BOTA 210: Environmental Conservation Basis **2 Cr. hr. (L2 + P0)**
Prerequisite: (BOTA 102)
Natural resources - Renewable and non-renewable - Biodiversity - Conservation strategies inside and outside the protected areas - Protected areas conservation - Techniques used in studying natural resources conservation and biodiversity - Legislation on endangered species -Agencies involved in conservation activities.

BOTA 211: Evolution of Plant Genome **1 Cr. hr. (L1 + P0)**
Prerequisite: (BOTA 102)
What is the genome- genome structure and function- - DNA sequencing- DNA alignment- DNA annotation- DNA biodiversity- Comparative genomics- How to compare between genomes in different organisms to determine their evolution?

BOTA 212: Plant water relations-Transport in plant –Mineral nutrition **3 Cr. hr. (L2 + P2)**
Prerequisite: (BOTA 102)
Plant-water relations: Colloids – Diffusion – Osmosis - Absorption – Translocation – Transpiration - Stomatal physiology-mechanism of opening and closing - Antitranspirants - *Organic Translocation* (Phloem translocation).
Transport in plant : Biomembrane structure - Membrane transport : Carriers (uniport, symport, antiport) - Channels (Types of channels) – Pumps.
Mineral nutrition: Classification of nutrients into macronutrients and micronutrients - Functions of mineral nutrients in plant growth and development - Symptoms of deficiency and toxicity of these nutrients.

BOTA 213: Principles of Phycology **2 Cr. hr. (L1 + P2)**
Prerequisite: (BOTA 102)
Introduction, Cell structure of algae, Life cycles and types of reproduction, Different algal divisions, Evolution of algae.

BOTA 214: Plant Communities and environmental pollution **3 Cr. hr. (L2 + P2)**
Prerequisite: (BOTA 102)
Concept of plant community - Physiognomy and structure of plant communities - Plant succession (hydroxere and xeroxere) and Climax - Competition of plant species and its effects – Classification of vegetation - Quantitative and qualitative characteristics of plant communities - Pollution concept, nature and sources of pollution (air, water and soil) - Effect of pollution on ecosystems - Biological methods of controlling pollution.

BOTA 215: Basics of Ecosystems **1 Cr. hr. (L1 + P0)**
Prerequisite: (BOTA 102)
Ecosystem and its components - Food chains and food web and their role in the environmental balance , biotic pyramids, biogeochemical cycles - Examples from world major ecosystems (Pond, forest, grassland).

BOTA 216: Principles of Plant Taxonomy+Selected families of flowering plants
2 Cr. hr. (L1 + P2)
Prerequisite: (BOTA 101)
Introduction, Definition objectives, different types of plant taxonomy - Principles of taxonomy (Identification, nomenclature [ICBN] and classification) - General characters of angiosperms - Floral characters (Flower structure): Calys and Corolla (shapes + aestivation) - Androecium

and Gynoeciium (Adhesion and cohesion of stamens and placentation) - Key characters of both monocotyledoneae and dicotyldoneae - Inflorescences - fruits - Studies of some selected families of monocotylodoneae and dicotyledoneae - Keys.

BOTA 217: Principles and Tools of Proteomics - DNA Nanotechnology 2 Cr. hr. (L2 + P0)
Prerequisite: (BOTA 102)
Principles and tools of proteomics:
Introduction to proteomics- Structure and function of proteins- Amino acids as building units of proteins- Proteins synthesis- Protein folding- Protein modification- Protein transportation- Cellular function of proteins- Some techniques in proteomic analysis.
DNA Nanotechnology:
Introduction and terminology of nanotechnology -DNA nanotechnology- Structural DNA assembly – DNA nano pore - DNA arrays- DNA detection, sorting, sequencing - DNA studies by AFM - DNA computer - PCR amplification of DNA fragments -Molecular surgery of DNA - Nanoscale DNA organization - Nanoscale DNA characterization - Studying structural changes of DNA by Quantum size effects – Nano-biosensors - Current and future applications of structural DNA nanotechnology.

BOTA 218: Economic Plants 1 Cr. hr. (L1 + P0)
Prerequisite: (BOTA 101, 102)
Introduction, studies of the natural plant sources and the continuous improvement for their exploitation and their economic uses - Studying examples of economical plants and their industrial uses; food plants, fiber plants, wood and cork plants, rubber and plant latex products, Fatty oils and wax plants, Aromatic plants (oil essential plants), sugar, starch and cellulose plants, spices plants, Beverages plants, Fumitory and masticatory plants, biofuel producing plants. Gums, resins, tannin plants and short notes on medicinal plants.

BOTA 219: Medicinal and Aromatic Plants (Microbiology) 2 Cr. hr. (L1 + P2)
Prerequisite: (-)
Historical introduction – Public medicine – taxonomy of Medicinal plants – Importance of herbal medicine – examples of drugs obtained from different parts of the medicinal plants from, roots, bark, stems, leaves, flowers and seeds – Examples on aromatic plants – Methods of Extraction distillation of volatile and nonvolatile oils – propagation of medicinal plants by tissue culture technique - the importance of aromatic plants – medicinal and aromatic plants in Sinai peninsula.

BOTA 220: Cell and Plant Genome (An evolutionary trend) 1 Cr. hr. (L1 + P0)
Prerequisite: (BOTA 102)
What is the genome? – How genomes evolve? – Characteristics of eukaryotic genomes (ploidy state, size, and regulatory proteins) – The diversity of genomes and the tree of life - Genome structure and function- Organization of plant genomes – Genome studying tools - DNA sequencing - DNA alignment - DNA annotation - DNA biodiversity - Comparative genomics (Genome mapping and model systems) - Arabidopsis thaliana; the plant chosen as the primary model for studying plant molecular genetics – Functional genomics in plants.

Bota 226: Paleobotany (For geology and geophysics) 2 Cr.Hr. (L1+P3)
Prerequisite (-)
Plant Systematic: Studying basic aspects of different systems of classifications and the bases on which living kingdoms are classified. Studying general characters of kingdom Monera, Fungi, Protista, Plantae and describing examples.

Paleobotany: Fossilization and types of fossils, nomenclature and classifications of fossils. Characters of fossils in different eras. Fossil plants of Egypt. Fossil plants and Paleoclimatology.

Course Contents of the Zoology Department

BIOL 201: General biology (for mathematics and biophysics students) 3 Cr.Hr. (L2+P3)
Prerequisite (-)
Part I: Zoology (L 1 + P 1½ hr): Basic concepts of cytology. Bases of genetic informations. Introduction to the tissue levels of organization (the main types of animal tissues). Embryonic development in animals. Bases of nomenclature and classification of the animal kingdom (examples for each group).
Practical Skills: Structure of cells – different embryonic stages – types of animal tissues – examples of animal groups.
Part II: Botany (L 1 + P 1½ hr): Botany Department.

ZOOL 201: Systematic diversity in invertebrates 4 Cr.Hr. (L3+P3)
Prerequisite: ZOOL 102
Taxonomy, general morphology and biology of representative examples of the main taxonomic units of Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, and Echinodermata, with emphasis on the detailed internal anatomical structure of some selected examples and to biological and ecological important aspects.

ZOOL 202: Chordates and evolution 4 Cr.Hr. (L3+P3)
Prerequisite: ZOOL 101
Part I: Chordates (L2½ +P3 Hr): The chordates course concern by the following items: Classification of phyla Hemichordata and Chordata and its different classes. The morphological and anatomical structure of the body of the hemichordates and chordates, at the level of systems and from an evolutionary point of view. **Part II Evolution (½ Hr):** It includes the following topics: The evolutionary history of life: Origin of life, Macroevolution, Does microevolution lead to macroevolution, Continental drift. Early ideas and history of evolution theories. Charles Darwin and his contemporaries. Natural selection. Evidence for evolution: Comparative anatomy, embryology, biogeography, biochemistry, and molecular biology.

ZOOL 203: Basic Ecology 1Cr.Hr. (L1+P 0)
Prerequisite: (-)
This course deals with the study of the basic principles of ecology such as biotic and abiotic components of the ecosystem such as temperature, moisture, light, and soil, the biogeochemical cycles, production in ecosystem and types of ecological pyramids, patterns of terrestrial ecosystem and environmental pollution.

