theory and principles with their application to entomological problems.

Ent206 Insect Interrelationships
The framework for the course will be an overview of the relation of insects to man (Injurious and beneficial insects), interrelationships of insects and plants, interrelationships among insects and Interrelationships between insects and microorganisms.

Chm234 Introduction to Instrumental Chemistry
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.
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.

Ent208 Post-harvest Insect Pests
This course aims to teach the students the biology and management of insect pests of bulk-stored grains, flour, feed, dried fruits and nuts within food processing plants, warehouses, wholesale and retail distribution systems.

Ent210 Greenhouse Pests

This course develops skills related to greenhouse types, structure, crops, pests and diseases, with hands-on pest management principles, methods, and current practice.

Ent212 Cell Biology
This module aims 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 the organelle; the main elements of the cytoskeleton and their functions; intercellular and intracellular communication.

Mic248 General Microbiology
This course offers a comprehensive study of the field of microbiology to science majors. The course will give detailed insights into the following major themes: Structure and function of microbes (cellular structures, metabolism, and growth), microbial ecology, microbial diversity including prokaryotes (bacteria), eukaryotes (fungi and microalgae), in addition to viruses, and finally clinical microbiology (immunity, pathogenicity, epidemiology, control of microbes, and diseases)

Geo220 Macrofossils
Importance of fossils, fossilization, Body and trace fossils. Morphology and geological history of some selected fossil groups. Phylum Mollusca, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina. Practical work includes examination, description, definition and classification and of some selected macro -invertebrate fossils, field trip: collection, mode of preservation, definition of macrofossils.

Ent301 Insect Behavior
This course stresses comprehensive coverage of the principles of insect behaviour. Physiology mechanisms, behavioural ecology and evolution of insect behaviour will be covered.

Ent303 Insect Physiology
This course introduces principles of insect physiology with emphasis on regulatory mechanisms. Throughout the course, the student will learn about experimental methods used in insect physiology.

Ent305 Insect Genetics
This course focuses on the study of the major laws of inheritance and the cellular and molecular bases for these laws. Topics will include cell division, Mendelian inheritance, linkage, recombination, quantitative inheritance, probability theory and statistical applications in genetics, problem-solving strategies, population genetics, and molecular genetics.

Chm371 Organic Chemistry
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. Also studying of the properties and reactivity of carbon compounds containing more than one functional.

Ent307 Chemical Ecology of Insects
The course presents descriptions of the chemicals involved, and how insects interact them by modifying behaviour and ultimately reproductive success. The focus here is on semiochemicals and defensive secretion.

Ent309 Insect Hormones and Pheromones
The course deals with the chemistry, action and metabolism of different insect hormones, the organization of the neuroendocrine system, pheromones, intracellular communication, novel systems for studying insect endocrinology, and others include insect hormones in plants and insect control.

Ent311 Trends in Biological Control of Insect Pests
The course teaches the ecological principles and applied practices of biological control of insects. Epizootiology including the scientific basis of biological control; natural enemies and their biology; biological control methods; and biological control in integrated pest management programs.

BTe315 Introduction to Bioremediation
This course deals with the applications of microorganisms in the treatment of polluted water with heavy metals, and other chemical and industrial wastes.

Chm359 Chromatographic Analysis

Ent302 Insect Pathogens and Biological Control
This course aims to teach the students about various microbes that are pathogenic to insects, factors that affect their virulence; provide hands-on training in identification, isolation, culturing various pathogens and assessing pathogenicity. Roles of diseases in insect population dynamics, biotechnology and insect pathogens. The utilization of these insect pathogens in controlling the insect pests.

Ent304 Medical Entomology
This course presents the biology and control of principal arthropods of medical importance and coverage of the natural history and abatement of selected arthropod-related diseases, including the major insect, mite, and tick vectors of disease to man.

Ent306 Forensic Entomology
The course focuses on the entomological contributions that have served to further our understanding of how both human and animal remains decompose, as well as how insects can be employed as evidence in court and explain how they can assist in solving crimes, neglect, abuse, and food contamination cases.

BCh336 Biochemistry (1)
Carbohydrate classification, derivatives and reactions, Lipid classification biological membrane and lipoprotein

Ent308 Biological Control of Weeds Using Insects
The overall objective of this course is to cover the principles of modern classical biological control of weeds with the deliberate use of plant-feeding insects, of which beetles, flies, and moths are among the most commonly used to limit the abundance of a target weed. Particular attention will be paid to the most problematic weeds for which there are at least some biocontrol agents established.

Ent310 Molecular Entomology and Biotechnology
This course aims to provide students with hands-on experience in basic molecular biology strategies: DNA extraction, Polymerase Chain Reaction (PCR), quantitative PCR, primer design and optimization, DNA blocking strategies cloning, Sanger sequencing, Fragment sizing, Next Generation Sequencing. Students will learn to apply molecular tools to entomology and entomological problems.

Ent312 Livestock Entomology
This course presents the biology and control of principal arthropods of veterinary importance and coverage of the natural history and abatement of selected arthropod-related diseases, including the major insect, mite, and tick vectors of disease to livestock.

Ent401 Applied Field Training
Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Ent403 Insecticides and Toxicology
This course aims to study the chemical, physical properties and classification of the pesticides. Testing and evaluating the efficiency of insecticides in both the field and laboratory. Factors affecting toxicity and chemical reaction.

Ent405 Aquatic Entomology
This course will introduce students to the biology, ecology, and systematics of aquatic insects that live in streams, lakes, and wetlands and some of the special adaptations that aquatic insects have for a successful existence in running waters, and to relate that information to the concept of biodiversity.

Ent411 Scientific Writing
In this course, we will cover the basics of scientific writing using sessions, exercises and small-scale feedback sessions. All teaching materials are tailored to the needs of a psychological

researcher in action. The course focuses on the skills to write scientific reports, thesis, and papers, how to express your report in a poster or PowerPoint presentation.

Ent409 Insect Control in Organic Systems
This course deals with principles and strategies of crop protection in the organic farming system, crop protection practices in organic farming, plant protection products authorized in organic farming and case studies of organic farming.

Ent413 Transgenic Plants for Insect Control
This course discusses what is genetic modification, a genetically modified crop, how does a genetically modified crop differ from conventional plant breeding? and the steps required for successful development of genetically modified crops.

Ent415 Insect Control in Museums, Archives and Libraries
This study deals with the problems of insect pests of libraries, archives and museums, on their habits and life histories, on methods for recognition of damage which they cause, and on the best ways to handle the management for treating library, archives and museum pests.

Ent402 Graduation Project
This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Ent404 Integrated Pest Management
The main goal of this course is that students understand how sound IPM practices rely on an understanding of ecological interactions among crops, pests and their natural enemies and to breach the illusionary gap between applied and basic research.

Ent406 Insect Conservation
This course deals with factors leading to biodiversity losses, habitat loss, overuse of resources, habitat pollution, climate change, extinctions and habitat fragmentation, protected areas and nature protection. Policies that may protect endangered insects from being extinct are also covered.

BCh430 Biochemistry (2)
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.

Ent414 Insect Transmission of Plant Diseases
This course addresses the basic principles of the role of insects as vectors of plant pathogens, including viruses, bacteria, fungi, nematodes and protozoa. The course includes the major modes of transmission of plant pathogens by insects and identification, the morphology of important vectors and how these features affect the transmission of plant pathogens.

Ent408 Insect Population Genetics
The course will deal with an understanding of population genetics theory and examples of applications. The focus shifts away from the individual toward the population of which the individual is a member. This will include Hardy-Weinberg low and factors that change allele and genotype frequencies in populations, use of DNA fingerprinting in the identification and relationship testing.

Ent410 Insect Biochemistry
The course is designed to present the organization of insect systems and metabolic processes. There will also be a discussion on the biochemistry of exoskeleton and regulation of metamorphosis; insect hormones affecting growth and development; insecticides and their modes of action; insecticidal proteins, biopesticide and mechanisms of insecticide resistance.

Ent412 Invasive Insect Species
This course is designed to provide students with up-to-date perspectives on invasive insect species, include the characteristics of invasive insect species, ecological and evolutionary processes that occur when non-native species are introduced into new habitats, the damage they cause, linkages between invasive insect pests and trade, pathways of pest invasions, the social, environmental, and economic impacts of the introduction of agricultural pests and the issues surrounding methods used to control these insects.

Chm472 Environmental Chemistry
Environmental chemistry is the study of the distribution and interactions of matter (chemicals) in the environment, which includes both the outdoors and the indoors. Environmental Chemistry is an application of chemical principles to the study of the environment. It includes natural processes and pollution problems related to air, water, and soil. In this course the emphasis is on how the specific discipline of chemistry can help us understand contemporary environmental issues, and what it tells us about possible solutions to environmental problems the world is facing. 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.

Chm474 Natural Products
A **natural product** is a chemical compound or substance produced by a living organism that is, found in nature. In the broadest sense, natural products include any substance produced by life. Natural products can also be prepared by chemical synthesis (both semi-synthesis and total synthesis) and have played a central role in the development of the field of organic chemistry by providing challenging synthetic targets. Topics cover concepts of natural product chemistry, carbohydrates, traditional and modern approaches to studying natural products. **Courses include Extraction and Isolation of Natural Products.** Extraction of Natural Products, Separation of Natural Products.



Program Title	**Chemistry / Biochemistry**
Program Type	**Double major**
Department(s)	**Chemistry**

Chm207 Aliphatic Chemistry

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 alcohols, ethers, thio compounds, aldehydes, ketones, carboxylic acids, and there derivatives, nitrogen compounds and its derivatives as well as monosaccharides.

Chm209 Aromatic Chemistry

The chemistry of aromatic compounds. The topics covered in this course include nomenclature, structure and reactions of aromatic hydrocarbons, phenols aromatic aldhydes, ketones, acids m nitrogen compounds and their derivatives as well as thio-compounds.

Practical, 2hrs: study the separation and detection oh a mixture of organic compounds as well as the scheme of organic liquids.

Chm221 Principles of Analytical Chemistry

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, 2 h: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation, and complex formation reactions.

Chm223 Chemical Thermodynamics and Surface Chemistry

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. Also, 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.

Zoo233 Cell Biology

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.

Bph225 Biophysics

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. 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.

Sta227 Basics of 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.

Bot253 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, pseudo alleles, 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.

Sta225 Applied 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.

Chm214 Stereochemistry and Bifunctional Organic Compounds
The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its formation, properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis.
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.
Practical, 2hrs: study the quantitative estimation of several organic material and their solutions.

Chm220 Chemical Kinetics
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.

Chm222 Chemistry of Main Elements

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, chalcogens, 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.

BCh222 Chemistry and Metabolism of Carbohydrates and Lipids

Carbohydrate classification, derivatives and reactions, Lipid classification biological membrane and lipoprotein. Digestion and absorption of carbohydrate. Catabolism of carbohydrate: glycolysis, TCA cycle, pentose phosphate pathway, glycogenolysis. Anabolism of carbohydrate Gluconeogenesis, glycogenosis. Metabolism of fructose, galactose, lactose. Digestion of lipids. Catabolism of Fatty acids: Fatty acid oxidation. Anabolism of fatty acids: fatty acids synthesis.

BCh224 Chemistry and Metabolism of Proteins and Nucleic Acid

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

Mic240 General Microbiology

Part one: This part deals with the occurrence and distribution of prokaryotic organisms and their structure, diversity and classification. Also, this part deals with the occurrence and distribution of bacteria and viruses and their structure, diversity and classification. The importance and role of these organisms in nature will be described. Special attention will be given to cyanobacteria and actinomycetes.

Part two: This part will enable students to acquire knowledge about the science of mycology with special emphasis on nutrition, reproduction and classification of fungi. The course will cover reproduction in fungi (vegetative, asexual and sexual) and the life history and life cycles of representative taxa.

Part three: In this part 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.

Sta214 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).

Phy226 Electronics and Semiconductors

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). 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.

Chm321 Transition Elements and Coordination Chemistry

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. Also, 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.

Chm323 Electrochemistry and Quantum Chemistry

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernest-Plank 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). 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.

Chm325 Heterocyclic Chemistry

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.

BCh321 Enzymology (1) and Hormones

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

BCh323 Vitamins and Inorganic Metabolism

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 such as sodium, potassium, calcium, iron, phosphorus and trace elements metabolism.

BCh325 Molecular Biology

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.

Chm327 Materials Chemistry and Solid State

Materials chemistry involves the use of chemistry for the design and synthesis of materials. Special attention will be for nanomaterials. Through a case study approach, synthesis, properties, and applications of nanomaterials, as well as techniques used to study and characterize them, will be explored. Examples of topics likely to be included: metal nanowires, quantum dots, nanoparticles, gold nanomaterials, nanofibers, nanotubes, grapheme, mesoporous materials, block copolymer assemblies, photonic crystals, self- assembled monolayers, biomaterials, cellulose nanocrystals, magnetic nanoparticles, etc. Recent literature on the subject of nanomaterials will also be discussed.

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.

Chm329 Environmental Chemistry and Water Treatment

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. 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 contaminates to be treated and methods of water treatment

including; ultraviolet light, filtration, water softening, reverse osmosis, ultra-filtration, deionization and powdered activated carbon treatment.

Bph323 Basics of Radiobiology

Introduction to radiobiology, Initial physical effects of irradiation: dosimetry-micro dosimetry, radiation chemistry, Effects of radiation on DNA molecules and chromosomes, Cellular effects of ionizing radiation, cell survival curves, Effects on normal tissues, The effects of radiation on tumors, the biological bases of radiotherapy, Hypoxic cells and their importance in radiotherapy, Time and fractionation in radiotherapy, Hyperthermia, Chemical modifiers of radiosensitivity, Neutrons and other heavy particles, Effects of irradiation on the human body, Recent issues in radiobiology.

Phy331 Physics of Nanotechnology

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.

Chm320 Instrumental Analysis (1)

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.

Chm322 Organic Polymers and Natural Products

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. 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, benzylisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D….) and vitamins (vitamin B1,2,5,6, E, K and A).

