

| Code | Course Title | Course Content | Theoretical | Practical | Tutorial | Credit hours |
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| First Level | | | | | | |
| B 101 | General Botany | <p>Plant morphology: Types of leaves, roots, shoot system, flowers – inflorescences and their morphology</p> <p>Plant anatomy: Structure of plant cell, types of plant tissues, anatomy of roots, stems & leaves.</p> <p>Pollinology: Pollen grains, structure, identification, applications</p> <p>Reproduction, and importance of plants.</p> | 2 | 2 | 1 | 3 |
| B 102 | Plant Biodiversity | <p>Types and classification of living organisms.</p> <p>Study the degree of variation of plant life forms within a given plant species, ecosystem, or an entire Egypt.</p> <p>Biodiversity is a measure of the health of ecosystems.</p> <p>Biodiversity is in part a function of climate.</p> | 2 | 2 | 1 | 3 |
| Chem1 01 | Inorganic Chemistry | <ul style="list-style-type: none"> - Fundamentals of Coordination Chemistry, Cell Biology, Biochemistry and Evolution, Physical Methods for Bioinorganic Chemistry - Binding of Metal Ions to Proteins: Metal-dependent lyases and hydrolases, Zinc Binding domains, Calcium and calcium-binding proteins - Special cofactors and metal clusters: Electron transfer proteins, Cobalamins, Molybdenum-cofactor enzymes - Transport & Storage of Metal Ions: Transport and Storage of iron within organisms, Obtaining iron from the environment. - Oxygen metabolism - Metals & Health | 2 | 2 | 1 | 3 |
| Phys 101 | Introduction to physics | <ul style="list-style-type: none"> - Introduction to macromolecular structures and their physical environment - Thermodynamics, calorimetry and surface plasmon resonance - Hydrodynamics: macromolecular diffusion, electrophoresis and centrifugation; fluorescence anisotropy and dynamic light scattering; infrared and Raman spectroscopy - Crystallography and cryo-electron microscopy | 2 | 2 | - | 3 |

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| | | <ul style="list-style-type: none"> - Introduction to NMR: spin Hamiltonians, chemical shielding, spin-spin coupling, dipolar interactions - Protein structure determination; NMR studies of dynamics: spin relaxation, chemical exchange and hydrogen exchange studies - * Optical microscopy: light, fluorescence and atomic force microscopy; single molecule detection and manipulation | | | | |
| Math 101 | General Mathematics:1 | <ul style="list-style-type: none"> - Functions- an introduction to linear and quadratic functions, the quadratic formula, exponents and power functions. The exponential and logarithm functions. - Data- the use of histograms, scatter plots pie-charts and log-log plots to represent data. Basic numerical and graphical summaries. The normal distribution. - Infinite series and Taylor series. - * Fundamental theorem of calculus and integration | 2 | - | 2 | 3 |
| G S 101 | English Language | <p>Writing paragraph + topic sentence</p> <ul style="list-style-type: none"> - Countable and non-countable nouns <p>Speaking, listening, reading & writing skills in English</p> | 1 | - | 2 | 3 |
| G S 102 | Human Development (1) | General introduction to the area of Developmental Psychology and a survey of developmental processes that influence the growth of the physical, intellectual, and socio-emotional aspects of the person throughout the lifespan | 1 | - | 2 | 2 |
| Z 101 | Animal Biodiversity | <p>Biodiversity and the Extinction Crisis</p> <ul style="list-style-type: none"> - Temporal Patterns of Biodiversity - Ecosystem Processes and Natural Disturbance - Conservation Genetics and the Conservation Physiology Interface | 2 | 2 | 1 | 3 |

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| | | - Population Dynamics and Conservation | | | | |
| B 103 | Fundamentals of Plant Physiology | <p>Cytoplasm and its physical and chemical properties</p> <ul style="list-style-type: none"> – plants & environment interrelationship – plants soil , water & air interrelationships – Enzymes – Respiration and photosynthesis | 2 | 2 | - | 3 |
| Chem 102 | Principles of Organic Chemistry | <p>Formation of carbon - Carbon bonds: (a) Base – catalyzed condensation: Condensation of carbanions with aldehydes, ketones and esters – The alkylation of carbanions – Addition of carbanions to activated olefins. (b) Acid – catalyzed condensations: The self-condensation of olefins - Friedel Craft's reactions - perkin reaction – condensation of aldehydes and ketones - Mannich reaction. (c) Enolates: Control of extent of alkylation - Michael reactions – Robinson annelation. Carbanions stabilised by second-row elements: Use of sulphur- and phosphorus stabilized nucleophilic species in C–C bond formation, especially olefination</p> | 2 | 2 | 1 | 3 |
| B 104 | Principles of cytology & Genetics | <p>Cellular structure</p> <ul style="list-style-type: none"> - Cell organelles - Monohybrid standard inheritance – Mechanisms – Dihybrid inheritance – Principles of genetics, Kinds & specifications – Effects of environmental pollution on the genetic makeup. | 2 | 2 | 1 | 3 |