ZOOL 204: Principles of Genetics 2 Cr.Hr. (L2+P 1)
Prerequisite: ZOOL 102
Introduction to genetics. The genetic material - The nature of genes and how they work? Chromosomes; the carriers of genes - Gene interaction and phenotypic expression, terminology and symbols- Heterozygous gene expression - Intermediate inheritance, Codominant inheritance and heterozygous influence of recessive genes – Epistasis - Complementary genes,

Polygenic inheritance, Multiple alleles, Penetrance and expressivity, Multiple effect of single gene (pleiotropy) - Gene and genotype frequencies in a population, Hardy-Weinberg principle and gene frequency - Sex influenced inheritance - Genes and mutations.

ZOOL 205: Cell Physiology **1 Cr.Hr. (L1+P 0)**
Prerequisite: ZOOL 101
This course provides students with the fundamental core of physiology. Topics include cellular interaction with the environment, control of homeostasis, pH regulation, forms of energy and chemical reactions, principles of energy metabolism, intracellular transport, cytoskeleton, communication and control of cellular growth, chemical messengers, signal transduction, feedback control.

ZOOL 206: Protozoology **3 Cr.Hr. (L2+P 2)**
Prerequisite: ZOOL 102
General biology and taxonomy of the Protozoa. Structure and ultrastructure of protozoan nuclei and organelles, and recent theories explaining their functions. Reproduction and morphogenesis. Life cycle patterns of the main protozoan groups and their biological importance.

ZOOL 207: Introduction to invertebrates **3 Cr.Hr. (L2+P3)**
Prerequisite: ZOOL102
General morphology and biology of representative examples of the main taxonomic units of Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, and Echinodermata. The internal anatomical structure of some selected examples will be studied. Biological and ecological important aspects will be included.

ZOOL 208: Histochemistry and Microtechnique **3 Cr.Hr. (L2+P 3)**
Prerequisite: ZOOL 102
Part 1:Histochemistry: Theoretical basis of histochemical fixation and cryostat methods - Classification and identification of carbohydrates, lipids, proteins, and nucleic acids - Roles and features of these components in cells under normal and pathological conditions - Histochemical methods for detection of mucopolysaccharides, proteins, lipids and nucleic acids in tissues - Cellular enzymes- Types of metal and pigments and their detection. **Part 2: Microtechnique:** Methods of preparation of permanent paraffin sections of different soft and hard tissues. Smears and their types - Preparation of whole mounts - Other methodologies such as TEM and SEM techniques.

ZOOL 209: Introduction to Genetics **1Cr.Hr. (L1+P 0)**
Prerequisite: ZOOL 102 (For Zoology+Chemistry Students), without Prerequisite (For Chemistry and Applied Chemistry Students)
Genetic material - The chromosomes (physical and chemical structure) – Organization of DNA in chromosomes (chromatin, centromere, telomeres and packaging of DNA into chromatin and chromosomes) – Number, types and morphology of chromosomes – Chromosome analysis – The karyotype, SKY technique, abnormal karyotypes – The genetic code – Genes and its kinds – Junk DNA - The central Dogma and gene expression – Control of gene action in prokaryotes

and eukaryotes - Sex determination and sex linked inheritance – Oncogenes – Tumor suppressors – Mitochondrial genome and cytoplasmic inheritance.

ZOOL 210: Digestion and metabolism 3 Cr.Hr. (L2+P 3)
Prerequisite: ZOOL 101
Carbohydrates and glycaemic index, lipids, proteins, vitamins and minerals, food pyramids and calories, obesity, human digestive system, mechanical and chemical digestion, absorption mechanisms, basal metabolic rate. Carbohydrate metabolism: glycogenesis, glycogenolysis, glycolysis and lactic acid pathway, Cori cycle and gluconeogenesis, Krebs cycle, electron transport and oxidative phosphorylation, ATP balance sheet. Lipid metabolism: lipogenesis, β-oxidation and lipolysis, ketone bodies. Protein metabolism: transamination and oxidative deamination. Interconversion of glycogen, fat and protein. Uses of different energy sources by different organs.

ZOOL 211: General physiology (For biochemistry students) 2 Cr.Hr. (L2+P0)
Prerequisite: ZOOL 101
Fundamentals of physiological principles and the concept of internal environment and homeostasis; some examples of homeostatic mechanisms of the major functional systems and various control systems that are utilized by different organs to regulate various physiological functions are also emphasized. The functions of the nervous, endocrine, digestive, circulatory, respiratory and urinary system are discussed.

ZOOL 212: Introduction to Chordates and evolution 3 Cr. Hr. (L2+P3)
Prerequisite: ZOOL 101
Part I: Chordates: Morphology, functional anatomy and biology of selected examples of the protochordata and the vertebrata including the agnatha, pisces, amphibia, reptilia, aves, and mammalia. **Part II Evolution:** It includes the following topics: The evolutionary history of life: Origin of life, Macroevolution, Does microevolution lead to macroevolution, Continental drift. Early ideas and history of evolution theories. Charles Darwin and his contemporaries. Natural selection. Evidence for evolution: Comparative anatomy, embryology, biogeography, biochemistry, and molecular biology.

ZOOL 214: Bioinformatics 2 Cr.Hr. (L2+P 0)
Prerequisite: (-)
Introduction to molecular biology and bioinformatics .Retrieval, analysis and interpretation of biological data, searching the biomedical literature. Sequence homology searching and multiple alignments .Protein sequence motif analysis. Genome analytical methods, annotation, protein database searching, protein physicochemical properties. Techniques for extracting and evaluating patterns from large databases .Introduction to knowledge discovery process . Fundamental tasks including classification, prediction, clustering, association analysis, summarization, and discrimination .Basic techniques including deçision trees, neural networks, statistics, partitional clustering, and hierarchical clustering.

ZOOL 216: Medical invertebrates 2 Cr.Hr. (L1+P 2)
Prerequisite: ZOOL 102

The course will focus on invertebrate animals of medical importance in different Phyla. It will discuss the negative impacts of these parasites on animals and human and consequently on the economic status of community . In addition, the invertebrate animals act as intermediate hosts will included. Moreover, the positive impact of some invertebrates as a source of natural medical products will be covered.

ZOOL 217: Systematic Invertebrate (for geology and geophysics students)
2Cr.Hr. (L1+P 2)

Prerequisite: (-)

This course designed to geology students. It emphasize on invertebrates of geological importance. Principles of nomenclature and classification of the animal kingdom. Morphology and biology of representative examples and general reviews of the main taxonomic units.

ZOOL 218: Introduction to Histochemistry and Microtechnique Cr.Hr. (L1+P 3)
Prerequisite: ZOOL 102

Part 1: Histochemistry: Theoretical basis of histochemical fixation, freezing and cryostat methods – Classification and identification of carbohydrates, lipids, proteins, and nucleic acids - Roles and features of these components in cells under normal conditions - Histochemical methods for detection of mucopolysaccharides, proteins and lipids in tissues. **Part 2: Microtechnique:** Methods of preparation of permanent paraffin sections of different soft tissues – Fixation and types of fixatives – Embedding - Sectioning – Staining – Mounting – Smears and their types – Preparation of whole mounts.

ZOOL 219: Zoo diversity (for geology students) **3 Cr.Hr. (L2+P 3)**

Prerequisite: (-)

This course deals with animal history, distribution, classification and conservation biology. Morphology and biology of representative examples of invertebrates as Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Vertebrates including the Agnatha, Pisces, Amphibia, Reptilia, Aves, and Mammalia, with special concern on those of geological importance.

ZOOL 220: Biogeography **2 Cr.Hr. (L2+P 0)**

Prerequisite: (-)

This course deals with the study of the different aspects of biogeography with special reference to zoogeography. It deals with historical biogeography concerned with the distribution and movement of living organisms between different parts of the old world, the land bridges which connected different parts of the old world, and the zoogeographical realms of the world and their faunistic characteristics. The course deals also with ecological biogeography concerned with the ecological factors which helps establishing the present distribution of living organisms all over the world and the role of man in this distribution.

ZOOL 222: Principles of animal physiology (for biophysics students) 2Cr.Hr. (L2+P 0)

Prerequisite: BIOL 201

This course demonstrates sufficient knowledge of fundamental concepts in vertebrate body structure and functions, and demonstrates the ability to integrate this knowledge in understanding how living organisms perform functions necessary to maintain life. Topics in

this course include nervous, cardiovascular, respiratory, excretory, endocrine and immune systems in addition to membrane physiology and signal transduction.