BCh320 Body Fluids and Biological Functions

Compositions and functions of blood, blood volume, hematopoiesis, hemostasis, abnormal hemoglobin's. 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.

Chm324 Pesticides Chemistry
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.

Chm326 Organic Spectroscopy
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.

Chm328 Bioinorganic and Biophysical Chemistry
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. 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. 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.

Chm330 Nuclear Chemistry and Inorganic Reactions Mechanism
This course will provide the fundamentals of nuclear chemistry including; nuclear structure, nuclear models (Fermi gas, liquid drop and nuclear shell models), isotopes Radioactivity and radioactive decay, 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. 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.

BCh322 Enzyme and Signal Transductions

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

BCh324 Nutrition and Disturbance Metabolism

Regulation of Carbohydrate, Lipid and protein. Hormonal action of metabolic control. Regulation of metabolism in starvation and obesity. An overview of nutrition, food choice and diet planning diets, diet and health, functional foods, antioxidants, food drugs interactions, genetically modified food.

BCh326 Biological Membranes and Biological Separation

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. Also, Determination of macro-molecules. Separation of macromolecules by different methods chromatography, electrophoresis, Ultracentrifugation. Molecular weight determination.

BCh328 Drug Metabolism and Toxicology

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. 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.

Chm-BCh401 Applied Field Training

Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Chm421 Photochemistry and Laser Chemistry

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. 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.

Chm423 Practical Organic Chemistry
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.

BCh421 Practical Biochemistry (1)
The aim of this course is to study the practical details in analytical clinical chemistry as determination the chemical component in serum or plasma and urine and complete investigation of urine and blood.

BCh423 Immunology
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.

Chm425 Chemistry of Petroleum and Petrochemicals
The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team-oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes. It also concerned with current problems of petroleum chemistry and processing such as chemical composition of crude oils and natural gas liquids; petroleum refining (cracking, hydrocracking, and catalytic reforming); catalysts for petrochemical processes (hydrogenation, isomerization, oxidation, hydroformylation, etc.); activation and catalytic transformation of hydrocarbons and other components of petroleum, natural gas, and other complex organic mixtures; new petrochemicals including lubricants and additives.

Chm427 Alkaloids and Terpenes and Vitamins
the chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzylisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D….) and vitamins (vitamin B1,2,5,6, E, K and A).

Chm 429 Selected Topics in Inorganic Chemistry

This will include but not limited to: Charge transfer complexes, Medicinal applications, Transition metal complexes, Application of transition metal complexes in catalysis, Biological applications of transition metal complexes.

Chm431 Physical Polymer and Instrumental Analysis (2)

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. 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.

BCh425 Tissue Chemistry

Mechanism of Collagen, elastin, fibrin and fibronectin proteoglycans in extracellular matrix. Role of bone as mineralized connective tissue. Many metabolic and genetic disorders involve bone. Muscle transduction actin and myosin as the major protein of muscle. Actin based regulation occurs in striated muscles.

BCh427 Genetic Engineering

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.

BCh429 Clinical Biochemistry

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.

Chm-BCh402 Graduation Project

This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Chm420 Molecular Spectroscopy
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. 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.

BCh420 Practical Biochemistry (2)
This aim to study the practical enzyme purifications in different ways and also study microbial analysis and antibiotics include the biochemical substance in micro-organism.

BCh422 Cancer Biology
Definition, Nature of cancer, some terms frequently applied in cancer. Cancer metabolism. Cell cycle and apoptosis. Host tumor-relationship. Diagnosis and treatment of cancer.

Chm424 Nucleic Acids and Industrial Chemistry
This course will provide the fundamentals of nuclear chemistry including; nuclear structure, nuclear models (Fermi gas, liquid drop and nuclear shell models), isotopes Radioactivity and radioactive decay, 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. 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.

Chm426 Chemistry of Dyes
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.

Chm428 Nanoscience
This course includes the history of nanoscience, definition of nanoscience, and nanotechnology, classification of nanomaterials, methods of characterization of nanomaterials, synthesis

approaches including Top down and down up approaches, general properties of nanomaterials, general applications of nanomaterials in energy, medicine and drugs, nanobiotechnology, cosmetics and bioengineering.

Chm430 Computational Chemistry and Electrochemistry (2)
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. This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernest-Plank 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).

BCh424 Environmental Biochemistry
Effects of trace element and pollution. carcinogen, phytotoxins, zootoxin and environmental toxicants. Food drug interactions. Relation between cancer and pollution.

BCh426 Tissue Culture and Microbial Biochemistry
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. 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 cover 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 emphasis on the production of haploid plants. Genetic variation of cells under tissue cultures conditions will also be covered in this module.

BCh428 Advanced Biotechnology
The course explores the applications of biotechnology, its products, and processes. It examines the mechanisms through which biotechnology is commercialized, 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.

Program Title	**Chemistry/ Geology**
Program Type	**Double major**
Department(s)	**Geology**

Geo203 Optical Mineralogy

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 ordinary light; plane polarized light, methods of light polarization, and optical properties using polarized light; and Interference between crossed Nicols, optical properties between crossed Nicols (Interference and interference colours, birefringence, retardation, extinction and extinction angle); Convergent light and interference figures; Optical orientation.

Laboratory work: Optical properties and microscopic examination and description of selected minerals in thin sections.

Geo215 Stratigraphy and Paleontology
Introduction, strata and stratification, basic stratigraphic principles and laws, types of stratigraphic contacts, conformable and unconformable boundaries, geologic time units, relative and absolute ages, branches of stratigraphy, stratigraphic procedures, stratigraphic maps and diagrams, practical work includes determination of stratigraphic relationships and sequence of events, construction of different types of stratigraphic maps and diagrams, field trip: field stratigraphic relationships, verifying stratigraphic laws in the field. Importance of fossils, fossilization, Body and trace fossils. Morphology and geological history of some selected fossil groups. Phylum Mollusca, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina. Practical work includes examination, description, definition and classification and of some selected macro-invertebrate fossils, field trip: collection, mode of preservation, definition of macrofossils.

Chm207 Aliphatic Chemistry
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 alcohols, ethers, thio compounds, aldehydes, ketones, carboxylic acids, and their derivatives, nitrogen compounds and its derivatives as well as monosaccharides.

Chm209 Aromatic Chemistry
The chemistry of aromatic compounds. The topics covered in this course include nomenclature, structure and reactions of aromatic hydrocarbons, phenols aromatic aldehydes, ketones, acids m nitrogen compounds and their derivatives as well as thio-compounds.
Practical, 2hrs: study the separation and detection oh a mixture of organic compounds as well as the scheme of organic liquids.

Chm221 Principles of Analytical Chemistry
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, 2 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chm223 Thermodynamics and Surface Chemistry
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.
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.

Geo201 Structural Mineralogy

Introduction, Crystal chemistry: i- crystal lattice, lattice planes, glide planes, screw axis, fourteen Bravais lattice, ii- Coordination and coordination number, 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; calculation of crystal lattice and coordination numbers of minerals.

Geo217 Principles of GIS

What is GIS?, Characteristics of GIS, Spatial data types, Types of geographic phenomena, Computer representations of geographic information, Organizing and managing spatial data, Spatial referencing and positioning, Map projections, GIS data sources, Data management and processing systems, Data entry and preparation, Spatial data analysis, Raster based surface analysis, Network analysis, Geospatial analysis, advances of GIS softwares, Geomorphological and geological applications of GIS, Terrain and hydrological analyses, lineaments and structural elements automatic extraction.

Practical Course**:** include GIS different softwares, introduction to ArcGIS package, How to enter data (direct and indirect methods), Geo-referencing, Geocoding and registration, Map projections and transformation, Editing in ArcMap, Introduction on Arc Catalog and Arc Toolbox, geo-statistical, surface analysis, network analyst, how to use open source data, how to download free GIS data, building geodatabase, application on geological and structural examples, Periodic field trips are needed to draw base maps, collecting ground control points and validation.

Gph213 Principles of 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.

Bot209 Fundamental of Soil Science

This part deals with soil ecology. 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, soil pollution and soil quality.

Zoo235 Invertebrates-Forming Skeleton

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.

Sta205 Applied Statistics
Introduction to biostatistics – clinical trials – hazard rates – odds ratio – inference of odds ratio – ROC curve – comparing survival functions – life table – Kaplan–Meier estimator – cox proportional hazard model.

Geo202 Rock-Forming Minerals
Introduction, general mineral classification and classification of rock-forming minerals; silicate structures; mineral structure, mineral composition and mineral classification of mineral groups; general optical properties of mineral groups and their occurrences. Mineral groups include: 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 feldspathoide group); Non-silicate minerals (carbonate minerals).
Practical work includes identification and descriptions of the rock-forming minerals in hand specimens; identification of the rock forming minerals and their optical properties using transmitted polarized microscope.

Geo214 Sedimentary Rocks and Sedimentation
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.

Chm214 Stereochemistry and Bifunctional Compounds
The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its formation, properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis.

Chm220 Chemical Kinetics
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.

Chm222 Chemistry of Main Elements

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, chalcogens, 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.

Geo216 Micropaleontology

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, Morphology, Wall structure and arrangement of some selected microflora including Pollen and Spores, and Diatoms. Ecology and significance of microflora, Practical work includes examination, classification and description of some selected microflora and microfauna fossils.

Gph214 Geophysical Methods

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.

Geo218 Applied Mineralogy

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.

Phy226 Electronics and Semiconductors

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). 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.

Bot248 Introduction to Plant Taxonomy

This module introduces the students to the principles of plant taxonomy and the definitions and terms used in plant taxonomy and systematic, 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 angiopermae, 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.

Bot256 General Ecology

This course 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). This part also 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.

Geo313 Igneous and Metamorphic Petrology

Igneous rocks: Introduction, generation of magma, magma constituents and types of magma. Crystallization of magma and Bown's reaction series, and magmatic evolution (magmatic differentiation, magma mixing and magmatic assimilation) Forms of igneous bodies (plutonic and volcanic rocks), field relations, structures and textures. Classifications of igneous rocks.

Metamorphic rocks: Introduction, definitions, metamorphic processes; factors of metamorphism; types of metamorphism; metamorphic grades, metamorphic zones and index minerals; metamorphic facies; metamorphic fabrics and textures; classification of metamorphic rocks. Metamorphism and plate tectonics.

Field trip and training: field observations; structures and collecting samples of igneous and metamorphic rocks.

Laboratory study: consists of rocks in hand specimens; identification and petrographic descriptions of rocks under the microscope.

Geo321 Fundamentals of Structural Geology

Introduction to structural Geology, measurements of attitudes of strata and bedding planes, primary sedimentary structures, primary igneous structures, stress and Strain, types of unconformities, folds and their types, faults and their classification, joints and their types, types of foliation, types of lineation and linear structures, shear zones and shear sense indicators.

Practical Course: Reading structural maps of dipping beds, folded beds, faulted beds, folded and faulted beds. Plotting of planes, lines, Pole to a plane, trend and plunge on stereographic Determining the orientation of the intersection of two planes and Measuring the angle between two planes using stereographic projection. Drawing Rose Diagrams for Azimuthal Data. Softwares in structural geology. Periodic field trips are needed to make measurements, interpretation, and visualization of structural elements.

GPh311 Field Geology and Geological Trips
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 includes sampling and interpreting geologic maps, applied geologic problems.

Chm321 Transition Elements and Coordination Chemistry
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.
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.

Chm323 Electrochemistry and Quantum Chemistry
This is introductory electrochemistry focusing on the spontaneity of oxidation-reduction reactions, electrochemical cells (galvanic and electrolytic cells), Nernest 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).
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.

Chm325 Heterocyclic Chemistry
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.

Chm327 Materials Chemistry and Solid State
Materials chemistry involves the use of chemistry for the design and synthesis of materials. Special attention will be for nanomaterials. Through a case study approach, synthesis, properties, and applications of nanomaterials, as well as techniques used to study and characterize them, will be explored. Examples of topics likely to be included: metal nanowires, quantum dots, nanoparticles, gold nanomaterials, nanofibers, nanotubes, grapheme, mesoporous materials, block copolymer assemblies, photonic crystals, self- assembled monolayers, biomaterials, cellulose nanocrystals, magnetic nanoparticles, etc. Recent literature about nanomaterials will also be discussed.

Solid state course will provide 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.

Chm329 Environmental Chemistry and Water Treatment

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.

This water treatment 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 contaminates to be treated and methods of water treatment including; ultraviolet light, filtration, water softening, reverse osmosis, ultra-filtration, deionization and powdered activated carbon treatment.

Bot359 Introduction to 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 of the Herbarium. Different field trips to different wild habitats to recognize the components of the Egyptian flora.

Zoo335 Fauna of Egypt and Zoogeography

This course introduces students to the breadth of diversity of the Egyptian fauna and investigates its origins and significance of this diversity. The adaptations of the fauna to the diversity of habitats available. Major lifestyle themes, life history adaptations, and habitat characteristics are explored. Study Zoogeography provide students with the basic concepts of the geographical distribution of animals. The study of the causes, effects, and other relations involved in such distributions.

Phy331 Physics of Nanotechnology

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.

Geo306 Subsurface Geology
Subsurface Geology: 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.

Geo310 Geology of Ores
Introduction, economic terminology, wall-rock alteration and interaction, Mineral parageneses, geothermometry and zoning Classification of ore deposits, Magmatic ore deposits, pegmatites, contact metasomatism, hydrothermal deposits, Metamorphic ore seposits, evaporates, sedimentary ore deposits, residual concentrations and supergene sulphides enrcichments. Field trip for mineral exploration and collecting samples, and Laboratory study consists of hand specimens examination (ornamental and building stones, nonmetallic and metallic ores) description and identification.

Geo318 Fundamentals of Hydrogeology
Introduction, Hydrogeological cycle and water balance, Occurrence of groundwater, Types of aquifers, Darcy's law, Aquifer hydrologic properties, Field and lab techniques employed for aquifer test. Groundwater flow system and flow net, Water well design. Field visits are needed to groundwater wells.

Chm320 Instrumental Analysis (1)
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.

Chm322 Organic Polymer and Natural Products
This is introductory course to macromolecules and synthetic polymers including free radical, ionic polymerization, polycondensation, 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.
Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products.

Geo322 Fundamentals of Environmental Geology

Philosophy and Fundamental Concepts, Ecology and Geology, Introduction to Natural Hazards, Water Resources, Water Pollution, Water Quality, Mineral Resources and the Environment, Energy Resources, Soils and Environment, Waste as a Resource, Waste Management, Global Climate Change, Geology, Society, and the Future, Field visits are needed to some hazardous and polluted areas

Geo324 Principles of Tectonic Geology
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. Field visits are needed to explore the geotectonic in the field

Gph314 Principles of Macropaleontology
Introduction, Fossils and fossilization, Significance of fossils, types of fossils, Taxonomy and classification, Phylum Mollusca, Phylum: Bryozoa, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina, Trace fossils and Plants. Practical work includes examination, description, definition and classification and of some selected macro-invertebrate fossils, field trip: collection, mode of preservation, definition of macrofossils.

Chm324 Pesticides Chemistry
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.

Chm 326 Organic Spectroscopy
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.
Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products and its practical.

Chm334 Biochemistry
Carbohydrate classification, derivatives and reactions, Lipid classification biological membrane and lipoprotein.

Chm328 Bioinorganic and Biophysical Chemistry
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
Physical properties of acid and base buffer. Physical chemistry of protein and amino acids. Blood buffering action. Biological membranes. Determination of macromolecules

Chm330 Nuclear Chemistry and Inorganic Reactions Mechanism
This course will provide the fundamentals of nuclear chemistry including; nuclear structure, nuclear models (Fermi gas, liquid drop and nuclear shell models), isotopes Radioactivity and radioactive decay, 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.
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.

Geo-Chm401 Applied Field Training
Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Geo403 Geology of Egypt (Precambrian)
Introduction, Distribution and age of Precambrian rocks, Theories of rock evolution, Classifications of Precambrian rock units in Egypt, their field observations and relations, their tectonic settings and evolution. Precambrian rock units include: Gneisses and migmatites; Island-arc associations (metasediments and metavolcanics); Granites (older and younger granites), Dokhan volcanic; Gabbros; Hamamat molasse sediments; Natash volcanics and ring complexes. Proposed tectonic models of the evolution of the Precambrian rocks of Egypt.
Field trip and training: field observations, measurements and field relations of Precambrian rocks in the Eastern Desert and red sea hills of Egypt and in Sinai, Egypt; mapping of rock units and collecting samples.
Laboratory work: mapping and location plots of Precambrian rock units; Identification and descriptions of rock types of each unit in hand specimens and under polarized microscope.

Chm421 Photochemistry and Laser Chemistry
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.
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.

Chm423 Practical Organic Chemistry
Synthesis and identification of various organic compounds. This course provides a study of chemical structure and reactivity correlation. Methods and Manipulation advances techniques of separation and purification, preparation of organic compounds, polymers. Solvent purification and reagent preparation. Purification, including crystallization and distillation. Reactions and Identification of organic compounds.

Geo413 Microstructures
Types of Deformation and Deformation Microstructures, Classification and characteristic of shear zones, Microstructural Shear Sense Criteria, Opposite shear senses, types of prophyroclasts, types of prophyreoblasts, Strain-Induced Grain-Boundary Migration, Deformation Microstructures in minerlas, Deformation Microstructures in rocks. Intracrystalline Plasticity, From Microstructures to Mountains: Deformation Microstructures and Tectonics

Geo415 Facies Analysis and Depositional Environments
Facies Analysis, Facies Model, Facies Patterns, Facies Types, Facies Migration, Marine Transgressions, Walther's Law of the Correlation of Facies, Facies Relationships, Sedimentary (litho) Facies and (litho) Facies Analysis, Paleocurrents and Paleocurrent Indicator Analysis, Facies Associations, Facies Sequences, Environments of Deposition (Continental, Marginal-Marine, Marine), Process/ Response Model, Physical Marine Process, Marine Facies & Depositional Environment, Shallow Marine Carbonate, Controls on carbonate sedimentation, Carbonate grain types and assemblages, Coastal Carbonate and Evaporite Environments (Beaches, Beach barrier lagoons, Carbonate lagoons, Arid lagoons, Arid sabkha flats), Shallow Marine Environments (Carbonate sand shoals, Carbonate mud mounds, Reefs, Reef-forming organisms, Reef structures, Reef settings), Distinctive and Common Sedimentary Facies Associations (Alluvial Fan, River Channels, Meandering Stream Facies, Glaciers, Swamps, Deltas, Beaches and Barrier Islands, Dunes, Lagoons, Tidal Flats, Reefs, Continental shelf, slope, and rise).

Geo419 Fundamentals of Geochemistry
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.

Geo421 Groundwater Geochemistry
Principles of Aqueous chemistry, Hydrogeochemical processes affecting the groundwater chemistry, Graphical representation of the hydrochemical data, Groundwater quality, groundwater pollution, Isotope hydrology, Surface and subsurface exploration of groundwater hydrology of Egypt. Field visits are needed to groundwater geochemical analysis laboratories.

Chm425 Petroleum Chemistry and Petrochemicals

The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team-oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes. It also concerned with current problems of petroleum chemistry and processing such as chemical composition of crude oils and natural gas liquids; petroleum refining (cracking, hydrocracking, and catalytic reforming); catalysts for petrochemical processes (hydrogenation, isomerization, oxidation, hydroformylation, etc.); activation and catalytic transformation of hydrocarbons and other components of petroleum, natural gas, and other complex organic mixtures; new petrochemicals including lubricants and additives.

Chm427 Alkaloids and Terpenes and Vitamins

The chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzylisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D) and vitamins (vitamin B1,2,5,6, E, K and A).

Biopolymers are natural polymers produced by the cells of living organisms. Biopolymers consist of monomeric units that are covalently bonded to form larger molecules. There are three main classes of biopolymers, classified according to the monomers used and the structure of the biopolymer formed: polynucleotides, polypeptides, and polysaccharides. Polynucleotides, such as RNA and DNA, are long polymers composed of 13 or more nucleotide monomers. Polypeptides and proteins are polymers of amino acids and some major examples include collagen, actin, and fibrin. Polysaccharides are linear or branched polymeric carbohydrates and examples include starch, cellulose, and alginate. Other examples of biopolymers include natural rubbers (polymers of isoprene), suberin and lignin (complex polyphenolic polymers), cutin and cutan (complex polymers of long-chain fatty acids) and melanin. Biopolymers have various applications such as in the food industry, manufacturing, packaging and biomedical engineering.

Chm429 Selective Topics of Inorganic Chemistry

Includes but not limited to: Charge transfer complexes**,** Medicinal applications**,** Transition metal complexes**,** Application of transition metal complexes in catalysis**,** Biological applications of transition metal complexes.

Chm431 Physical polymers and Instrumental Analysis (2)

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.
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.

Geo-Chm402 Graduation Project
This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Geo420 Fundamentals of Petroleum Geology
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.

Geo424 Geology and Tectonics of Egypt
Introduction, Landmasses during the Phanerozoic, Pre-Cambrian/Cambrian Transition, Paleozoic Litho- and Biostrtigrphic units in the Eastern desert and Sinai, Subsurface Paleozoic rock units in the western desert, Palaeozoic Paleogeography and Economic aspects. The Mesozoic: The Triassic Litho- and Biostrtigrphic units in the Gulf of Suez, South Western Desert and Northeast Sinai (Arif El Naga). The Jurassic Litho- and Biostrtigrphic units in the Gulf of Suez and Gebel Maghara. The Cretaceous: Litho- and Biostrtigrphic units in Sinai, Ataqa, Galala, Nile Valley, Farafra – Bahariya and the Subsurface North Western Desert. The Cenozoic Litho- and Biostrtigrphic units in: The Nile Valley, Fayium, Bahariya – Farafra and Sinai. Oligocene stratigraphic units in Egypt, Miocene in Red Sea, Gulf of Suez, Weastern Desert and Delta. Pliocene sediments in Red Sea. Selected stratigraphic sections in Egypt. Practical work includes construction of stratigraphic sections, geological reports and correlation of different Phanerozoic outcrops, Field trips in Sinai, Eastern and western deserts. Tectonic framework of Egypt, Mesozoic to Cenozoic Tectonic events of Egypt.

Chm420 Molecular Spectroscopy
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.
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.

Geo406 Introduction to Remote Sensing

Principals of remote sensing, Electromagnetic energy (sources and interaction), Spectral reflectance curves and libraries, Sensors and platforms, Airborne and Spaceborne, remote sensing, Multispectral scanners and missions, Different satellite data types and applications, Pre-processing techniques (Radiometric and Geometric corrections), Image Enhancement and visualization, Image color composites, Image Fusion, Visual image interpretation, Principal of digital image processing, Supervised and unsupervised image classification algorithms, Validation of the classified maps, Principal and interpretation of imaging radar, Remote sensing below the grounds surface, Geological remote sensing, Methods of rock units discriminations, Remote sensing geomorphological, structural and mineral exploration applications, Groundwater indicators by remote sensing.

Practical Course: Introduction and definitions, Visual image interpretation, Introduction to Whitebox and ENVI digital image processing softwares, pixel size and transformations data, remote sensing data download, image radiometric and atmospheric corrections, Image registration methods, Unsupervised and supervised image classification algorithms, change detection techniques, lithological discrimination methods, geological mapping, structural elements identification and extraction, Periodic field trips are needed to draw base maps, collecting ground control points and validation.

Geo408 Mining Geology

Introduction, mining terminology, stages of mine life, surface mining, subsurface mining, materials for underground support, explosives, mine transportation, mine gases and ventiliations, mine drainage, mine lights and ore reserves. 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, costin. Future of mining: economics, automation, bacteria, viruses, future company.

Field trip and Practical works, laboratory examinations

Geo410 Isotope Geology

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.

Laboratory work and Exercisesinclude estimating the decay and fractionation of isotopes, age dating of rocks and minerals; interpreting the geological processes and origin of their formations.

Geo422 Geochemical Exploration
Overview of exploration geology, Exploration geochemistry. Exploration geology terminology, Dispersion halos, geochemical sampling, geochemical survey, Field analytical methods. Interpretation of geochemical data, statistical interpretation, univariate analysis, Interpretation of geochemical data, multivariate analysis.
Laboratory analytical methods, Treatment of geochemical data, geochemical map, Treatment of geochemical data, Geostatistics.

Chm424 Nucleic Acids and Industrial Chemistry
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.
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 production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Chm426 Chemistry of Dyes
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.

Chm428 Nanoscience
This course includes the history of nanoscience, definition of nanoscience, and nanotechnology, classification of nanomaterials, methods of characterization of nanomaterials, synthesis approaches including Top down and down up approaches, general properties of nanomaterials, general applications of nanomaterials in energy, medicine and drugs, nanobiotechnology, cosmetics and bioengineering.

Chm430 Computational Chemistry and Electrochemistry (2)
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.
This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernest-Plank 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).

Program Title	**Chemistry/Botany**
Program Type	**Double major**
Department(s)	**Chemistry and Botany**

Chm207 Aliphatic Chemistry

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 alcohols, ethers, thio compounds, aldehydes, ketones, carboxylic acids, and their derivatives, nitrogen compounds and its derivatives as well as monosaccharides.

Chm209 Aromatic Chemistry

The chemistry of aromatic compounds. The topics covered in this course include nomenclature, structure and reactions of aromatic hydrocarbons, phenols aromatic aldehydes, ketones, acids m nitrogen compounds and their derivatives as well as thio-compounds.
Practical, 2hrs: study the separation and detection oh a mixture of organic compounds as well as the scheme of organic liquids

Chm221 Principles of Analytical Chemistry
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, 2 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chm223 Principles of Thermodynamics and Surface
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.
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 colloids 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.

Bot 201 Ecology and Environmental Issues
First Part: This part 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.
Second part: This part 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.

Mic271 Viruses and Bacteria

First part: 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.
Second part: 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 a major part of this course.

Bot241 Soil Ecology and Wetland Ecology
First part: This part deals with soil ecology. 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, soil pollution and soil quality.
Second part: This part will give knowledge about the following; 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. Different field trips.

Bot243 Water Relations and Plant Mineral Nutrition
First part: 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.
Second part: Introduction, Definition and classification of plant nutrients, Mechanisms of ion uptake by individual plant cells and root system, Influence of environmental factors nutrient uptake. Transport of nutrients by xylem and phloem and regulation of transport processes, Uptake and leaking of mineral elements through leaves and other above-ground.

Zoo277 Animal Toxicology
The toxicological module will provide students with knowledge and skills that enable him/her to be aware of the basic concepts of toxicology; history, mechanisms of toxicity, factors affecting toxicity, different types of intoxication and different toxic episodes. Taking into consideration organ and tissue toxicological aspects, mutagenesis, carcinogenesis and teratogenesis. In addition, students should estimate the risk of different toxicities Specific organ toxicities. General management of toxicity with natural toxins, gases, animal and plant toxins, maternal,

fetal and neonatal toxicity. The Pathology part of this course is designed to present students with essential concepts of pathological processes and altered health states. The course looks in depth at a wide variety of common pathological conditions and nomenclature. General topics covered include the nature and causes of cell injury and death; adaptive cellular changes; inflammation, healing and repair, thrombosis, blood disease, infarction and neoplasia. Clinical scenarios within each module correlate the anatomical pathology with major clinical symptoms and signs. In addition to lectures, small group tutorials provide an opportunity for students to examine macroscopic and microscopic specimens illustrating the pathology covered in lectures.

BPh223 Introduction to Radiobiology

Introduction to radiobiology, Initial physical effects of irradiation: dosimetry-micro dosimetry, radiation chemistry, Effects of radiation on DNA molecules and chromosomes, Cellular effects of ionizing radiation, cell survival curves, Effects on normal tissues, The effects of radiation on tumors, the biological bases of radiotherapy, Hypoxic cells and their importance in radiotherapy, Time and fractionation in radiotherapy, Hyperthermia, Chemical modifiers of radiosensitivity, Neutrons and other heavy particles, Effects of irradiation on the human body, Recent issues in radiobiology.