Course Contents of the Entomology Department

ENTM 201 Insect Morphology **3Cr.Hr. (L2+P3)**
Prerequisite: ENTM 102
The exoskeleton (structure, function, &processes)-Cuticular outgrowth – Special integumentary structures -internal cuticular appendages (Apodemes–apophysis) - epidermal glands - Modification of cuticle. Body regions and their segmentation – sclerites - **Structure of insect head** - sutures - types of head in various insects- head appendages, antennae and mouth parts,(Structure - types and modifications -**Structures of thorax** -structure, sclerites and appendage- wings (articulation-types-venation- movement),legs (structure- articulation- modifications - movement),**Structure of abdomen**- genital and pregenitalabdominal appendages - Genitalia - modifications and sexual dimorphism -Development and metamorphosis.

ENTM 202 Principles of Pest Control **1Cr.Hr. (L1+P0)**
Prerequisite: ENTM 102
Introduction-Basic requirements for control of insect pests - economic importance of control – economic threshold and economic injury level. Different methods of pest control: regulatory "legal", cultural, physical, mechanical, biological, genetic and chemical control. Application of genetic engineering for insect control. Molecular analysis of insect meiosis and sex ratio distortion.

ENTM 203 Advanced Insect Anatomy **2Cr.Hr. (L1+P3)**
Prerequisite: ENTM 102
Course topics begin with an introduction of anatomical terminology and an overview of cellular processes and tissue classification. The structure and functions of different anatomical structures well be studied for the following systems: Structural and microscopic anatomy of the digestive system, blood vessels and circulation, respiratory system, muscular system, nervous system and sense organs, reproductive system, endocrine system, and excretory system. The laboratory component of the course generally parallels and reinforces lecture concepts through the dissecting of model insects, histological slides, and cadaver demonstration.

ENTM 204 Insect Transmission of Plant Diseases **2Cr.Hr. (L1+P2)**
Prerequisite: ENTM 102
Adaptation of insect vectors of phytopathogens: morphological, anatomical, physiological and biological adaptations - Damage by pathogens - Types of phytopathogens transmitted by insects: non-microbial and microbial diseases (fungal and viral diseases in agricultural crops). Recombinant DNA technology and insect control.

ENTM 205 Insect Bionomics **1Cr.Hr. (L1+P0)**
Prerequisite: ENTM 102
Introduction and historical - Definitions and terminology - Insects in their environment. Insects as a part of the ecological cycle - Insect habitats {Terrestrial insects (Locomotion) - Aquatic insects (Respiration) – Flying (Flight mechanisms) - Subterranean insects - Cave insects}- Insect food and feeding habits (Classes of feeders) - Survival and natural protection.

ENTM 206 Social insects **1Cr.Hr. (L1+P0)**
Prerequisite: ENTM 102
Introduction and natural history (The importance of social insects; systematic positions of social insects; degrees of social behavior-Social wasps; social bees; honey bees; ants; termites; social behavior in other insects)-Sex and cast determination. Group effects and control of nest mates (Control of gone production and worker lying; division of labor; colony multiplication; swarming)-Communication and pheromones-The evolution of social behavior (Genetic theory of social behavior; parental manipulation and nutrition; mutualism) - Symbiosis and the super-organism concept - Symbioses among social insects and arthropods; social homeostasis; social insects as super-organisms.

ENTM 207 Pollution and Protection of the Environment **1Cr.Hr. (L1+P0)**
Prerequisite: ENTM 102
Air pollution. Noise. Radioactive materials (sources- methods of measuring and control) - Pollution of fresh and marine water (sources - methods of control). Land pollution(sources-methods of control).Legislations to control air, water and land pollution.

ENTM 208 Insect Pathology & Biological Control **3Cr.Hr. (L2+P3)**
Prerequisite: ENTM 102
Introduction - Mechanical control - Infection and its epizootic (Symptoms and pathology) - Infectious diseases caused by microorganisms-Identification of natural and biological control, factors affecting insect population {Parasitic insects(Characteristics, Identification of different types of parasitism- Application of biological control -Predators(Identification, characteristics and its greatest importance) -Characteristics for introduction of natural enemies and a successful example -Microbial Control of insect pests (definitions -Characteristics of insect pathogens) - Approaches to microbial control of insect pests -Basics of microbial control planning with examples of successful trials-Microbial control of pests using entomopathogens and case studies of different microorganisms.

ENTM 209 Insect taxonomy 1 **3Cr.Hr. (L2+P3)**
Prerequisite: ENTM 102
Definitions, Taxonomy, Systematic, Classification and Nomenclature - Class: Insecta
Subclass: Apterygota (5 Orders) - Subclass: Pterygota -Division: Exopterygota(14 Orders)
Division: Endopterygota (9 Orders) .

ENTM 210 Community health and insects **1Cr.Hr. (L1+P0)**
Prerequisite: ENTM 102 or (-)
Definitions of vector, pathogen, host, carrier, reservoir, etc… - Most common medically important insect groups - Directly affect human and animal health.

ENTM 211 Insects as Bioindicators **1Cr.Hr. (L1+P0)**
Prerequisite: (-)
Introduction- Definitions (Bioindication, biological monitoring, biological indicators and biomarkers) - Living organisms as monitors reflecting the health and status of the environment or ecosystem and the cumulative effects of different pollutants -The role of insects as biological

indicators- Biochemical, physiological, and behavioural responses to environmental stress- Bioaccumulative indicators - How bioindicators can detect the history of environmental pollution and stress - How can this information be deduced -Methods of monitoring -Bioassays and **Biotechnology- Based Bioassays**- The role of bioindicators in sustainable development-The success of biomonitors over man-made equipment and chemical monitoring.

ENTM 212 Entomological Techniques **2Cr.Hr. (L1+P3)**
Prerequisite: ENTM 102
Introduction - Microscopic and ultramicroscopic preparations - Fixation, washing, dehydration, imbedding, sectioning and staining and mounting- Collecting, mounting and preserving insects- Training on special techniques e.g. TLC, electrophoresis, GLC, etc.

ENTM 213 Insects in Ancient (Pharoenic) Egypt **1Cr.Hr. (L1+P0)**
Prerequisite: (-)
Insect fauna; Butterflies and Moths – Flies – Mosquitoes - Bed Bugs – Fleas – Headlice - Honey Bees - Locusts (Grasshoppers) - Praying Mantis – Ants - Beetles {Scarab (Dung) Beetle, Buprestid (Jewel) Beetle, Elaterid (Click) Beetle, Spider Beetles, and Lesser Mealworm Beetle} - Insect borne diseases in Ancient Egypt (Malaria – Elephantiasis – Plague) - Remedies.

ENTM 214 Honey bees **1Cr.Hr. (L1+P0)**
Prerequisite: (-)
Colony organization and nest architecture - Development and castes - Anatomy of the honey bee – Nutrition - Worker Behaviors - Age Levels of Bees Correlated with Work Habits - Communication and Orientation (Honey bee pheromones) - Products of the honey bee (Honey- Beeswax- Pollen-Propolis- Royal jelly) - Hymenopterous Insect Stings(Bee Venom - Sting Reactions - Treatment and Precautions) - Seasonal Cycles of Activities in Honey Bee Colonies (Spring Activity - Swarming) - Hazards to honey bee survival (Environmental hazards - Honey bee predators - Diseases - Pests and pesticides)

ENTM 215 Beneficial Insects and Their Products **2Cr.Hr. (L2+P0)**
Prerequisite: (-) or ENTM 102
Introduction - Insects as Suppliers of Useful Products (Honey – Propolis - Bee pollen - Royal jelly - Bees wax - Silk – Lac - Natural dyes - Insect galls) - Insect used in Medicine (Cantharidin – Apitherapy - Maggot therapy) - Insects as Pollinators of Crops - Insects as Bioagents in Natural and Biological Control of Crop Pests (Predators – Parasitoids) - Insects Used in Fundamental and Applied Biological Research - Insects used as Food - Insects as food for human being - Insects as food for wildlife - Forensic Entomology - Insects as Scavenger - Insects as Soil Fertilizers - Insects as Weed Destroyers - Insects as Luminescent Agent - Aesthetic Values of Insects; Cultural Entomology.

ENTM 216 Methods in Scientific Paper Writing and Oral Presentations2Cr.Hr. (L1+P2)
Prerequisite: (-)
This course delivers instruction on reading, understanding, preparing and writing a report on a scientific subject. It aims to develop thinking, analysis and argument skills. It also is designed to instruct students on preparing and delivering oral presentations.

Reading, understanding and analyzing a paper - Noting the main points in a paper - Writing a report(Planning, presenting tables and graphics) - Critical analysis and conclusions - Recommendations - Class peer reviewing of student papers - Oral reports - Slide making - Poster making - Student presentations and class interaction.

ENTM 217 Mechanisms of Insect Defenses **1Cr.Hr. (L1+P0)**
Prerequisite: (-)
Types of mechanical defenses- The chemical nature and sources of defensive compound Defensive ways (Repellency - Induce cleaning – Adhesion - Cause pain or discomfort) Protective Coloration (Crypsis – Mimesis - Warning Colors–Mimicry) - Collective defenses in gregarious and social insects.

ENTM 218 Polyphenism in Insects **1Cr.Hr. (L1+P0)**
Prerequisite: (-)
Identification of polyphenism-Different types of polyphenism - Ecological factors affecting polyphenism - Physiological factors laid to polyphenism in insects - Advantages of polyphenism in some insects - The physiological changes resulted from polyphenism in some insects - The effect of physiological changes on insect's life.

ENTM 219 External anatomy **2Cr.Hr. (L1+P2)**
Prerequisite: ENTM 102
Exoskeleton (Structure, exoskeletonprocesses, exoskeleton invagination) - Body regions {(Head: Structure of antenna, structure of different types of mouth part), (Thorax: segmentation, sclerites, appendages; wings and legs), (Wings: venation - types and modifications - mechanism of flight), (Leg: Structure of leg - articulation - modification with reference to mobility), (Abdomen – immature and mature appendages)} - Types of metamorphosis

ENTM 220 Sound and light producing organs in insects **1Cr.Hr. (L1+P0)**
Prerequisite: (-)
Methods of sound production and sound producing organs in insects.Stridulatory and Tymbal organs in orders of insects.Patterns of sound signals.Control and significance of sound production.-Light emission and self-luminescence in insects. Nature and structure of light producing organs.Chemical and physical mechanisms, control and significance of light production.

ENTM 221 Systematic Entomology1 **3Cr.Hr. (L2+P3)**
Prerequisite: ENTM 102
Introduction, Identificationand classification - Class: Insecta: Apterygota (Silverfish & Spring tail) - Pterygota: Exopterygota (Mayflies, Dragonflies, Damselflies, Grasshoppers & Crickets, Stonflies, Stick insects, Earwigs, Spinner insects, Mants, Cockroaches, White ants, Book lice, Human lice, Bird lice, True bugs, Water bugs, Plant hoppers, Aphis, Scale insects&Thrips) - Endopterygota (Lace insects, Scorpion flies, Butter flies & Moths, Mosquitoes & True flies, Fleas, Wasps, Bees, Ants, Beetles and Weevils)

ENTM 224 Insect adaptations **1Cr.Hr. (L1+P0)**
Prerequisite: ENTM 102

Introduction and Definitions - The effects of the environment on insect adaptation - Ecological relationships between insects and the environment - Insect habitats (Terrestrial insects - Aquatic insects - Flight mechanisms) - Adaptation in subterranean and cave insects - Adaptation in insects feeding habits - Adaptation for survival and fortification.

ENTM 228 Insect Cytogenetics **2Cr.Hr. (L1+P2)**

Prerequisite: ENTM 102

Introduction (Nucleus -Chromatin: structure, types and distribution - Nucleolus) - The organization of DNA into chromosomes (Nucleosomes - High level of organization in chromosomes) -The cell cycle and DNA replication - Variations in cell division - Analysis of chromosomal rearrangements-Extra nuclear genetic system - Eukaryotic transcriptional systems - Plotting of chromosome maps; mapping parameters - The organization and diversity of the insect chromosome - Some aspects of the structure and function of the polytene chromosomes of the Diptera - The evolution of DNA sequences common to closely related insect genomes - Description of the relationships between the chromosome structure and phenotype of some insects.

ENTM 230 Insect Pest Control **2Cr.Hr. (L2+P0)**

Prerequisite: ENTM 102

Introduction - Basic requirements for control of insect pests - economic importance of control – economic threshold and economic injury level.

Different methods of pest control: regulatory "legal", cultural, physical, mechanical, biological, genetic and chemical control.

Application of genetic engineering methods for insect control.

Molecular analysis of insect meiosis and sex ratio distortion.

Insecticide Resistance and Eco-toxicology - Examples of insect pest management cases

ENTM 251 Principles of Insect Morphology **3Cr.Hr. (L2+P3)**

Prerequisite: ENTM 102

Structure of integument – modifications of its layers (epidermis &cuticle) - Endoskeleton – External integumentary processes. **Body regions**: **HEAD**:- Structure of insect head –head orientation – head appendages [**1-antennae** (their structure and types) **2- mouth parts** (Mandibulate&Modified mouth parts)] **THORAX**:- segmentation, sclerites and suture – thoraxappendages[(**1- wings**: types and modifications - venation - mechanism of flight)-**2- legs**: Structure - articulation - modification with reference to mobility] – **ABDOMEN**: - segmentation, genital and nongenital abdominal appendages – Development (types of stages) and types of metamorphosis.

ENTM 252 Fundamental Parasitology **2Cr.Hr. (L1+P2)**

Prerequisite: ZOOL 102

The basic concepts of parasites and parasitism - Types of parasitism - Types of hosts, host-parasite relationships - Parasite specificity - Host resistance and host immunity to parasitic infections - Classification, morphology, life cycles, methods of transmission, symptomatology, and pathogenesis of parasites of humans and domestic animals - Methods of detection of pathogens and parasites.

ENTM 253 Insect Classification **4Cr.Hr. (L2+P4)**
Prerequisite: ENTM 102
Introduction: classification, nomenclature, and main taxonomic characters.- Identification and types of taxonomic keys.- Class Insecta, application of keys.- Subclass Apterygota (4 orders). Subclass Pterygota- Division Exopterygota (14 orders)- Division Endopterygota (9 orders). - Wings and wing venation in orders.

ENTM 254 Insect Anatomy **2Cr.Hr. (L1+P3)**
Prerequisite: ENTM 102
The digestive system- The circulatory system - The respiratory system- The muscular system- The male reproductive system - The female reproductive system - The nervous system - The excretory organs - Glands and organs of secretion (exocrine and endocrine glands, concise reference is made to the physiology of each system)

ENTM 255 Insect and Public Health **3Cr.Hr. (L2+P2)**
Prerequisite: ENTM 102
Definitions of vector, pathogen, host, carrier, reservoir, etc.... - Common medically important insect groups and other arthropods {Directly affecting human and animal health - Mechanical carriers of disease (cockroaches, bedbugs, houseflies) - Biological vectors (lice, fleas, mosquitoes, sand flies) - Role played by insects and other arthropods in human and animal health - Role played by vertebrate reservoirs - Prevention and control of arthropod-borne diseases}

ENTM 256 Insect Ecology **2Cr.Hr. (L1+P3)**
Prerequisite: ENTM 102
Introduction (definitions and history of ecology – subdivisions of ecology – value of ecological information) – Compo223nents of the environment and their effects on an insect chance to survive, develop and reproduce(Weather factors; temperature – moisture – light; food; biodiversity; gene banks and bionomics) - Diapause in insects (types of diapause and life cycles; intensity of diapause; factors inducing or terminating diapause; importance of diapause) - Analysis of population parameters.

ENTM 257 Methods of Pest Control **1Cr.Hr. (L1+P0)**
Prerequisite: (-)
Identify insect pest economic threshold - Basic requirements for insect control - Natural control measures - Applied control measures - Legal control - Cultural control - Physical and mechanical control - Biological control - Genetic control including genetic engineering - Chemical control – Attractants - Repellents – Antifeedants – Hormones - Integrated control – pest control management.

ENTM 258 Writing of Scientific Reports **2Cr.Hr. (L1+P3)**
Prerequisite: (-)

Types of scientific reports-Reading and analyzing a scientific report- The college-level report - Preparing a report: Documentation, title, outline- The report: Critical analysis, sections, sentences, paragraphs - Tables and graphics- Conclusions and potential recommendations

ENTM 261 Skills in Scientific Writing **1Cr.Hr. (L1+P0)**
Prerequisite: (-)
Writing and Science (Types of scientific writing: essay, report, thesis, papers for publication, research projects - Word processing station: PC, software, magnetic storage device, printer - Format: Margins, font, line spacing - Chemical and biological nomenclatures - Numbers, quantities, equations - Figures: lines, bar charts, column charts, pie charts, drawings, photographs – Tables - A scientific document: sections, headings, subheadings, paragraphs, sentences - Style in scientific writing: confusing word pairs, waste words, abbreviations, punctuations, spelling) – Plagiarism - Class groups (Scientific document to be prepared and presented by each group).