Sta205 Applied Statistics

Introduction to biostatistics – clinical trials – hazard rates – odds ratio – inference of odds ratio – ROC curve – comparing survival functions – life table – Kaplan–Meier estimator – cox proportional hazard model.

Chm214 Stereochemistry and Bifunctional Compounds

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

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.

Chm220 Chemical Kinetics

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.

Chm222 Chemistry of Main Elements

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, chalcogens, 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.

Practical, 2hrs: study the quantitative estimation of several organic materials and their solutions.

Bot242 Genetics and Plant Cytology

First part: This part 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, pseudo alleles, 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.

Second Part: The aim of this part 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 organelles; the main elements of the cytoskeleton and their functions; intercellular and intracellular communication. This course will also offer a solid foundation for understanding the structure and function of biological membranes, the main elements of the cytoskeleton and their functions; intercellular and intracellular communication.

Mic272 Fungi and Phytopathology

First part: This part enables students to acquire more knowledge about fungi with special reproduction, nutrition, and classification (Tedersoo et. al. 2018) The course will also cover reproduction and life cycles (vegetative, asexual and sexual) and life history 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.

Second part: This part 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 biocontrol using natural enemies

Bot246 Cell Signals and Biomembranes

First part: The growth, development, and environmental responses of even the simplest microorganism are determined by the programmed expression of its genes. Among multicellular organisms, turning genes on (gene expression) or off alters a cell's complement of enzymes and structural proteins, allowing cells to differentiate and respond properly to the surrounding environment. In this course, students will be exposed to the discussion of various aspects of the plant response to its environment in relation to the regulation of gene expression.

The course will introduce various internal signals that are required for coordinating the expression of genes during development and for enabling the plant to respond to environmental signals through signal transduction pathways.

Second part: Plant cell walls are complex, dynamic cellular structures essential for plant growth, development, physiology and adaptation. This course provides an in-depth and diverse view of the microanatomy of plant cell walls. Importantly, this course puts an emphasis on the details of the biosynthesis and the molecular physiology of cell walls. The course highlights the importance of plant cell walls both in the life of the plant and in their use for bio-products and biofuels. Plant cell membranes: This course offers a solid foundation for understanding the structure and function of biological membranes. The course explores the composition and dynamics of cell membranes. The molecular and biological diversity of lipid and protein in cell membrane components will be discussed. The course will show how the interactions between lipids and proteins within the cell membrane explain the chemical, mechanical, and self-renewing properties of cell membranes. The signaling roles that the cell membrane plays in the communication between cells and the surrounding environment will be presented

Bot346 Taxonomy of Flowering Plants

This module introduces the students to the principles of plant taxonomy and the definitions and terms used in plant taxonomy and systematic, 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 Angiospermae, 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.

Zoo234 Parasitology and Protozoa

This module will deal with the general concepts and terms of parasitology and provide knowledge on the types of 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, diagnosis, control and treatments, Protozoa.

Sta214 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).

Phy226 Electronics and Semiconductors

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). 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.

Chm321 Transition Elements and Coordination Chemistry

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.

This course explains the 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.

Chm323 Electro and Quantum Chemistry

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

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.

Chm325 Heterocyclic Chemistry

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.

Bot341 Algae and their Applications

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 hydrocolloids, 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, diatom's role in soil fertility, commercial applications of algal hydrocolloids.

Bot343 Photosynthesis and Stress Physiology

First part: The aim of this part 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 plants and algal systems.

Second part: (Stress physiology), plants experience in their natural habitats, subjected to a wide range of biotic stresses. This module will focus on the mechanisms used by plants to respond to and avoid the harmful effects of various biotic stresses imposed by pathogenic viruses, bacteria, fungi and bests. The modern molecular approaches to study the adaptations of plants to these stressful conditions will be stressed with an emphasis on the roles of plant hormones.

In addition to the biotic stresses that they are also Abiotic stress. Among multicellular organisms, turning genes on (gene expression) or off alters a cell's complement of enzymes and structural proteins, allowing cells to differentiate and respond properly to the surrounding environment. In this course, students will be exposed to the discussion of various aspects of cell signaling including the control layer of cell signaling and modifications in protein folding and binding mediating cell signaling. Importantly, the course will make an emphasis on the two-component signaling systems, and on signaling events regulating gene expression in eukaryotes and prokaryotes. Students will be, also, exposed to various signal transduction protocols applied in constructing cell signaling networks.

Chm327 Materials Chemistry and Solid State

Materials chemistry involves the use of chemistry for the design and synthesis of materials. Special attention will be paid to nanomaterials. Through a case study approach, synthesis, properties, and applications of nanomaterials, as well as techniques used to study and characterize them, will be explored. Examples of topics likely to be included: metal nanowires, quantum dots, nanoparticles, gold nanomaterials, nanofibers, nanotubes, grapheme, mesoporous materials, block copolymer assemblies, photonic crystals, self- assembled monolayers, biomaterials, cellulose nanocrystals, magnetic nanoparticles, etc. Recent literature about nanomaterials will also be discussed.

Solid state course will provide 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.

Chm329 Environmental Chemistry and Water Treatment
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.
This water treatment 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 contaminates to be treated and methods of water treatment including; ultraviolet light, filtration, water softening, reverse osmosis, ultra-filtration, deionization and powdered activated carbon treatment.

Bot345 Medicinal Plants
This course covers broad topics on medicinal plants and their cultivation and the problematic business communication in the 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.

Bot347 Plant Tissue Culture
This course 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 cover 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 emphasis on the production of haploid plants. Genetic variation of cells under tissue cultures conditions will also be covered in this module.

Zoo375 Immunochemistry
This course provides the ground knowledge and ability to give the student a broad understanding of the immune system and its functions. The course will emphasize the description of molecular and cellular elements of the immune system, and their basic function and in which these elements operate to provide immunity and how the impairments of their function may result in diseases. Topics include activation and regulation of innate and adaptive immunity and the principles governing vaccination; the molecular basis of antigen specificity; antibody structure and interaction with antigens; disorders of the immune system; tumor and transplantation immunology; the application of laboratory immunological techniques for diseases diagnosis and monitoring.

Geo315 Remote Sensing
Principals of remote sensing, Electromagnetic energy (sources and interaction), Spectral reflectance curves and libraries, Sensors and platforms, Airborne and Spaceborne, remote

sensing, Multispectral scanners and missions, Different satellite data types and applications, Pre-processing techniques (Radiometric and Geometric corrections), Image Enhancement and visualization, Image color composites, Image Fusion, Visual image interpretation, Principal of digital image processing, Supervised and unsupervised image classification algorithms, Validation of the classified maps, Principal and interpretation of imaging radar, Remote sensing below the grounds surface, Geological remote sensing, Methods of rock units discriminations, Remote sensing geomorphological, structural and mineral exploration applications, Groundwater indicators by remote sensing.

Practical Course: Introduction and definitions, Visual image interpretation, Introduction to Whitebox and ENVI digital image processing softwares, pixel size and transformations data, remote sensing data download, image radiometric and atmospheric corrections, Image registration methods, Unsupervised and supervised image classification algorithms, change detection techniques, lithological discrimination methods, geological mapping, structural elements identification and extraction, Periodic field trips are needed to draw base maps, collecting ground control points and validation.

Phy331 Physics of Nanotechnology

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.

Chm320 Instrumental Analysis (1)

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.

Chm322 Natural Products and Organic Polymer

This is introductory course to macromolecules and synthetic polymers including free radical, ionic polymerization, polycondensation, 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.

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products.

Bot342 Plant Enzymology and Plant Hormones

First part: This part 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, and 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

Second part: (Hormones) This part 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 topic of the course starts with the regions and phases of growth in plant bodies and the factors affecting growth. Detailed topics include the chemistry, biosynthesis, translocation, action and role of various plant hormones such as auxins, gibberellins, cytokinins, ethylene and abscisic acid in plant growth. Additional lectures will be devoted to photoperiodism and vernalization and the molecular biology aspects of seed embryogenesis, dormancy and germination.

Bot344 Flora of Egypt and Biodiversity

First part: 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 of the Herbarium. different field trips to different wild habitats to recognize the components of the Egyptian flora.

Second part: This part will cover the ecological principles 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.

Chm324 Pesticides Chemistry

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.

Chm326 Organic Spectroscopy

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

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products and their practical.

Chm334 Biochemistry

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

Chm328 Bioinorganic Chemistry and Biophysical Chemistry

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 perspective. The importance of these is discussed in regard to drug design and understanding of diseases resulting from mutations

Physical properties of acid and base buffer. Physical chemistry of protein and amino acids. Blood buffering action. Biological membranes. Determination of macromolecules

Chm330 Nuclear Chemistry and Inorganic Reactions Mechanism

This course will provide the fundamentals of nuclear chemistry including; nuclear structure, nuclear models (Fermi gas, liquid drop and nuclear shell models), isotopes Radioactivity and radioactive decay, 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.

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.

Bot348 Algal Biohazards and Ecosystem

First part: This part gives the student at the end of his/her study the knowledge and understanding of the harmful role of toxic algal blooms. It also provides students with the opportunity to explore the fundamentals of: Detection and characterization of harmful Algal Blooms, how can Algal Populations be Controlled Prevention and mitigation of Harmful Algal Bloom Impacts. Control of harmful algal blooms. Algae can function as indicators of water.

Second part: This part gives the student by the end of his/her study the knowledge and understanding of the algal abundance and classification in the ecosystem according to their habitat and environmental conditions. This course also aims to give the student the opportunity to explore the ecological importance of algae as they are the beginning of the food chain for many animals in the aquatic ecosystems.

Bot352 Molecular Biology

This course 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.

Mic302 Physiology of Microorganisms

First part: Physiology of Bacteria: This part in microbial physiology pays 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.

Second part: Physiology of Fungi: This part 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 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 fungicides and their mode of action.

Chm-Bot401 Applied Field Training

Applied Training is a joint program with seminar courses. It deals with any form of learning that takes place at the workplace the students have chosen. Experience can be obtained in the form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Chm421 Photochemistry and Laser Chemistry

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.

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.

Chm423 Practical Organic Chemistry

Synthesis and identification of various organic compounds. This course provides a study of chemical structure and reactivity correlation. Methods and Manipulation advances techniques of separation and purification, preparation of organic compounds, polymers. Solvent purification and reagent preparation. Purification, including crystallization and distillation. Reactions and Identification of organic compounds.

Bot441 Physiology of Algae and Biochemistry

First part: This part: 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 secondary metabolites in algal tolerance to the environment will be discussed.

Second Part: This part aims to develop an understanding the biochemical compounds such as the algal Polysaccharides, pigments (Chlorophyll, Carotenoids and phycobilins), proteins, carbohydrates, Fatty Acids and Saponifiable Lipids, Vitamins and Growth Regulators. Also, the students will gain the fundamentals of nucleic Acids and their Metabolism, Biotechnology of microalgae, based on molecular biology and biochemistry of eukaryotic algae and cyanobacteria

Bot443 Phytoremediation

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, biosenses 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.

Chm425 Petroleum Chemistry and Petrochemicals

The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team-oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes. It also concerned with current problems of petroleum chemistry and processing such as chemical composition of crude oils and natural gas liquids; petroleum refining (cracking, hydrocracking, and catalytic reforming); catalysts for petrochemical processes (hydrogenation, isomerization, oxidation, hydroformylation, etc.); activation and catalytic transformation of hydrocarbons and other components of petroleum, natural gas, and other complex organic mixtures; new petrochemicals including lubricants and additives.

Chm427 Alkaloids and Terpenes and Vitamins

The chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzylisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D) and vitamins (vitamin B1,2,5,6, E, K and A).

Biopolymers are natural polymers produced by the cells of living organisms. Biopolymers consist of monomeric units that are covalently bonded to form larger molecules. There are three

main classes of biopolymers, classified according to the monomers used and the structure of the biopolymer formed: polynucleotides, polypeptides, and polysaccharides. Polynucleotides, such as RNA and DNA, are long polymers composed of 13 or more nucleotide monomers. Polypeptides and proteins are polymers of amino acids, and some major examples include collagen, actin, and fibrin. Polysaccharides are linear or branched polymeric carbohydrates and examples include starch, cellulose, and alginate. Other examples of biopolymers include natural rubbers (polymers of isoprene), suberin and lignin (complex polyphenolic polymers), cutin and cutan (complex polymers of long-chain fatty acids) and melanin. Biopolymers have various applications such as in the food industry, manufacturing, packaging and biomedical engineering.

Chm429 Selected Topics in Inorganic Chemistry
Includes but not limited to: Charge transfer complexes, Medicinal applications, Transition metal complexes, Application of transition metal complexes in catalysis,Biological applications of transition metal complexes.

Chm431 Physical Polymers and Instrumental Analysis (2)
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.
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.

Bot409 Population Genetics and Molecular Plant Breeding
This module will concentrate on how the frequencies of different alleles are distributed and altered in populations. The emphasis will be on polymorphisms and 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 a single major gene, 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.
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**.**

Mic441 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.

Chm-Bot402 Graduation Project

This course is given with no fixed content. It depends upon whether a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Chm420 Molecular Spectroscopy

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.

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.

Bot404 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.

Bot442 Genetic Engineering and Biotechnology

First part: 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 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.

Second part: Biotechnology: This part 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.

Chm424 Nucleic Acids and Industrial Chemistry

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.

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 such as production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Chm426 Chemistry of Dyes

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.

Chm428 Nanoscience

This course includes the history of nanoscience, definition of nanoscience, and nanotechnology, classification of nanomaterials, methods of characterization of nanomaterials, synthesis approaches including Top down and down up approaches, general properties of nanomaterials, general applications of nanomaterials in energy, medicine and drugs, nanobiotechnology, cosmetics and bioengineering.

Chm430 Computational Chemistry and Electrochemistry (2)

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.