ENTM 262 إدارة الجودة الشاملة والمعايير العالمية لاعتماد المعامل 1Cr.Hr. (L1+P0)
Prerequisite: (-)
الجودة الشاملة كمفهوم إداري متكامل
مفهوم ادارة الجودة - رواد إدارة الجودة - الجودة وتحديات المنافسة الدولية - تطور مفاهيم الجودة - مفهوم الجودة الشاملة - المبادئ العشرة لتحقيق الريادة في إدارة الجودة الشاملة - أهداف إدارة الجودة الشاملة - التخطيط للجودة - أنشطة إدارة الجودة الشاملة - تطبيق ادارة الجودة الشاملة - أدوات الجودة الشاملة - جوائز الجودة - المواصفة القياسية الدولية أيزو ١٧٠٢٥ لاعتماد المعامل - تعريف المواصفة القياسية - أهمية توحيد القياس - الأسباب الرئيسية لتوحيد القياس - المواصفة القياسية أيزو ١٧٠٢٥- متطلبات المواصفة القياسية الدولية أيزو ١٧٠٢٥ - المتطلبات الإدارية - المتطلبات الفنية

ENTM 263 Economic Insects and Pests **3Cr.Hr. (L2+P2)**
Prerequisite: ENTM 102
Introduction - Economic pests - Importance of insects to man (Commercial products derived from useful insects: silk, honey, bees wax, shellac, cochineal and other dyes) -
Insect predators and parasites "examples" - Insects as(pollinizers, soil builders, subject for scientific study, food of man and animals, scavengers) - Pests attacking cotton, sugar cane, corn, leguminous plant crops, fruit trees, stored grains and their products, vegetables - Insects as vectors of phytopathogens(adaptation of insect vectors of phytopathogens, types of phytopathogens transmitted by insects; non-microbial and microbial diseases in agricultural crops)

ENTM 264 Communication Skills **2Cr.Hr. (L1+P2)**
Prerequisite: (-)
Types of communication in science - Organizing the communication: Title, structure, development - Research articles - Preparing a PowerPoint presentation - Poster presentations: Title, structure, arrangement of building blocks - Oral presentations: the talk - Critical analysis of pre-prepared student posters.

ENTM 274 Principles of Epizootiology and Insect bio-Control agents **3Cr.Hr. (L2+P3)**
Prerequisite: ENTM 102

Principles of Epizootiology - Basic principles of epizootiology (insect pathogen population, host population, the environment) -Modeling epizootics in Entomology - Microorganisms associated with insects (pathogenic relationship –diseases of harmful and beneficial insects) - Pathological effect of non-microbial agents against insects. Insect bio-Control agents – Historical development and ecological basis of biological control-Significance and developmental stages of insect parasites and predators -Applied epizootiology (basic concepts of microbial control-factors affecting efficacy-improving production of entomopathogens) - Case studies in biological control (inoculation – augmentation - conservation) -Managing resistance to entomopathogens.

Courses Contents of the Biochemistry Department

BIOC 201: Protein Chemistry and Metabolism **3 Cr.Hr. (L2+P3)**
Prerequisite: (CHEM 102)
This course aims to provide the students with the basic knowledge about nutritionally essential and nonessential aminoacids, properties, buffer action, physiological functions, digestion, absorption and classification. Introduction to peptides, proteins structure (simple and conjugated), globular and fibrous, protein conformation and denaturation. In addition, the course aims to illustrate the significant relationships among different biochemical topics of protein metabolism including biosynthesis and catabolism of phenylalanine, tyrosine, tryptophan, histidine and sulphur containing aminoacids, inborn errors of aminoacids metabolism, ammonia and urea formation, the catabolism of carbon skeleton of aminoacids.

BIOC 202: Carbohydrate and Lipid Metabolism **4 Cr.Hr. (L3+P3)**
Prerequisite: (CHEM 102)
This course aims to provide concise coverage of the basic chemistry metabolism of carbohydrates including definition, biological importance and classification. In addition to glycolysis, TCA cycle, electron transport chain and oxidative phosphorylation, glycosuria, and glycogen storage diseases, diabetes mellitus; it's diagnosis and acute metabolic complication; glycogen metabolism, gluconeogenesis and pentose phosphate pathway to conclude the energy consumed and / or produced during each metabolic pathway. Also, this course aims to provide the students definition, biological importance, classification of fats and fatty acids, digestion, absorption and transport of lipids. Introduction to compound lipids, hydrophobic and hydrophilic groups, cholesterol, bilesalts, micelle and bimolecular leaflet. Chemistry and metabolism of lipids, pathological disturbances, oxidation of fatty acids, metabolism of cholesterol and it's clinical association with disease, lipids and linkage of cardiovascular diseases.

BIOC 203: Enzymology and Tissue chemistry **3 Cr.Hr. (L2+P3)**
Prerequisite: (CHEM 102)
This course aims to provide the students definition, structural, functional organization, properties, classification, specificity, active sites and kinetic behavior of enzymes. Activators, inhibitors, co-enzymes and prosthetic groups, allosteric enzymes and isozymes and clinical significance of serum enzymes level, industrial and medical applications of enzymes. In the meantime, the course aims to provide the students with application the structure and the biochemistry of the different types of animal tissues and their cellular components, understand the causes of tissue transplantation and to the know the basic principles of tissue culture.

BIOC 204: Industrial Biochemistry **2 Cr.Hr. (L2+P0)**

Prerequisite: (-)

The aim of the course is to provide the students the basic concept of definition and scope of microbiology, the biology of the microbial catalysis and use of microorganisms in fermentation and bioremediation as well as industrial processes for the production and purification of small molecules, proteins and enzymes using microorganisms, tissue culture and immobilized enzymes. Also, the use of enzymes technology and the biotechnology in the treatment of organic liquid and solid wastes and in the medical/industrial applications particularly in pharmaceutical and food industry.

BIOC 205: Advanced Biochemistry 3 Cr.Hr. (L2+P3)

Prerequisite: (-)

This course provide an introduction to the structure, biological significance, function, and metabolism of fundamental major macromolecules building blocks (amino acids, carbohydrates, lipids, enzymes, hormones, vitamins, nucleotides and their relationship to each other), organic and inorganic prosthetic groups, biopolymers (nucleic acids, peptides/proteins, glycoproteins, lipids), macromolecular conformations, membranes and metabolism of the major classes of biological macromolecules including carbohydrates, proteins, lipids and nucleic acids with materials and techniques used to study these compounds in the laboratory.

BIOC 206: Plant Biochemistry 2 Cr.Hr. (L2+P0)

Prerequisite: (-)

This course aims to provide concise coverage of the basic knowledge about the biochemistry of plants, role of different biosynthetic pathways in plant growth and development, basic principles of plant metabolism including the mechanisms of uptake of small molecules from the environment and their elaboration into more complex structures via primary and secondary metabolism. A major emphasis will be placed on plant carbon metabolism (photosynthesis, respiration, lipid biosynthesis, carotenoid and terpenoid biosynthesis), nitrogen, sulfur and secondary metabolism in plants and interconnections between these metabolic networks, regulation of these pathways. Genetically engineer them to enhance plant productivity, increase plant stress tolerance and improve nutritional quality and economic value of harvested organs.

BIOC 208: Principle of Radiobiology 2 Cr.Hr. (L2+P0)

Prerequisite: (-)

This course aims to provide a fundamental knowledge of physics and chemistry of radiation interactions with matter, sources of ionizing radiation, types of ionizing radiation, particulate radiations, linear energy transfer, radiation dose and units, principles of radiation dosimetry, direct and indirect effects, mechanisms and biological responses of human beings to ionizing and non-ionizing radiations through the study of the effects of radiation on biological molecules, cells, and man including cancer and mutagenesis. The course will develop the ability to make objective decisions regarding the relative risks and benefits of radiation use in a variety of applications.

BIOC 210: Basis of Carbohydrate and Lipid Metabolism 4 Cr.Hr. (L3+P2)

Prerequisite: (CHEM 102)

This course aims to study the molecular composition of living cells, the organization of biological molecules within the cell, and the structure and function of these biological

molecules, a survey of the fundamental principles of biochemistry. The topics covered includes: basic chemistry of the biological macromolecules which this course focuses on are amino acids structure, protein structure, carbohydrate chemistry, lipids, nucleic acids, enzyme kinetics and enzyme inhibition, relationship between chemical structure, biological function and metabolism pathways occurring in living systems, the basic concepts of metabolism related to the different classes of biomolecules including digestion, absorption and hormones controlling this process.

BIOC 221: An Introduction to Biochemistry **3 Cr.Hr. (L2+P2)**
Prerequisite: (-)
This course provides an introduction to the structure and biological significance of the major classes of biological macromolecules including carbohydrates, proteins, lipids, enzymes, nucleic acids and vitamins. A series of practical classes is integrated with the lectures to allow students to further understand the concepts covered in some lectures and also to become familiar with the use of materials and equipment commonly used in biochemistry

Course Contents of the Microbiology Department

MICR 201: Introduction to Microbiology (for minor biology) **2Cr.Hr. (L1+P2)**
Prerequisite (-)
Historical introduction to the science of Microbiology; Differences between Prokaryotes and Eukaryotes; How microorganisms are isolated and classified; Benefits and harms of microorganisms. Introduction to Viruses, What are the main characteristics of viral particles; Classification of viruses; Examples of bacterial, plant and animal viruses; Examples of RNA and DNA viruses; Viral diseases. The ultrastructure and functions of the bacterial cell components; Types of bacteria. The bacterial growth and reproduction; Different factors Affecting bacterial growth; Nutrition and respiration in bacteria. Introduction to fungi; Main characteristics of kingdom Fungi; Fungal cell wall structure and components, Reproduction in fungi; Differences between bacteria & fungi; Classification of fungi; Fungal infections "Mycoses", Types and examples.

MICR 202: General Microbiology II (Viruses, Bacteria and Fungi) **3 Cr.Hr. (L2+P3)**
Prerequisite: MICR 102
Section 1: Historical review, general properties, structure and morphology of Viruses classification of viruses, an introduction to different types of viruses (plant, animal, and human viruses, bacteriophage, algaephage, mycophage and subviral agents). Isolation, cultivation, purification and transmission of viruses.
Section 2: Cell structure and function in Bacteria and Archaea. Physiology and metabolism in bacteria. Reproduction, growth curve and phases of growth. Sex in bacteria (Conjugation, transformation and transduction). Sterilization and disinfection. Bacterial diversity and their role in our lives. **Section 3:** Growth and nutrition in fungi; Physiology of the growing hyphae; Hyphal aggregates; reproduction in fungi; Taxonomic groups of fungi; Ecological groups of fungi; Nomenclature of fungi.

MICR 212: An Introduction to Virology **2 Cr.Hr. (L1+P2)**
Prerequisite: MICR 102
Historical review, general properties, structure and morphology of viruses classification of viruses, an introduction to different types of viruses (plant, animal, and human viruses, bacteriophage, algaephage, mycophage and subviral agents). Isolation, cultivation, purification and transmission of viruses. Viruses and cancer. Viral diseases and control of viral diseases.

MICR 221: An Introduction to Bacteriology **2 Cr.Hr. (L1+P2)**
Prerequisite: MICR 102
What are Prokaryotes. The size, shape, and arrangement of bacterial cells. Staining techniques in Bacteriology. Cell structure and function in Bacteria and Archaea. Nutrition, respiration and metabolism in bacteria. Reproduction, growth curve and phases of growth. Sex in bacteria (Conjugation, transformation and transduction). Sterilization and disinfection. Bacterial diversity and their role in our lives.

MICR 231: An Introduction to Mycology **3 Cr.Hr. (L2+P2)**
Prerequisite: MICR 102
What are fungi; General characteristics, Composition of fungal cell; Growth and nutrition in fungi; Physiology of the growing hyphae; Hyphal aggregates; reproduction in fungi; Taxonomic groups of fungi; Ecological groups of fungi; Nomenclature of fungi.

MICR 252: Environmental Microbiology **2 Cr. Hr. (L1+P2)**
Prerequisites: MICR 102
Environmental microbiology describes microbial environments, evidence of microbial activity, the effect of microbial activity on the environment in terms of nutrient cycling & the fate of pollutants, Detection & control of microorganisms in the environment. Microbial pathogens and toxins in environment. Contamination control and biosafety. Pollution microbiology, environmental management, and Waste treatment systems. The course also covers the fields such as the transport of microbes & DNA, microbial risk assessment & use of molecular recognition in environmental applications. The diversity of microbial communities. The use of 16S rRNA gene as a phylogenetic marker, metaproteomics, microarrays and molecular fingerprinting.

MICR 253: Microbial Ecology **1 Cr.Hr. (L1+P 0)**
Prerequisites: MICR 102
Foundations of microbial ecology (terms and definitions) ,Methods used in microbial ecology (culturing-dependent analysis of microbial communities); Molecular analysis of microbial communities; Measuring different microbial activities in nature; The microbial ecosystems and microbial associations; Natural soil and fresh water and air microbial habitats; Marine microbial habitat; Microbial interactions with plants; Nutrient cycles in nature and the role of microbes in the cycles completion; Normal flora of human body, Role of microbes in Bioremediation.

MICR 254: Microbial Pollution **1 Cr.Hr. (L1+P 0)**
Prerequisites: MICR 102
Classification of wastes; Costal pollution (chemical pollutants, microbial pollutants); Interaction between microorganisms in water column; Biological processes for pollution control. 1. Water pollution sources, mechanisms and symptoms. Influence of pollution on living beings: oxygenation and deoxygenation, eutrophication. Measuring water quality. 2. Air Pollution - Chemical reactions and the greenhouse gas effect: 3. Radioactive pollution: 4. Soil Pollution: - Mineral Pollution (heavy metals): origin and consequences of pollutions, effects on fauna and flora. - Organic pollution. Pesticide pollution: prevention, fixing mechanisms, detoxification. Microorganisms as indicator of water pollution.

MICR 262: Molecular Biology I **2 Cr.Hr. (L2+P 0)**
Prerequisite: MICR 102
Introduction to molecular biology and the discovery of the DNA. Basic genetic mechanisms including structure and functions of DNA, RNA and the flow of genetic information. From DNA to Protein including transcription and translation. Techniques in molecular biology including DNA isolation, gel

electrophoresis, PCR mechanisms, hybridization and other advanced techniques in molecular biology. Quorum sensing and microbial whole cell biosensor and DNA microarrays.

MICR 264: Microbial Genetics **1 Cr.Hr. (L1+P 0)**
Prerequisites: MICR 102
Introduction, mutation and mutant, molecular basis of mutation, genetic recombination, genetic transformation and transduction, plasmid and conjugation, chromosome mobilization and transposons, *Escherichia coli* chromosome, genetics in prokaryotes, eukaryotes and the viral genetics.

MICR 272: Microbial Enzymes **2 Cr.Hr. (L1+P2)**
Prerequisite: MICR 102
Industrially important microbial enzymes. Properties and Structure of enzymes, classification of enzymes, mechanism of enzyme reactions, effect of environment on enzyme activity, control of enzyme activity, Enzyme inhibition; control of enzyme activity; enzymes from extremophiles and some examples of enzymes of economic importance (Amylase, Proteinases, Cellulase, Lipase, Chitinase, etc…). Immobilization, development of immobilizaiton techniques, Specific examples of immobilized microbial enzymes useful in food stuff and biotechnology, immobilized enzymes reactors.

MICR 282: Nano- Biotechnology **1 Cr.Hr. (L1+P 0)**
Prerequisite: MICR 102
Process of synthesis of nano powders, Electro deposition, Important na materials Nanobiology : Interaction between bimolecules and naoparticle surface Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies; Application of nano in biology, naoprobes for Analytical Applications; Methodology in medical diagnostics and Biotechnology; Current status of nano Biotechnology; Future perspectives of Nanobiology and Nanosensors; NanoMedicens : Developing of Nanomedicens Nanosytems in use, Protocols for nanodrug Administration, Nanotechnology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications, Molecular Nanomechanics, Molecular devices.