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernest-Plank 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).

Bot412 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) understanding 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, networks, 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.

Bot414 Scientific Writing and Presentations

First part: Plant cell: The aim of this part 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 organelles; the main elements of the cytoskeleton and their functions; intercellular and intracellular b

Second part: Tissue culture: This part 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 cover 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 emphasis on the production of haploid plants. Genetic variation of cells under tissue cultures conditions will also be covered in this module.

Bot416 Bioethics and Biosafety

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

Bot418 Economics and Marketing

The first part of this course provides the analytical skills necessary to understand forces that determine prices of financial and real assets. It also develops a system of tools to show how interest rates, prices of bonds, international capital flows, and exchange rates are

simultaneously determined. It demonstrates how firms use financial derivatives, such as futures, options, and swaps to protect against risk. The second part of this course introduces students to the strategic and tactical approaches used in the marketing of biological products and services. The roles of managers and leaders within companies which 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.

Program Title	**Chemistry/ Microbiology**
Program Type	**Double major**
Department(s)	**Chemistry and Botany**

Chm207 Aliphatic Chemistry
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 alcohols, ethers, thio compounds, aldehydes, ketones, carboxylic acids, and their derivatives, nitrogen compounds and its derivatives as well as monosaccharides.

Chm209 Aromatic Chemistry
The chemistry of aromatic compounds. The topics covered in this course include nomenclature, structure and reactions of aromatic hydrocarbons, phenols aromatic aldehydes, ketones, acids m nitrogen compounds and their derivatives as well as thio-compounds.

Practical, 2hrs: study the separation and detection of a mixture of organic compounds as well as the scheme of organic liquids.

Chm221 Principles of Analytical Chemistry

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

Chm223 Thermodynamics and Surface Chemistry

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.

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 colloids 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.

Mic241 Viruses and Bacteria

First part: 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.

Second part: 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 a major part of this course.

Bot271 Ecology and Environmental Issues

First Part: This part 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). This part also 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.
Second part: This part 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.

Mic207 Actinomycetes
In this module special emphasis 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 detail.

Mic211 Microbial Biodiversity and Environmental Microbiology
First part: This course will study the diversity of microorganisms in selected environments at an organism level, investigate the metabolic and enzymatic diversity in microbes that contribute to and thrive within these environments, and examine the methods used to study the relationships and evolution of microorganisms within an ecosystem.
Second part: This part concerns studying the biology and distribution of different microbial species in order to use them as bioindicators for contamination. In addition, it also describes the application of microorganisms in solving many environmental problems through bioremediation and other biological processes. Learning outcomes Studying the diversity in microbial community Evaluate the effect of different microorganisms on the global environment. The use of microorganisms in remediation of many environmental contaminants and other environmental impacts.

Mic213 Microbial 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, biosenses 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.

Zoo277 Animal Toxicology
The toxicological module will provide students with knowledge and skills that enable him/her to be aware of the basic concepts of toxicology; history, mechanisms of toxicity, factors affecting toxicity, different types of intoxication and different toxic episodes. Taking into consideration

organ and tissue toxicological aspects, mutagenesis, carcinogenesis and teratogenesis. In addition, students should estimate the risk of different toxicities Specific organ toxicities. General management of toxicity with natural toxins, gases, animal and plant toxins, maternal, fetal and neonatal toxicity. The Pathology part of this course is designed to present students with essential concepts of pathological processes and altered health states. The course looks in depth at a wide variety of common pathological conditions and nomenclature. General topics covered include the nature and causes of cell injury and death; adaptive cellular changes; inflammation, healing and repair, thrombosis, blood disease, infarction and neoplasia. Clinical scenarios within each module correlate the anatomical pathology with major clinical symptoms and signs. In addition to lectures, small group tutorials provide an opportunity for students to examine macroscopic and microscopic specimens illustrating the pathology covered in lectures.

Bph223 Introduction to Radiobiology

Introduction to radiobiology, Initial physical effects of irradiation: dosimetry-micro dosimetry, radiation chemistry, Effects of radiation on DNA molecules and chromosomes, Cellular effects of ionizing radiation, cell survival curves, Effects on normal tissues, The effects of radiation on tumors, the biological bases of radiotherapy, Hypoxic cells and their importance in radiotherapy, Time and fractionation in radiotherapy, Hyperthermia, Chemical modifiers of radiosensitivity, Neutrons and other heavy particles, Effects of irradiation on the human body, Recent issues in radiobiology.

Sta205 Applied Statistics

Introduction to biostatistics – clinical trials – hazard rates – odds ratio – inference of odds ratio – ROC curve – comparing survival functions – life table – Kaplan–Meier estimator – cox proportional hazard model.

Chm214 Stereochemistry and Bifunctional Compounds

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

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.

Practical, 2hrs: study the quantitative estimation of several organic materials and their solutions.

Chm220 Chemical Kinetics

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.

Chm222 Chemistry of Main Elements

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, chalcogens, 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.

Mic242 Fungi and Plant Pathology

First part: This part enables students to acquire more knowledge about fungi with special reproduction, nutrition, and classification (Tedersoo et. al. 2018) The course will also cover reproduction and life cycles (vegetative, asexual and sexual) and life history 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.

Second part: This part 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 biocontrol using natural enemies

Bot272 Genetics

This course 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, pseudo alleles, 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.

Mic244 Fundamental of Microbial Enzymes

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: factors affecting enzymatic reactions, the type of inhibition, regulatory enzymes, multi-enzyme system and prosthetic groups. 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.

Mic246 Fundamental of Microbial Toxins

Microbial toxins: This course will give a spot on the severity of microbial toxins produced in contaminated food, textile, and paper industry; and their characterization, detection methods, and expected hazards.

Bot274 Plant Hormones and Stress Physiology

First part: This part 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 topic of the course starts with the regions and phases of growth in plant bodies and the factors affecting growth. Detailed topics include the chemistry, biosynthesis, translocation, action and role of various plant hormones such as auxins, gibberellins, cytokinins, ethylene and abscisic acid in plant growth. Additional lectures will be devoted to photoperiodism and vernalization and the molecular biology aspects of seed embryogenesis, dormancy and germination.

Second part: 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.

Zoo234 Parasitology and Protozoa

This module will deal with the general concepts and terms of parasitology and provide knowledge on the types of 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, diagnosis, control and treatments, Protozoa.

Sta214 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).

Phy226 Electronics and Semiconductors

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). 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.

Chm321 Transition Elements and Coordination Chemistry

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.

This course explains the 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.

Chm323 Electro and Quantum Chemistry

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

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.

Chm325 Heterocyclic Chemistry

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.

Mic341 General 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.

Bot371 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.

Chm327 Materials Chemistry and Solid State

Materials chemistry involves the use of chemistry for the design and synthesis of materials. Special attention will be for nanomaterials. Through a case study approach, synthesis, properties, and applications of nanomaterials, as well as techniques used to study and characterize them, will be explored. Examples of topics likely to be included: metal nanowires, quantum dots, nanoparticles, gold nanomaterials, nanofibers, nanotubes, grapheme, mesoporous materials, block copolymer assemblies, photonic crystals, self- assembled monolayers, biomaterials, cellulose nanocrystals, magnetic nanoparticles, etc. Recent literature about nanomaterials will also be discussed.

Solid state course will provide 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.

Chm329 Environmental Chemistry and Water Treatment

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.

This water treatment 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 contaminates to be treated and methods of water treatment including; ultraviolet light, filtration, water softening, reverse osmosis, ultra-filtration, deionization and powdered activated carbon treatment.

Mic343 Soil and Water Microbiology

First part: This part 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.

Second part: This part deals with soil ecology from 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.

Bot373 Algal Physiology and Biochemistry

First part: This part 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.
Second part: This part aims to develop an understanding the biochemical compounds such as the algal Polysaccharides, pigments (Chlorophyll, Carotenoids and phycobilins), proteins, carbohydrates, Fatty Acids and Saponifiable Lipids, Vitamins and Growth Regulators. Also, the students will gain the fundamentals of nucleic Acids and their Metabolism, Biotechnology of microalgae, based on molecular biology and biochemistry of eukaryotic algae and cyanobacteria.

Zoo375 Immunochemistry
This course provides the ground knowledge and ability to give the student a broad understanding of the immune system and its functions. The course will emphasize the description of molecular and cellular elements of the immune system, and their basic function and in which these elements operate to provide immunity and how the impairments of their function may result in diseases. Topics include activation and regulation of innate and adaptive immunity and the principles governing vaccination; the molecular basis of antigen specificity; antibody structure and interaction with antigens; disorders of the immune system; tumor and transplantation immunology; the application of laboratory immunological techniques for diseases diagnosis and monitoring.

Geo315 Remote Sensing
Principals of remote sensing, Electromagnetic energy (sources and interaction), Spectral reflectance curves and libraries, Sensors and platforms, Airborne and Spaceborne, remote sensing, Multispectral scanners and missions, Different satellite data types and applications, Pre-processing techniques (Radiometric and Geometric corrections), Image Enhancement and visualization, Image color composites, Image Fusion, Visual image interpretation, Principal of digital image processing, Supervised and unsupervised image classification algorithms, Validation of the classified maps, Principal and interpretation of imaging radar, Remote sensing below the grounds surface, Geological remote sensing, Methods of rock units discriminations, Remote sensing geomorphological, structural and mineral exploration applications, Groundwater indicators by remote sensing.
Practical Course: Introduction and definitions, Visual image interpretation, Introduction to Whitebox and ENVI digital image processing softwares, pixel size and transformations data, remote sensing data download, image radiometric and atmospheric corrections, Image registration methods, Unsupervised and supervised image classification algorithms, change detection techniques, lithological discrimination methods, geological mapping, structural elements identification and extraction, Periodic field trips are needed to draw base maps, collecting ground control points and validation.

Phy331 Physics of Nanotechnology
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.

Chm320 Instrumental Analysis (1)

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.

Chm322 Organic Polymers and Natural Products

This is introductory course to macromolecules and synthetic polymers including free radical, ionic polymerization, polycondensation, 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.

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products.

Mic304 Medical and Food Microbiology

First Part: This Part 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.

Second part: 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.

Bot372 Photosynthesis and Stress Physiology

First part: The aim of this part 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 plants and algal systems.

Second part: (Stress physiology), plants experience in their natural habitats, subjected to a wide range of biotic stresses. This module will focus on the mechanisms used by plants respond to and avoid the harmful effects of various biotic stresses imposed by pathogenic viruses, bacteria, fungi and bests. The modern molecular approaches to study the adaptations of plants to these stressful conditions will be stressed with an emphasis on the roles of plant hormones.

In addition to the biotic stresses that they are also Abiotic stress. Among multicellular organisms, turning genes on (gene expression) or off alters a cell's complement of enzymes and structural proteins, allowing cells to differentiate and respond properly to the surrounding environment. In this course, students will be exposed to the discussion of various aspects of cell signaling including the control layer of cell signaling and modifications in protein folding and binding mediating cell signaling. Importantly, the course will make an emphasis on the two-component signaling systems, and on signaling events regulating gene expression in eukaryotes and prokaryotes. Students will be, also, exposed to various signal transduction protocols applied in constructing cell signaling networks.

Chm324 Pesticides Chemistry

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.

Chm326 Organic Spectroscopy

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.

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products and its practical.

Chm334 Biochemistry

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

Chm328 Bioinorganic and Biophysical Chemistry

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 perspective. The importance of these is discussed in regard to drug design and understanding of diseases resulting from mutations

Physical properties of acid and base buffer. Physical chemistry of protein and amino acids. Blood buffering action. Biological membranes. Determination of macromolecules

Chm330 Nuclear Chemistry and Inorganic Reactions Mechanism

This course will provide the fundamentals of nuclear chemistry including; nuclear structure, nuclear models (Fermi gas, liquid drop and nuclear shell models), isotopes Radioactivity and radioactive decay, 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.
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.

Mic302 Physiology of Microorganisms

First part: Physiology of Bacteria: This part in microbial physiology pays 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.
Second part: Physiology of Fungi: This part 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 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 fungicides and their mode of action.

Mic342 Fundamental of Microbial Bioremediation

Bioremediation is the use of plants and microorganisms to combat pollution. The aim of this course 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, biosenses 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.

Bot374 Algal Applications and Biohazard

First part: This part gives an opportunity to explore the fundamental uses and economic importance of algae with reference to its application in food, industry, agriculture, pharmacy and medicine. Also dealing with some details with the uses of algae and their products in human life, particularly their commercial applications of algal hydrocolloids, 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 polysaccharides from micro-algae, diatom's role in soil fertility, commercial applications of alghydrocolloidsids. Thise 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.

Second Part: This part gives the student by the end of his/her study the knowledge and understanding of the harmful role of toxic algal blooms. It also provides students with the opportunity to explore the fundamentals of: Detection and characterization of harmful Algal Blooms, how can Algal Populations be Controlled? Prevention and mitigation of Harmful Algal Bloom Impacts. Control of harmful algal blooms. Algae can function as indicators of water.

Chm-Mic401 Applied Field Training

Applied Training is a joint program with seminar courses. It deals with any form of learning that takes place at the workplace the students have chosen. Experience can be obtained in the form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Chm421 Photochemistry and Laser Chemistry

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.

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.

Chm423 Practical Organic Chemistry

Synthesis and identification of various organic compounds. This course provides a study of chemical structure and reactivity correlation. Methods and Manipulation advances techniques of separation and purification, preparation of organic compounds, polymers. Solvent purification and reagent preparation. Purification, including crystallization and distillation. Reactions and Identification of organic compounds.

Mic403 Yeast 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.

Mic413 Microbial Enzymes

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: factors affecting enzymatic reactions, the type of inhibition, regulatory enzymes, multi-enzyme system and prosthetic groups. 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.

Chm425 Petroleum Chemistry and Petrochemicals

The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team-oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes. It also concerned with current problems of petroleum chemistry and processing such as chemical composition of crude oils and natural gas liquids; petroleum refining (cracking, hydrocracking, and catalytic reforming); catalysts for petrochemical processes (hydrogenation, isomerization, oxidation, hydroformylation, etc.); activation and catalytic transformation of hydrocarbons and other components of petroleum, natural gas, and other complex organic mixtures; new petrochemicals including lubricants and additives.

Chm427 Alkaloids and Terpenes and Vitamins

The chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzylisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D) and vitamins (vitamin B1,2,5,6, E, K and A).

Biopolymers are natural polymers produced by the cells of living organisms. Biopolymers consist of monomeric units that are covalently bonded to form larger molecules. There are three main classes of biopolymers, classified according to the monomers used and the structure of the biopolymer formed: polynucleotides, polypeptides, and polysaccharides. Polynucleotides, such as RNA and DNA, are long polymers composed of 13 or more nucleotide monomers. Polypeptides and proteins are polymers of amino acids, and some major examples include collagen, actin, and fibrin. Polysaccharides are linear or branched polymeric carbohydrates and examples include starch, cellulose, and alginate. Other examples of biopolymers include natural rubbers (polymers of isoprene), suberin and lignin (complex polyphenolic polymers), cutin and cutan (complex polymers of long-chain fatty acids) and melanin. Biopolymers have various applications such as in the food industry, manufacturing, packaging and biomedical engineering.

Chm429 Selected Topics in Inorganic Chemistry

Includes but not limited to: Charge transfer complexes**,** Medicinal applications**,** Transition metal complexes**,** Application of transition metal complexes in catalysis**,** biological applications of transition metal complexes.

Chm431 Physical Polymers and Instrumental Analysis (2)

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.

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.

Bot471 Fundamental of Genetic Engineering and Biotechnology

First part: 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 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.

Second part: This part covers a comprehensive panorama of biotechnology and describes in sufficient detail 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.

Mic449 Biological Control

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.

Bot473 Soil Ecology and Biodiversity

First part: This part deals with soil ecology. 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, soil pollution and soil quality.
Second part: This part 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.

Chm-Mic402 Graduation Project
This course is given with no fixed content. It depends upon whether a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Chm420 Molecular Spectroscopy
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.
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.

Mic404 Fundamental 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 detail.

Mic442 Applied Microbiology and Fertilizers
First part: The aim of this part 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.
Second part: This Part gives detailed information about algalization technology. Use of cyanobacteria, micro and macroalgae as agricultural biofertilizers, and benefits of algalization on crops, soil characteristics and aggregation will be considered. The application of bacteria in fertilizers industry will be presented as well. Also, this course will give students general knowledge of biofertilizers including N-fixing microorganisms (blue green algae, Azotobacter, Azospirillum, Rhizobium and Azolla). Phosphate soulubilizers and mobilizing (Fungi, Bacteria, Actinomycetes and Mycorrhizae). Compost making microorganisms (cellulotic and lignolytic). Biofertilizers for rice crops (Azolla, blue green algae, Azopirillum).)

Chm424 Nucleic Acids and Industrial Chemistry
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.
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 such as production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Chm426 Chemistry of Dyes
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.

Chm428 Nanoscience
This course includes the history of nanoscience, definition of nanoscience, and nanotechnology, classification of nanomaterials, methods of characterization of nanomaterials, synthesis approaches including Top down and down up approaches, general properties of nanomaterials, general applications of nanomaterials in energy, medicine and drugs, nanobiotechnology, cosmetics and bioengineering.

Chm430 Computational Chemistry and Electrochemistry (2)
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.

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernest-Plank 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).

Bot412 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) understanding 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, networks, 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.

Bot414 Scientific Writing and Presentations

First part: Plant cell: The aim of this part 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 organelles; the main elements of the cytoskeleton and their functions; intercellular and intracellular b

Second part: Tissue culture: This part 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 cover 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 emphasis on the production of haploid plants. Genetic variation of cells under tissue cultures conditions will also be covered in this module.

Bot416 Bioethics and Biosafety

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

Bot418 Economics and Marketing
The first part of this course provides the analytical skills necessary to understand forces that determine prices of financial and real assets. It also develops a system of tools to show how interest rates, prices of bonds, international capital flows, and exchange rates are simultaneously determined. It demonstrates how firms use financial derivatives, such as futures, options, and swaps to protect against risk. The second part of this course introduces students to the strategic and tactical approaches used in the marketing of biological products and services. The roles of managers and leaders within companies which 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.

Program Title	**Chemistry/ Zoology**
Program Type	**Double major**
Department(s)	**Chemistry and Zoology**

Chm207 Aliphatic Chemistry
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 alcohols, ethers, thio compounds, aldehydes, ketones, carboxylic acids, and their derivatives, nitrogen compounds and its derivatives as well as monosaccharides.

Chm209 Aromatic Chemistry
The chemistry of aromatic compounds. The topics covered in this course include nomenclature, structure and reactions of aromatic hydrocarbons, phenols aromatic aldehydes, ketones, acids m nitrogen compounds and theire derivatives as well as thio-compounds.

Practical,2hrs: study the separation and detection oh a mixture of organic compounds as well as the scheme of organic liquids.

Chm221 Principles of Analytical Chemistry
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, 2 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chm223 Chemical Thermodynamics and Surface Chemistry
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. 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.

Zoo221 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.

Zoo223 Biotechnology and Bioinformatics
This cutting-edge course provides students with hands-on experience and knowledge of the latest techniques in biotechnology and bioinformatics research as well as nanotechnology and bio-processing technologies. Students will gain experience in the use of various molecular biology techniques and bioinformatics tools, along with the opportunity to operate analytical equipment similar to those used in industrial scale production facilities. Student will gain skills in the applications of computational methods to biological data analysis and for discovery as in Genomics analysis. Genomics, computational methods will include DNA sequencing and fragment assembly, identification of genes in DNA, gene regulation, expression, large data arrays, and methods to study genetic diversity and In Proteomics, computational methods will embrace similarity, homology and analogy, protein folding and protein structure.

Zoo225 Aquatic Biology and Fish Biology
This course is designed to deal with several topics in Fish Biology, Fish Physiology, 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. 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.

Zoo227 Population and Community Ecology
This course provides an advanced view of the major processes governing population dynamics, species interactions, and community structure. Topics to be covered will include population growth and regulation, species interactions, Eco-evolutionary dynamics, food webs, patterns of diversity, stability, and sustainability of communities., with skills in using mathematical models as tools to understand the development of populations and community ecology processes.

Sta215 Introduction to Biostatistics
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.

BPh223 Introduction to Radiobiology
Introduction to radiobiology, Initial physical effects of irradiation: dosimetry-micro dosimetry, radiation chemistry, Effects of radiation on DNA molecules and chromosomes, Cellular effects of ionizing radiation, cell survival curves, Effects on normal tissues, The effects of radiation on tumors, the biological bases of radiotherapy, Hypoxic cells and their importance in radiotherapy, Time and fractionation in radiotherapy, Hyperthermia, Chemical modifiers of radiosensitivity, Neutrons and other heavy particles, Effects of irradiation on the human body, Recent issues in radiobiology.

Chm214 Stereochemistry and Bifunctional Compounds
The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its formation, properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis. 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.

Practical,2hrs: study the quantitative estimation of several organic material and there solutions.

Chm220 Chemical Kinetics

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.

Chm222 Chemistry of Main Elements

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, chalcogens, 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.

Zoo222 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 invertebrates.

Zoo224 Immunology

This course provides the ground knowledge and ability to give the student a broad understanding of the immune system and its functions. The course will emphasizes the description of molecular and cellular elements of the immune system, and their basic function and in which these elements operate to provide immunity and how the impairments of their function may result in diseases. Topics include activation and regulation of innate and adaptive immunity and the principles governing vaccination; the molecular basis of antigen specificity; antibody structure and interaction with antigens; disorders of the immune system; tumor and transplantation immunology; the application of laboratory immunological techniques for diseases diagnosis and monitoring.

Zoo208 Functional Histology

This course enables students to be familiar with the histology of all organ systems of the body (e.g. Integumentary, Circulatory systems system Digestive, Endocrine, Respiratory, Urinary and Reproductive systems) and to acquire basic understanding of at the practical level, 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 and adaptation of the organ.

Zoo226 Animal Products and Human Health

Animal products and human health course will provide students with basics principles of animal biological products and human health Sciences. This course divides into three equally modules: 1) Biological identification of animal of medically importance; 2) Immunological responses of animal product; 3) Physiological responses of different animal products. The first module provides student with fundamental knowledge in general biology and identification of different animal groups, specifically invertebrates, which have human medical importance. The second and third modules provide students with the following: 1) immunological and physiological detection of dangerous animals causing poisoning and toxic responses to physiological and immunological compartments, 2) The nature of animal products such as venoms and other biological toxins and their immunological and physiological aspects of envenomation, 3) In cases of accidents, advice for first aid and treatment of bites, stings and other intoxication signs, 4) Animals contain substances of interest to the recombinant pharmaceuticals industry as bio-medicine for human health, 5) Signs of human health and disease related-to different biological toxins, immune competence vs tolerance, vaccination and immunization principles; monitoring disease incidence using biotechnological techniques will be delivered.

Zoo230 Experimental Design

This is a basic course in designing experiments and analyzing the resulting data. The course objective is to learn how to plan, design and conduct experiments efficiently and effectively, and analyze the resulting data to obtain objective conclusions. Both design and statistical analysis issues are discussed.

Zoo232 Toxicology and Pathology

The toxicological module will provide students with knowledge and skills that enable him/her to be aware of the basic concepts of toxicology; history, mechanisms of toxicity, factors affecting toxicity, different types of intoxication and different toxic episodes. Taking into consideration organ and tissue toxicological aspects, mutagenesis, carcinogenesis and teratogenesis. In addition, students should estimate the risk of different toxicities Specific organ toxicities. General management of toxicity with natural toxins, gases, animals and plant toxins, maternal, fetal and neonatal toxicity. The Pathology part of this course is designed to present students with essential concepts of pathological processes and altered health states. The course looks in depth at a wide variety of common pathological conditions and nomenclature. General topics covered include the nature and causes of cell injury and death; adaptive cellular changes; inflammation, healing and repair, thrombosis, blood disease, infarction and neoplasia. Clinical scenarios within each module correlate the anatomical pathology with major clinical symptoms and signs. In addition to lectures, small group tutorials provide an opportunity for students to examine macroscopic and microscopic specimens illustrating the pathology covered in lectures.

Mic248 General Microbiology

This course offers a comprehensive study of the field of microbiology to science majors. The course will give detailed insights into the following major themes: Structure and function of microbes (cellular structures, metabolism, and growth), microbial ecology, microbial diversity including prokaryotes (bacteria), eukaryotes (fungi and microalgae), in addition to viruses, and finally clinical microbiology (immunity, pathogenicity, epidemiology, control of microbes, and diseases).

Geo220 Macrofossils

Importance of fossils, fossilization, Body and trace fossils. Morphology and geological history of some selected fossil groups. Phylum Mollusca, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina. Practical work includes examination, description, definition and classification and of some selected macro -invertebrate fossils, field trip: collection, mode of preservation, definition of macrofossils.

Phy226 Electronics and Semiconductors

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). 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.

Chm321 Transition Elements and Coordination Chemistry

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.

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.

Chm323 Electrochemistry and Quantum Chemistry

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

Chm325 Heterocyclic Chemistry
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.

Zoo331 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.

Z333 Ecological Adaptations and Animal Behaviour
This course deals with the 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, theoretical basis and the empirical evidence for ecological adaptation. Students learn how an animal's behaviour affects its ability to survive and reproduce in its environment. Course topics, such as foraging behavior, sexual selection, parental care, etc., represent the interface of ecology, evolution, and behaviour.

Chm327 Materials Chemistry and Solid State
Materials chemistry involves the use of chemistry for the design and synthesis of materials. Special attention will be for nanomaterials. Through a case study approach, synthesis, properties, and applications of nanomaterials, as well as techniques used to study and characterize them, will be explored. Examples of topics likely to be included: metal nanowires, quantum dots, nanoparticles, gold nanomaterials, nanofibers, nanotubes, grapheme, mesoporous materials, block copolymer assemblies, photonic crystals, self- assembled monolayers, biomaterials, cellulose nanocrystals, magnetic nanoparticles, etc. Recent literature about nanomaterials will also be discussed. Solid state course will 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.

Chm329 Environmental Chemistry and Water treatment

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.

This water treatment 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 contaminates to be treated and methods of water treatment including; ultraviolet light, filtration, water softening, reverse osmosis, ultra-filtration, deionization and powdered activated carbon treatment.

Zoo313 Immunology and infectious diseases

The course covers specialized aspects of Pathogens causing disease in mammals, their transmission & pathogenesis. Innate, humoral & cellular immune systems in health & disease. Interaction between immune system & infectious agents, including vaccines. The module will cover aspects of molecular approaches to the study and understanding of immunology and infectious diseases at an advanced level presented in a modular form. Modules include: immunology, mechanisms of bacterial pathogenesis, viral infectious diseases and immunity, and parasitic diseases and immunity. This course explores the basic principles of host defense against pathogens, including evolutionary aspects of innate and adaptive immunity and immune evasion strategies. Specific examples of viral and bacterial interactions with their hosts are studied in depth. A review of immunological mechanisms involved in specific cases is incorporated in this course.

Zoo335 Fauna of Egypt and Zoogeography

This course introduces students to the breadth of diversity of the Egyptian fauna and investigates its origins and significance of this diversity. The adaptations of the fauna to the diversity of habitats available. Major lifestyle themes, life history adaptations, and habitat characteristics are explored. Study Zoogeography provide students with the basic concepts of the geographical distribution of animals. The study of the causes, effects, and other relations involved in such distributions.

Zoo337 Embryology and 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.

BTe315 Introduction to Bioremediation

This course deals with the applications of microorganisms in the treatment of polluted water with heavy metals, and other chemical and industrial wastes.

Phy331 Physics of Nanotechnology

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.

Chm320 Instrumental Analysis (1)

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.

Chm322 Organic Polymer and Natural Products

This is introductory course to macromolecules and synthetic polymers including free radical, ionic polymerization, polycondensation, 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.