MICR 283: Microbiological Techniques **2Cr.Hr. (L1+P 2)**
Prerequisite: MICR 102
The microbiology lab. and safety rules; The fundamental Equipment and materials of the microbiology lab., Basics of some Instruments such as; haemocytometer, micropipettes, PH meter, autoclave, oven, incubators, water bath, shaker, air laminar flow, DNA and protein electrophoresis, spectrophotometers, microscopes, Methods of sterilization and disinfection, Media and growth of microorganisms, Microbial quantitation methods; Harvesting and processing of microorganisms Tissue culture methods; Advanced major microbiological methods that including Immunological and Molecular biological methods. Techniques of thin layer chromatography. High-performance liquid chromatography. Techniques of gas chromatography.

MICR 284: Research Skills **2Cr.Hr. (L1+P 2)**
Prerequisite: MICR 102.
This course involves independent study of a selected topic in Microbiology to present a concise report about it in a written paper and in a seminar. Reviewing and critical evaluation of international published research papers will be involved. Students will acquire basic skills in writing research papers, technical reports and news release.

MICR 286: Radiobiology **2Cr.Hr. (L2+P 0)**
Prerequisite: MICR 102.

Radiation in every-day life (Background on natural radiation – Man-made sources of radiation). Sterilization by gamma radiation; Types of radiation (properties of radiation); Basic terms: Microbial decontamination of food (meat, vegetables and fruits) and medicinal herbs and spices. Atomic structure (Building block of matter and isotopes); Radiation units: Bioburden testing of samples validation of bioburden method); Interaction of radiation with matter: Bioburden recovery methods.

MICR 288: Medical Microbiology **2 Cr.Hr. (L2+P0)**
Prerequisite: (MICR 101)
History, classification and examples of medically important viruses, bacteria and fungi; source, modes of transmission, portal of entry into the susceptible host, prevention; pathogenicity; staining methods, culture methods, biochemical tests other recent methods; sterilization and disinfection; normal microbial flora; antimicrobial agents, drug resistance and drug sensitivity test.

Course Contents of the Geology Department

GEOL 201: Optical Mineralogy **3 Cr. Hr. (L2+P3)**
Prerequisite: GEOL 104
The polarizing microscope: General features, parts, accessory plates, adjustment and care of the microscope. The nature of light. Polarized light. Isotropic and anisotropic minerals. Refractometry. Becke line. Optics of isotropic minerals. Optics of anisotropic minerals. Uniaxial optics. Biaxial optics. Mineral optics in convergent polarized light. Mineral Groups: Carbonates, Sulfates, Phosphate, Oxides, Silicates (feldspars - feldspathoids - olivine - garnet - sphene - zircon - pyroxene - amphiboles - tourmaline - mica group - chlorite - epidote - serpentine - Al_2SiO_5 group).

GEOL 202: Igneous Petrology **3 Cr. Hr. (L2+P3)**
Prerequisite: GEOL 104
Introduction, Forms and structures of extrusive and intrusive igneous rocks. Textures of extrusive and intrusive igneous rocks. Composition of igneous rocks, Crystallization of igneous minerals from silicate melts; two component systems (eutectic, solid solution), three component systems, incongruent melting. Consolidation of magma; orthomagmatic (Bowen reaction series), late stages (pegmatitic, penumatolitic, hydrothermal). Origin of igneous rocks; magmatic evolution and igneous rocks diversity (magmatic differentiation, assimilation, mingling of magma. Classification of igneous rocks, igneous rocks association: volcanic association, plutonic association.

GEOL 203: Macropaleontology **3 Cr. Hr. (L2+P3)**
Prerequisite: GEOL102
The invertebrate macrofossil phyla: Porifera, (incertae sedis Archaeocyathids), Cnidaria, (incertae sedis Stromatoporoids), Brachiopods, Annelida, Bryozoa, Arthropoda, Mollusca (classes: Bivalvia, Gastropoda, and Cephalopoda), and Echinodermata (classes: Asteroidea, Ophiuroidea, Crinoidea, and Echinoidea). For each of these phyla / classes the student well study the grade of organization, general features, skeleton, skeletal morphology, reproduction,

ecology and paleoecology, functional morphology, classification, geologic history, evolution, and occurrences in Egypt.

GEOL 204: Sedimentation and Sedimentary Rocks 4 Cr. Hr. (L3+P3)
Prerequisite: GEOL 104
Introduction - Rock cycle - Weathering - Type and origin of sediments - Transportation of grains - Textures of sediments - Sedimentary structures - Depositional environments - Classification of sedimentary rocks - Clastic sedimentary rocks (types -mineralogy - textural and compositional maturity of sandstone - diagenesis - classification) - Nonclastic sedimentary rocks (types - mineralogy - components - diagenesis and classification of carbonate rocks - evaporites - coal - phosphates - siliceous rocks - sedimentary ironstones).

GEOL 206: Micropaleontology 3Cr.Hr. (L2+P 3)
Prerequisite: GEOL 102
Introduction: definition, scope, historical review and objectives. Kingdom of life. Study of major microfossil groups: foraminifera, radiozoa, ostracoda, calcareous nannoplankton, diatoms, pollen and spores, and conodonts with respect to nature of the organism, the living organism, reproduction, development, the hard part (composition, detailed morphology and function), ecology, biogeography, classification, general history, stratigraphic distribution, evolution and applications.

GEOL 208: Paleoecology 2 Cr. Hr. (L1+P2)
Prerequisite: GEOL 102
Definition of ecology and paleoecology, fundamental ecological principles, the principle of uniformitarianism, the nature and classification of environments, the marine ecosystem, mode of life and nutrition, functional morphology, fossil orientation, evidence of biologic activity, associated sediments, lateral variation, abundance and diversity, changes in habits and habitats, interaction between species, spatial distribution of populations, limiting factors, fossil communities, post-mortem information loss, taphonomy (biostratinomy and fossil diagensis).

GEOL 210: Igneous and Metamorphic Petrology 3 Cr. Hr. (L2+P3)
Prerequisite: GEOL 106
Forms and structures of extrusive and intrusive igneous rocks. Composition and textures of igneous rocks. Crystallization of igneous minerals from silicate melts. Origin of igneous rocks. Magmatic evolution and igneous rocks diversity. Classification of igneous rocks. Igneous rock associations. Metamorphism and agents of metamorphism. Mineral paragenesis. Types of metamorphism, Textures of metamorphic rocks. Mineral composition of metamorphic rocks. Progressive regional metamorphism and metamorphic zones. Metamorphic facies. Metamorphism of different rock types. Mineral deposits associated with metamorphic rocks. Plate tectonics and metamorphism.

GEOL 211: Principles of Paleontology and Historical Geology 3Cr.Hr (L2+P3)
Prerequisite: (-)
Origin of the earth - Fossils, rocks and heresies - Catastrophism and uniformitarianism - Successive creations versus evolution - Relative time scale - Numerical time scale - The

hierarchical system of classification - Numerical taxonomy (cladistics and phenetics) - Nature of the fossil record - Fossils through time - Life beginnings - From prokaryotes to eukaryotes - The Ediacara fauna - Paleozoic life - Mesozoic life - Cenozoic life - Human origins - Major features of life - Evolution - Extinction - Adaptive radiation - The distribution of fossils and ancient continents through time.

Geol 213: Paleontology (1): Invertebrate Macrofossils 3Cr. Hr.(L2+P2)
Prerequisite: (GEOL. 102)
The invertebrate macrofossil phyla: Porifera, (incertae sedis Archaeocyathids), Cnidaria, (incertae sedis Stromatoporoids), Brachiopods, Annelida, Bryozoa, Arthropoda, Mollusca (classes: Bivalvia, Gastropoda, and Cephalopoda), and Echinodermata (classes: Asteroidea, Ophiuroidea, Crinoidea, and Echinoidea). For each of these phyla / classes the student well study the grade of organization, general features, skeleton, skeletal morphology, reproduction, ecology and paleoecology, functional morphology, classification, geologic history, evolution, and occurrences in Egypt.

Geol 215: Paleontology (2): Microfossils 1Cr. Hr. (L1+P1)
Prerequisite: (GEOL. 102)
Introduction: definition, scope, historical review and objectives. Kingdom of life. Study of major microfossil groups: foraminifera, radiozoa, ostracoda, calcareous nannoplankton, diatoms, pollen and spores, and conodonts with respect to nature of the organism, the living organism, reproduction, development, the hard part (composition, detailed morphology and function), ecology, biogeography, classification, general history, stratigraphic distribution, evolution and applications.

Geol 255: Introduction to Geology 2Cr. Hr. (L1+P2)
Prerequisite: (-)
Origin of the Earth. Internal structure of the earth. Minerals, rocks and rock cycle. Weathering and erosion. External geologic processes (wind, torrential rain, rivers, seas and oceans, groundwater, glaciers). Primary and secondary geologic structures. Internal geologic processes. Plate tectonics. Fossils, fossil record and evolution. Estimating geologic time. The geologic time scale. The distribution of fossils and ancient continents through geologic time. Geologic tools and methodologies.

Geol 257: General Geology 3Cr. Hr. (L2+P3)
Prerequisite: (-)
Origin of the Earth. Internal structure of the earth. Minerals, rocks and rock cycle. Weathering and erosion. External geologic processes (wind, torrential rain, rivers, seas and oceans, groundwater, glaciers). Primary and secondary geologic structures. Internal geologic processes. Plate tectonics. Estimating geologic time. The geologic time scale. Earth and life history throughout the geologic time. Ground water. Energy and mineral resources. Topographic and geologic maps.

Course Contents of the Geophysics Department

GEOP 201 : Gravity Methods **3 Cr.Hr. (L2+P2)**
Prerequisite: (GEOP 102)

Introduction to gravity methods. Establishment of gravity base net. Land gravity survey. Marine gravity survey. Air gravity survey. Gravity Processing (Vertical and Horizontal Corrections: Free air, Bouguer, Latitude, Terrain corrections). Graphical and Numerical Separation Methods. Second Vertical Derivative and Downward Continuation techniques. Stripping Techniques. Fault Estimations: (Fault Criteria, Fault throw, Fault Location, Fault trend, Fault Coincidence). Depth to basement based on Gravity methods. Mass Estimation based on Gravity methods. Application of Gravity methods.

GEOP 202: Electrical Methods **3 Cr. Hr. (L2+P3)**

Prerequisite: (-)

Introduction. Self-Potential method (Origin of potentials- equipments- field procedure and applications). Telluric current methods (Theory, field procedure and applications). Resistivity methods. Electrical properties of rocks . Concept of apparent resistivity. Galvanic resistivity methods and various electrode arrangements. Field procedure and the factor affecting the measured data. Characteristic parameters of geoelectric section. Analysis of stratified n-layered earth resistivity model. Interpretation of the resistivity data. Applications of resistivity methods. Induced polarization methods (theory, measurements, field procedure and applications).

GEOP 203: Physical and Mechanical Properties of Rocks 3 Cr. Hr. (L2+P2)

Prerequisite: (-)

Introduction. Porosity, classification, examples . Permeability, classification, examples. Quantitative use of porosity , permeability. Formation resistivity factor and water saturation, examples. Correlation between Formation factor and porosity, cementation, water saturation, examples. Stress and Strain measurements. Relationship between porosity and other mechanical properties. Strength of rocks. Compressive strength measurements and its relation to other rock properties. Rheological properties of rocks. Hydrodynamics and electrical properties of rocks. Acoustic properties of rocks. Magnetic and thermal properties of rocks. Radioactive properties of rocks.

GEOP 204: Principles of Magnetic Methods **3 Cr. Hr. (L2+P3)**

Prerequisite: (-)

Fundamentals and major concepts of magnetic properties of rocks, elements of the earth ,s magnetic field nature of earth ,s magnetism, induced and remanent magnetization. Theories deals with the origin of the earth's magnetic field (Non-dynamo hypotheses and dynamo problems). Contribution of airborne magnetic surveys to geological mapping. Magnetic instrumentations, surveying procedures and processing of magnetic data. Interpretation of magnetic maps and profiles as separation of magnetic anomalies and reduction to the pole RTP techniques. The role of magnetic in exploration for minerals and hydrocarbons.

GEOP 205 : Seismic Refraction **3 Cr.Hr. (L2+P2)**

Prerequisite: (GEOP 102)

Geometry of seismic refraction ray paths. Critical incidence. Snell's law. Problems to be solved by seismic refraction method. Refraction profiling, In-line refraction survey. Broad-side refraction. Fan-shooting. Engineering surveys on land. Refraction data reduction. Layer thicknesses determination using intercept-time method, crossover-distance method, delay time

method, wave-front method, generalized reciprocal method and plus minus method. True velocity determination. Determination of fault throws. Problems and limitations of seismic refraction.

GEOP 206: Principles of Electrical Methods 2 Cr. Hr. (L1+P3)
Prerequisite: (-)
Introduction. Self-Potential method (Origin of potentials- equipments- case studies). Resistivity methods, Electrical properties of rocks (Electric potentials, Electric conductivities, lab. measurements of resistivity). . Elementary theory and concept of apparent resistivity. Galvanic resistivity methods. Field procedure and the factor affecting the measured data. Characteristic parameters of geoelectric section. Graphical methods of interpreting the resistivity data. Applications of resistivity methods. Induced polarization methods: theory, methods of measurements.

GEOP 207 : Geophysical Instrumentation 3 Cr.Hr. (L2+P2)
Prerequisite: (-)
Seismic Equipments for land and marine surveys. Seismic energy sources, seismic receivers (receiver arrays, cables, streamers) . Recording systems. Roll-along switch, Preamplifier, Multiplexer, Main Amplifier, A/D Converter, Automatic Gain Controller, Formatter, and Tape Derive. Recording formats . SEG Formats. Recording techniques and recording channels, shot-holes and field records. Potential field Equipments. Magnetic equipments types. Electromagnetic surveying . Electric resistivity surveying.

GEOP 208: Physical Properties of Rocks 2 Cr. Hr. (L1+P3)
Prerequisite: (-)
Introduction. Porosity, classification, examples . Permeability, classification, examples. Quantitative use of porosity , permeability. Formation resistivity factor and water saturation, examples. Correlation between Fromation factor and porosity, cementation, water saturation, Examples. Acoustic properties of rocks use of wave velocity as indicator for fluid saturation and lithologic identification, examples.. Magnetic properties of rocks. Thermal properties of rocks and the effect of fluid saturation, applications.

GEOP 209 : Gravity Exploration Methods 3 Cr.Hr. (L2+P2)
Prerequisite: (GEOP 102)
Introduction to gravity methods. The purpose of gravity surveying and establishment of gravity base net. Land gravity survey. Marine gravity survey . Air gravity survey. Gravity Processing (Free air, Bouguer, Latitude, Terrain corrections). Graphical and Numerical Separation Methods. Second Vertical Derivative and Downward Continuation techniques. Stripping Techniques. Fault Estimations: (Fault Criteria, Fault throw, Fault Location, Fault trend, Fault Coincidence). Depth to basement based on Gravity methods. Mass Estimation based on Gravity methods. Advantages and disadvantages of gravity methods. Application of Gravity methods.

GEOP 210: Principles of Geothermal Methods 2 Cr. Hr. (L1+P3)
Prerequisite: (-)
Fumdamentals of the thermal properties of the rocks. Temperature within the earth. Terrestrial heat flow. Heat flow measurements. Equality of continental and oceanic heat flow. Regions of

anomalous heat flow. Thermal prospecting methods and measuring techniques. Case studies and pplications as Sulphide ore deposits prospecting and , thermal water and hot vapour zones,salt and granite structures and lithology information from temperature logs.

GEOP 212: Geodesy **3 Cr. Hr. (L2+P3)**

Prerequisite: (-)

History of geodesy, geodesy and other disciplines, the function of geodesy. Global properties of the Earth (Topography, gravity and Geoid, Global surface deformation, plate tectonics and plates deformation). The motion of the earth, earth's gravity field, earth shape and size. Point positioning, relative positioning and geodetic networks. Geodetic instruments (horizontal geodetic instruments, leveling instruments) . Measuring the Earth deformation using the present day tools (leveling, triangulation, SLR, VLBI, DORIS, GPS, Insar, etc). GPS (basics of the theory , data acquisition, processing and modeling). GPS applications (Measuring plate tectonics, monitoring faults).

MATH 210 : Linear Algebra and Applications in Chemistry 2 Cr. Hr. (L2+Se1)

Prerequisite: (-)

Systems of Linear equations – Matrices – Determinants – Vector spaces – Subspaces and bases – Linear Transformation – Inner product spaces – Orthognality – Eigenvalues & Eigenvectors – Diagonolization – quadratic form – Applications in chemistry