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products.

ZOO332 Functional Ecology (Ecosystem and Energetics)

The course will describe different aspects and methods in the field of functional ecology, combining theoretical lessons with hands-on real data. Lectures will provide the theoretical and mathematical basis for different applications of functional traits at organismal, community and ecosystem levels, with examples across different trophic levels including ecosystem energetics and biogeochemical cycles. It examines the relations between environmental resistance and biotic potential of animals. investigations of the production, transfer and transformation of

energy or energy-containing materials between and within organisms and populations in different ecosystems.

Zoo334 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, diagnosis, control and treatments.

Zoo336 Cell Biology and Genetics

This course gives an introduction to animal cell structure and function including the chemical components of the cell, the structure and function of cell organelles and their role in development, differentiation, bioenergetics and cellular communication. Examples of relevant human disorders will be used. The various basic concepts in genetics and hereditary transmission leading to organismal variations will be discussed. The topics covered include; the structure and replication of DNA, chromosome organization, the molecular basis of gene expression and regulation and how they are tied to intracellular and extracellular factors by signal transduction pathways. DNA repair mechanisms, epigenetics, irregularities, all will be studied structurally and functionally. Students will also learn principles of genetic engineering to practice ability to applications of genetics in biotechnology. The laboratory part exposes students to an overview of modern cell-related techniques in genetic engineering and basic recombinant DNA techniques and hands on experience to classical cell biology experiments.

Chm324 Pesticides Chemistry

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.

Chm326 Organic Spectroscopy

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.

Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products and its practical.

Chm334 Biochemistry
Carbohydrate classification, derivatives and reactions, Lipid classification biological membrane and lipoprotein.

Chm328 Bioinorganic Chemistry and Biophysical Chemistry
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
Physical properties of acid and base buffer. Physical chemistry of protein and amino acids. Blood buffering action. Biological membranes. Determination of macromolecules

Chm330 Nuclear Chemistry and Inorganic Reactions Mechanism
This course will provide the fundamentals of nuclear chemistry including; nuclear structure, nuclear models (Fermi gas, liquid drop and nuclear shell models), isotopes Radioactivity and radioactive decay, 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.
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.

ZOO338 Laboratory Techniques
This course will enable students to gain knowledge about the theory and practice of important laboratory techniques and divides into three modules: 1) Biotechnological and immunological techniques; 2) Macro techniques and 3) Micro techniques. The first module will introduce: nucleic acids isolation, gel documentation, electrophoresis, spectroscopy, chromatography, rDNA technology, DNA finger printing, gene cloning, delivery and transferring, genomic and cDNA libraries, DNA sequencing, genome sequencing and mapping, blotting methods, cell and tissue culture, ELISA assays, antibody production, immune- Blotting assays and bioinformatics databases. The second module will provide students with basic and advanced methods for different preparations of parasites and invertebrates (stained and unstained whole mount techniques, hand cut sections, enface methods, egg count….etc). The third module provides students with theory and hands-on experience in microscopic, cytological, histochemistry, cell structure techniques includes preparation of tissues and small specimens. Permanent slides such as paraffin slide, maturation slide in addition to preparations of microscopic sections (tissues fixation and processing), smears of soft tissues, histochemical techniques, cell biology and genetics methods.

Zoo342 Physiology Feeding, Digestion, and Metabolism (1)
The course will focus, in details, on the aspects of physiology of metabolism, intermediary metabolism, intermediary metabolism modifications, and other related processes, draw on

examples from the phyla studied in Level 2 and with an emphasis on Egyptian fauna. The course will include physiology of digestive system, nutrition, digestion, absorption, and feeding methods in different phyla. Cellular and molecular mechanisms will have discussed in order to present a current view of physiological principles in this area. 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.

Zoo344 Field Science

Field Science course focuses on the theoretical models of population ecology; population density, dispersion, population growth and demography. Students learn a variety of field techniques for field experimental design, animal sampling techniques, measuring population density and distribution. Labs include extensive field work at a variety of local sites. Students write their own lab reports with emphasis on the appropriate choice of statistical inference for the analysis of ecological data.

Chm-Zoo401 Applied Field Training

Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Chm421 Photochemistry and Laser Chemistry

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.

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.

Chm423 Practical Organic Chemistry

Synthesis and identification of various organic compounds. This course provides a study of chemical structure and reactivity correlation. Methods and Manipulation advances techniques of separation and purification, preparation of organic compounds, polymers. Solvent purification and reagent preparation. Purification, including crystallization and distillation. Reactions and Identification of organic compounds.

Zoo443 Introduction to Histochemistry

The course aims to study the identification and localization of different chemical components within and around the microstructure of cells and tissues using suitable fixation and specific staining techniques for different cell components; enzymes, lipids, carbohydrates, proteins,

nucleic acids, cytoskeleton and pigments……etc. The course throws light on the role they play in the general metabolic activities of the body. During the course the students will gain experience in new approaches in histochemical staining mechanism including DNA ploidy staining, immunohistochemistry (IHC) and Fluorescence in situ Hybridization (FISH) techniques as well as interpretation and analysis of stained sections in both normal and abnormal conditions to detect the diagnostic status.

Zoo445 Physiology (2) (Blood and body fluids)

This course will focus, in details, on the aspects of physiology of blood respiratory function (gases transport, buffering action, and acid-base balance), excretion, osmoregulation and, circulation as well as defensive mechanisms. The course will include the basic physiological processes of circulatory and excretory systems. It also familiarizes students with laboratory techniques and equipment used in the acquisition of physiological data and in the development of their investigative skills in this area.

Chm425 Chemistry of Petroleum and Petrochemicals

The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team-oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes. It also concerned with current problems of petroleum chemistry and processing such as chemical composition of crude oils and natural gas liquids; petroleum refining (cracking, hydrocracking, and catalytic reforming); catalysts for petrochemical processes (hydrogenation, isomerization, oxidation, hydroformylation, etc.); activation and catalytic transformation of hydrocarbons and other components of petroleum, natural gas, and other complex organic mixtures; new petrochemicals including lubricants and additives.

Chm427 Alkaloids and Terpenes, and Vitamins

The chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzylisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D) and vitamins (vitamin B1,2,5,6, E, K and A).

Biopolymers are natural polymers produced by the cells of living organisms. Biopolymers consist of monomeric units that are covalently bonded to form larger molecules. There are three main classes of biopolymers, classified according to the monomers used and the structure of the biopolymer formed: polynucleotides, polypeptides, and polysaccharides. Polynucleotides, such as RNA and DNA, are long polymers composed of 13 or more nucleotide monomers. Polypeptides and proteins, are polymers of amino acids and some major examples include collagen, actin, and fibrin. Polysaccharides are linear or branched polymeric carbohydrates and examples include starch, cellulose, and alginate. Other examples of biopolymers include natural

rubbers (polymers of isoprene), suberin and lignin (complex polyphenolic polymers), cutin and cutan (complex polymers of long-chain fatty acids) and melanin. Biopolymers have various applications such as in the food industry, manufacturing, packaging and biomedical engineering.

Chm429 Selected Topics in Inorganic Chemistry
Includes but not limited to: Charge transfer complexes**,** Medicinal applications**,** Transition metal complexes**,** Application of transition metal complexes in catalysis**,** Biological applications of transition metal complexes.

Chm431 Physical Polymers and Instrumental Analysis
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.
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.

Zoo413 Ecological Pollution
This course deals with major problems of pollution of the atmosphere, water, the land surface and the food chain. It covers processes responsible for the occurrence and release of pollutants in the environment, dispersion mechanisms, the hazards associated with different types of pollutant, problems of accumulation of toxic substances on living organisms and ecosystem health, and procedures for the reduction of emissions and remediation of contaminated environments.

ZOO447 Cancer Immunology and Vaccinology
Cancer immunology module will first provide a basic understanding of cancer immunology, giving an overview of the components of the immune system and evidence that the immune system can mount potent and potentially curative responses against cancer. This course is designed to provide students an understanding of the interplay between tumors and the immune system, as well as current therapies that use the immune system in the setting of oncology. The course will be broken up into three main sections. The first section will cover basic immunology and tumor biology, the second will address the interplay between the immune system and tumors, and the third will discuss current immunological therapies. At the conclusion of the course, participants should understand how the immune system functions, how genesis of cancer and its progression, and the links between these two systems. These strategies will include antibody therapies, checkpoint blockade strategies, T cell /chimeric antigen receptor adoptive therapy, and cancer vaccines. Vaccinology module aims to promote an appreciation of the development and application of vaccines as well as the benefits and constraints of vaccination as a component of integrated disease control. The vaccinology course aims to provide a

comprehensive and integrated overview in the important field of vaccinology, from immunology to all types of vaccine development, production, delivery and effect evaluation.

ZOO459 Epidemiology and Clinical Parasitology

The course is intended for students pursuing careers in the field of parasitology, such as medical and veterinary health centers, environmental researches centers and diagnostic parasitology centers. The course aims to: 1-provide students with the basic epidemiology concepts and principles that are of particular relevance to infectious diseases. It focuses on the application of epidemiologic methods and surveillance to clinical health issues. 2- provide students with skills in applications of descriptive and analytic epidemiology and practice of surveillance for parasitic infection and prevention and control in various settings. 3-develop awareness of concepts and knowledge of the parasites affecting human beings and animals, this will be achieved through the study of the life cycles and diagnostic stages characteristic and pathogenic potential of the parasitic agents .4- provide students with basic principles of traditional and up to date methods for clinical diagnosis of parasites.5- develop intellectual and technical skills to use laboratory methods for clinical diagnosis of parasites and epidemiological surveys in parasitic disease.

Zoo461 Field Science

Applied Training is a joint program with seminar courses. It deals with Any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector, and shall increase contact and acceptance between the university and industry.

Chm-Zoo402 Graduation Project

This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Chm420 Molecular Spectroscopy

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.

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.

Zoo406 Physiology (3) (Hormones and Coordinations)
The aim of this course is to introduce the physiological aspects of the nervous, muscular, endocrine and reproductive systems. This module examines the structures and functions of the various divisions of the nervous system and related sense organs, the muscles and neuromuscular junctions as well. Several important endocrine processes, including how hormones control growth, metabolism and other vital processes be included. During this course, students become able to acquire laboratory techniques, methods and equipment used in the investment of physiological data in this area.

Zoo444 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.

Chm424 Nucleic Acids and Industrial Chemistry
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.
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 production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Chm426 Chemistry of Dyes
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.

Chm428 Nanoscience

This course includes the history of nanoscience, definition of nanoscience, and nanotechnology, classification of nanomaterials, methods of characterization of nanomaterials, synthesis approaches including Top down and down up approaches, general properties of nanomaterials, general applications of nanomaterials in energy, medicine and drugs, nanobiotechnology, cosmetics and bioengineering.

Chm430 Computational Chemistry and Electrochemistry (2)

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.

This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernest-Plank 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).

Zoo408 Toxicology

Molecular and cellular toxicology course will cover the fundamental concepts of cellular and molecular toxicology including cellular responses to toxic insults involving integrated biological processes such as the activation of signaling pathways, the regulation of gene expression and cell division, and programmed cell death. This course will unravel the key processes in this cellular drama and discuss the scientific uncertainty in the measurement and in the data. The goal is to introduce cellular and molecular principles and the key biochemical players to foster a deeper understanding of the molecular basis of toxicology. This course emphasis area focuses on investigating how, why, and when chemicals cause harm to life, such as affecting cellular and molecular processes that lead to toxicity or cancer. This course provides students with the skills and knowledge necessary to investigate and elucidate how environmental toxicants/cellular stressors contribute to toxicity and influence human disease outcomes. This course aimed at understanding the deleterious effect of environmental factors on human health and disease.

Zoo412 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 digestive system will be studied to show the structure and function of its different parts. Study of the structure and function of the exocrine and endocrine portions of the pancreas and its diseases. The circulatory system and its role in energy production. Nervous system and the endocrine system and their role in controlling the body functions will be studied in details. 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.

Zoo454 Biological Associations

Provide students with informative knowledge concerning the types of relations that exist between different types of living organisms, involve intraspecific interactions and interspecific interactions. Interpret interactions among organisms exhibiting competition, predation, parasitism ,symbiosis, commensalism, and mutualism. Provide students with informative knowledge to differentiate between the beneficial and harmful living organisms and their impact on human and animal health and welfare.

ZOO456 Histopathology

The aims of the histopathological course are to: 1- Study microscopic structural abnormalities in the tissue under the effect 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.

Program Title	**Chemistry/ Entomology**
Program Type	**Double major**
Department(s)	**Chemistry and Zoology**

Chm207 Aliphatic Chemistry

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 alcohols, ethers, thio compounds, aldehydes, ketones, carboxylic acids, and there derivatives, nitrogen compounds and its derivatives as well as monosaccharides.

Chm209 Aromatic Chemistry

The chemistry of aromatic compounds. The topics covered in this course include nomenclature, structure and reactions of aromatic hydrocarbons, phenols aromatic aldehydes, ketones, acids m nitrogen compounds and theire derivatives as well as thio-compounds.

Practical,2hrs: study the separation and detection oh a mixture of organic compounds as well as the scheme of organic liquids.

Chm221 Principles of Analytical Chemistry
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, 2 hrs: Volumetric Analysis: Neutralization reactions, oxidation reduction reactions, precipitation and complex formation reactions.

Chm223 Chemical Thermodynamics and Surface Chemistry
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.
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.

Ent201 Insect Morphology
The course is designed to gain knowledge on the external morphology of the insect's body.

Ent205 Insect Anatomy and Histology
The course is designed to gain knowledge on the internal anatomy of the insect's body and histology of organs in different systems.

Ent203 Economic Entomology
This course introduces students to the economically important insects with specific emphasis on those beneficial and harmful to agricultural and horticultural crops, livestock, pets, and food products. The course includes distribution, habit, biology and life history, host and types of damages.

Ent209 Honeybee and Apiculture
The biology of honeybees and the craft of apiculture will be examined by exploring the natural history, biogeography and ecology of honeybees. Honeybee anatomy, physiology, colony social structure, pests/diseases, pollination ecology, management and current topics in beekeeping will be discussed.

Ent211 Insect Pests of Field Crops
Detailed coverage of the insects and mites attacking crops to familiarize the students with nature of the damage and seasonal incidence of insect pests that cause loss to major field crops and their effective management by different methods.

Sta215 Introduction to 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).

BPh223 Introduction to Radiobiology
Introduction to radiobiology, Initial physical effects of irradiation: dosimetry-micro dosimetry, radiation chemistry, Effects of radiation on DNA molecules and chromosomes, Cellular effects of ionizing radiation, cell survival curves, Effects on normal tissues, The effects of radiation on tumors, the biological bases of radiotherapy, Hypoxic cells and their importance in radiotherapy, Time and fractionation in radiotherapy, Hyperthermia, Chemical modifiers of radiosensitivity, Neutrons and other heavy particles, Effects of irradiation on the human body, Recent issues in radiobiology.

Sta205 Applied 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.

Chm214 Stereochemistry and Bifunctional Compounds
The course will cover description of structure, constitution, configuration and conformation of diastereomers and enantiomers, formation of racemic mixtures (its formation, properties and separation), stereochemistry of molecules with double bond and study several examples of asymmetric synthesis. 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.
Practical,2hrs: Study the quantitative estimation of several organic material and there solutions.

Chm220 Chemical Kinetics
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.

Chm222 Chemistry of Main Elements

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, chalcogens, 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.

Ent202 Insect Taxonomy and Evolution

This course is designed to teach students the fundamentals of insect taxonomy. Students will learn how to identify a diverse array of adult insects. Students will also be introduced to the International Code of Zoological Nomenclature and understand the basic phylogenetic theory and how it impacts classification.

Ent204 Insect Ecology

The course introduces students to the concepts of ecology, principles of distribution and abundance of insects and their causes. The course focuses on basic ecological theory and principles with their application to entomological problems.

Ent206 Insect Interrelationships

The framework for the course will be an overview of the relation of insects to man (Injurious and beneficial insects), interrelationships of insects and plants, interrelationships among insects and Interrelationships between insects and microorganisms.

Ent212 Cell Biology

This module aims 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 the organelle; the main elements of the cytoskeleton and their functions; intercellular and intracellular communication.

Mic248 General Microbiology

This course offers a comprehensive study of the field of microbiology to science majors. The course will give detailed insights into the following major themes: Structure and function of microbes (cellular structures, metabolism, and growth), microbial ecology, microbial diversity including prokaryotes (bacteria), eukaryotes (fungi and microalgae), in addition to viruses, and finally clinical microbiology (immunity, pathogenicity, epidemiology, control of microbes, and diseases).

Geo220 Macrofossils

Importance of fossils, fossilization, Body and trace fossils. Morphology and geological history of some selected fossil groups. Phylum Mollusca, Phylum: Porifera, Phylum: Arthropoda (Class: Trilobite), Phylum: Brachiopoda, Phylum: Cnidaria, Phylum: Echinodermata, Phylum: Hemichordata, Class Graptolithina. Practical work includes examination, description, definition and classification and of some selected macro -invertebrate fossils, field trip: collection, mode of preservation, definition of macrofossils.

Phy226 Electronics and Semiconductors

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). 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.

Chm321 Transition Elements and Coordination Chemistry

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.

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.

Chm323 Electrochemistry and Quantum Chemistry

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

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.

Chm325 Heterocyclic Chemistry

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.

Ent301 Insect Behavior

This course stresses comprehensive coverage of the principles of insect behaviour. Physiology mechanisms, behavioural ecology and evolution of insect behaviour will be covered.

Ent303 Insect Physiology
This course introduces principles of insect physiology with emphasis on regulatory mechanisms. Throughout the course, the student will learn about experimental methods used in insect physiology.

Chm327 Materials Chemistry and Solid State
Materials chemistry involves the use of chemistry for the design and synthesis of materials. Special attention will be for nanomaterials. Through a case study approach, synthesis, properties, and applications of nanomaterials, as well as techniques used to study and characterize them, will be explored. Examples of topics likely to be included: metal nanowires, quantum dots, nanoparticles, gold nanomaterials, nanofibers, nanotubes, grapheme, mesoporous materials, block copolymer assemblies, photonic crystals, self- assembled monolayers, biomaterials, cellulose nanocrystals, magnetic nanoparticles, etc. Recent literature about nanomaterials will also be discussed.
Solid state course will 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.

Chm329 Environmental Chemistry and Water Treatment
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.
This water treatment 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 contaminates to be treated and methods of water treatment including; ultraviolet light, filtration, water softening, reverse osmosis, ultra-filtration, deionization and powdered activated carbon treatment.

Ent305 Insect Genetics
This course focuses on the study of the major laws of inheritance and the cellular and molecular bases for these laws. Topics will include cell division, Mendelian inheritance, linkage, recombination, quantitative inheritance, probability theory and statistical applications in genetics, problem-solving strategies, population genetics, and molecular genetics.

Ent307 Chemical Ecology of Insects
The course presents descriptions of the chemicals involved, and how insects interact them by modifying behaviour and ultimately reproductive success. The focus here is on semiochemicals and defensive secretion.

Ent309 Insect Hormones and Pheromones
The course deals with the chemistry, action and metabolism of different insect hormones, the organization of the neuroendocrine system, pheromones, intracellular communication, novel systems for studying insect endocrinology, and others include insect hormones in plants and insect control.

BTe315 Introduction to Bioremediation
This course deals with the applications of microorganisms in the treatment of polluted water with heavy metals, and other chemical and industrial wastes.

Phy331 Physics of Nanotechnology
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.

Chm320 Instrumental Analysis (1)
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.

Chm322 Organic Polymer and Natural Products
This is introductory course to macromolecules and synthetic polymers including free radical, ionic polymerization, polycondensation, 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.
Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products.

Ent302 Insect Pathogens and Biological Control
This course aims to teach the students about various microbes that are pathogenic to insects, factors that affect their virulence; provide hands-on training in identification, isolation, culturing various pathogens and assessing pathogenicity. Roles of diseases in insect population dynamics,

biotechnology and insect pathogens. The utilization of these insect pathogens in controlling the insect pests.

Ent304 Medical Entomology
This course presents the biology and control of principal arthropods of medical importance and coverage of the natural history and abatement of selected arthropod-related diseases, including the major insect, mite, and tick vectors of disease to man

Ent306 Forensic Entomology
The course focuses on the entomological contributions that have served to further our understanding of how both human and animal remains decompose, as well as how insects can be employed as evidence in court and explain how they can assist in solving crimes, neglect, abuse, and food contamination cases.

Chm324 Pesticides Chemistry
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.

Chm 326 Organic Spectroscopy
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.
Topics cover concepts of natural product chemistry, traditional and modern approaches to studying natural products and its practical.

Chm334 Biochemistry
Carbohydrate classification, derivatives and reactions, Lipid classification biological membrane and lipoprotein.

Chm328 Bioinorganic and Biophysical Chemistry
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
Physical properties of acid and base buffer. Physical chemistry of protein and amino acids. Blood buffering action. Biological membranes. Determination of macromolecules.

Chm330 Nuclear Chemistry and Inorganic Reactions Mechanism

This course will provide the fundamentals of nuclear chemistry including; nuclear structure, nuclear models (Fermi gas, liquid drop and nuclear shell models), isotopes Radioactivity and radioactive decay, 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.

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.

Ent310 Molecular Entomology and Biotechnology

This course aims to provide students with hands-on experience in basic molecular biology strategies: DNA extraction, Polymerase Chain Reaction (PCR), quantitative PCR, primer design and optimization, DNA blocking strategies cloning, Sanger sequencing, Fragment sizing, Next Generation Sequencing. Students will learn to apply molecular tools to entomology and entomological problems.

Ent312 Livestock Entomology

This course presents the biology and control of principal arthropods of veterinary importance and coverage of the natural history and abatement of selected arthropod-related diseases, including the major insect, mite, and tick vectors of disease to livestock.

Chm-Ent401 Applied Field Training

Applied Training is a joint program with seminar courses. It deals with any form of learning takes place at the workplace the students have chosen. Experience can be obtained in form of a summer job, part-time job or work in a company over an extended period. The course will provide students with experience and practical skills regarding to practical engineering in the industry and public sector and shall increase contact and acceptance between the university and industry.

Chm421 Photochemistry and Laser Chemistry

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.

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.

Chm423 Practical Organic Chemistry

Synthesis and identification of various organic compounds. This course provides a study of chemical structure and reactivity correlation. Methods and Manipulation advances techniques of separation and purification, preparation of organic compounds, polymers. Solvent purification and reagent preparation. Purification, including crystallization and distillation. Reactions and Identification of organic compounds.

Ent403 Insecticides and Toxicology
This course aims to study the chemical, physical properties and classification of the pesticides. Testing and evaluating the efficiency of insecticides in both the field and laboratory. Factors affecting toxicity and chemical reaction.

Ent405 Aquatic Entomology
This course will introduce students to the biology, ecology, and systematics of aquatic insects that live in streams, lakes, and wetlands and some of the special adaptations that aquatic insects have for a successful existence in running waters, and to relate that information to the concept of biodiversity.

Chm425 Chemistry of Petroleum and Petrochemicals
The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team-oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes. It also concerned with current problems of petroleum chemistry and processing such as chemical composition of crude oils and natural gas liquids; petroleum refining (cracking, hydrocracking, and catalytic reforming); catalysts for petrochemical processes (hydrogenation, isomerization, oxidation, hydroformylation, etc.); activation and catalytic transformation of hydrocarbons and other components of petroleum, natural gas, and other complex organic mixtures; new petrochemicals including lubricants and additives.

Chm427 Alkaloids and Terpenes and Vitamins
The chemistry and biological importance of terpenes and alkaloids (the chemistry and biological importance of terpenoid indole, benzylisoquinoline and tropane alkaloids), carotenoids, in addition to the chemistry and biological importance of steroids (cholesterol, ergosterol vitamin D) and vitamins (vitamin B1,2,5,6, E, K and A).
Biopolymers are natural polymers produced by the cells of living organisms. Biopolymers consist of monomeric units that are covalently bonded to form larger molecules. There are three main classes of biopolymers, classified according to the monomers used and the structure of the biopolymer formed: polynucleotides, polypeptides, and polysaccharides. Polynucleotides, such as RNA and DNA, are long polymers composed of 13 or more nucleotide monomers.

Polypeptides and proteins, are polymers of amino acids and some major examples include collagen, actin, and fibrin. Polysaccharides are linear or branched polymeric carbohydrates and examples include starch, cellulose, and alginate. Other examples of biopolymers include natural rubbers (polymers of isoprene), suberin and lignin (complex polyphenolic polymers), cutin and cutan (complex polymers of long-chain fatty acids) and melanin. Biopolymers have various applications such as in the food industry, manufacturing, packaging and biomedical engineering.

Chm429 Selected Topics in Inorganic Chemistry
Includes but not limited to: Charge transfer complexes**,** Medicinal applications**,** Transition metal complexes**,** Application of transition metal complexes in catalysis**,** Biological applications of transition metal complexes.

Chm431 Physical Polymers and Instrumental Analysis (2)
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.
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.

Ent409 Insect Control in Organic Systems
This course deals with pprinciples and strategies of crop protection in the organic farming system, crop protection practices in organic farming, plant protection products authorized in organic farming and case studies of organic farming.

Ent411 Scientific Writing
In this course, we will cover the basics of scientific writing using sessions, exercises and small-scale feedback sessions. All teaching materials are tailored to the needs of a psychological researcher in action. The course focuses on the skills to write scientific reports, thesis, and papers, how to express your report in a poster or PowerPoint presentation.

Chm-Ent402 Graduation Project
This course is given with no fixed content. It depends upon either a theoretical topic or an experimental work will be explored. It will give students the opportunity to develop their search and writing skills by being given practice at obtaining information from a variety of sources, organizing and presenting it as a convincing argument.

Chm420 Molecular Spectroscopy
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.
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.

Ent404 Integrated Pest Management
The main goal of this course is that students understand how sound IPM practices rely on an understanding of ecological interactions among crops, pests and their natural enemies and to breach the illusionary gap between applied and basic research.

Ent408 Insect Population Genetics
The course will deal with an understanding of population genetics theory and examples of applications. The focus shifts away from the individual toward the population of which the individual is a member. This will include Hardy-Weinberg low and factors that change allele and genotype frequencies in populations, use of DNA fingerprinting in the identification and relationship testing.

Chm424 Nucleic Acids and Industrial Chemistry
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.
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 production of common inorganic chemicals, petrochemical industry and the production of various polymers. Chemical production related to agriculture and forestry is studied.

Chm426 Chemistry of Dyes
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.

Chm428 Nanoscience
This course includes the history of nanoscience, definition of nanoscience, and nanotechnology, classification of nanomaterials, methods of characterization of nanomaterials, synthesis approaches including Top down and down up approaches, general properties of nanomaterials, general applications of nanomaterials in energy, medicine and drugs, nanobiotechnology, cosmetics and bioengineering.

Chm430 Computational Chemistry and Electrochemistry (2)
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.
This course continues discussion of the fundamentals of electrochemistry with emphasize on the nature of electrode reactions, coupled chemical reactions and adsorption-phase formation, Nernest-Plank 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).

Ent410 Insect Biochemistry
The course is designed to present the organization of insect systems and metabolic processes. There will also be a discussion on the biochemistry of exoskeleton and regulation of metamorphosis; insect hormones affecting growth and development; insecticides and their modes of action; insecticidal proteins, biopesticide and mechanisms of insecticide resistance.

Ent414 Insect Transmission of Plant Diseases
This course addresses the basic principles of the role of insects as vectors of plant pathogens, including viruses, bacteria, fungi, nematodes and protozoa. The course includes the major modes of transmission of plant pathogens by insects and identification, the morphology of important vectors and how these features affect the transmission of plant pathogens.