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| | | The organization, evolution, modification, and functions of the cytological and genetic systems. | | | | |
| B 105 | Introduction to Plant Ecology & Taxonomy | <p>Plant ecology: vegetation & its evolution – plant succession – Classification of plants according to their water requirements —Soil formation & characteristics – Soil micro flora .</p> <p>Plant taxonomy: Historical review – structure & types of flowers , inflorescence, fruits, pollination, fertilization – Study of concise families of the monocots and dicots</p> | 2 | 2 | 1 | 3 |
| Chem 141 | Principles of Physical Chemistry | Principles of: Chemistry, gas laws, thermochemistry and their laws, solution chemistry and properties of solutions, and basic information about chemical equilibrium and ionic equilibrium and the factors affecting them. | 1 | 2 | - | 2 |
| G S 104 | Cultural Subject (2) | <p>This course examines the primary role of human resources development (HRD) in the organization to help people & organizations effectively manage change. This highly interactive course focuses on strategies for assessing, designing, & implementing training and organizational development efforts that positively impact the performance of the individual & the work group.</p> <p>The course provides an overview of change interventions, including training & staff development; succession planning & performance management. factors that influence HRD; the consulting role & skills of the HRD professional, including facilitation & group dynamics; & the trends in HRD, such as human performance technology & the work out process model.</p> | 2 | - | - | 2 |

Second Level

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| B 201 | General and Medical Bacteriology | <p>Bacteriology: This includes the basic features of general bacteriology: Classification - cell structure – Nutrition, Growth & control of bacteria-pathogenic bacteria, biotechnology.</p> <p>Describe the common diseases and life-threatening conditions as regards etiology, pathogenesis, clinical features, differential diagnosis and complications.</p> | 2 | 2 | 1 | 3 |
| B 202 | Mycology & Plant Pathology | <p style="text-align: center;">Mycology: Classification – Fungal biology – Pathogenic fungi, biotechnology.</p> <p style="text-align: center;">Biology of fungi and their role as plant pathogens; plant disease epidemiology and understanding fungal populations; infection processes and plant defense.</p> | 2 | 2 | 1 | 3 |
| B 204 | Principles and theories of Biotechnology | <p>Biotechnology: Principles and Theories:</p> <p>The integration of natural science and organisms, cells, parts thereof, and molecular analogues for products and services. Developed techniques of using live organisms or enzymes from organisms to produce products and processes useful to humans. Genetic engineering : Techniques to alter the chemistry of genetic material (DNA and RNA), to introduce these into host organisms and thus change the phenotype of the host organism. Transformation procedures through which a piece of DNA is introduced in a host: microbes, plant and animals. Bioreactors: vessels in which raw materials are biologically converted into specific products, individual enzymes, etc., using microbial plant, animal or human cells.</p> | 1 | 2 | - | 2 |

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| Math 201 | General Mathematics (2) | <ul style="list-style-type: none"> * Integration I. Introduction to integration * Derivatives I. Introduction to differentiation. * Derivatives II. Rules of differentiation, rates of change. * Applications of derivatives. | 2 | - | 2 | 3 |
| B 204 | Plant Biochemistry | <p>Descriptive biochemistry of macromolecules of plant cell</p> <p>– Functional biochemistry: Carbohydrate metabolism, Lipid metabolism, amino acids and protein metabolism, Plant hormones metabolism.</p> | 2 | 2 | - | 3 |
| Chem 201 | Principles of Analytical Chemistry | <p>Introduction to atomic and molecular absorption, quantitative analysis - gravimetric analysis, titrations – introduction to chromatographic separations, methods gas chromatography, liquid chromatography ion exchange chromatography, capillary zone electrophoresis - introduction to oxidation/reduction reactions - introduction to chemical sensors, biosensors, ELISA's, mass spectrometry (GC-MS, LC-MS, ICP-MS)</p> | 1 | 2 | - | 2 |
| Phys 201 | Principles of Electricity and Biological Systems | <ul style="list-style-type: none"> * Measuring intracellular Ca²⁺ signals I: principles of fluorescent indicators based on BAPTA, instrumentation. * Measuring intracellular Ca²⁺ signals II: genetically encoded Ca²⁺ sensors, fluorescence resonance energy transfer. * Transfer function for a troponin C-based genetically encoded Ca indicator * Electrical Signals I: Hodgkin-Huxley equations, basis of cellular excitability. Electrical Signals II: Structure and function of ion channels | 1 | - | 1 | 2 |

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| | | <p>* Ca²⁺ entry pathways I: voltage-gated Ca²⁺ channels. Ca²⁺ entry pathways II: ligand-gated Ca²⁺ channels, TRP Channels</p> <p>*Interplay between plasma membrane and intracellular Ca²⁺ channels: Ryanodine and IP₃ receptors, Ca-induced Ca release, cardiac EC coupling, Ca²⁺ oscillations.</p> | | | | |
| B 205 | Nuclear & Cytoplasmic Genetics | <p>Review of mitosis & meiosis - basis of inheritance; structure of nucleic acids & proteins.-structure & function of nuclear material during the cell cycle - packaging of DNA into the nucleus & ultimately into chromosomes - DNA replication & segregation at the molecular level</p> | 1 | - | 1 | 2 |
| B 206 | Virology and Immunology | <p>What are viruses?, their structures, types, methods of replications, classifications, viruses as pathogens to humans, animals and plants, examples of viral pathogens. Economic importance and use for vaccination.</p> <p>Human immune systems: cells and organs of immune systems, innate and specific systems, antibody diversity, immune disorders.</p> | 2 | 2 | 1 | 3 |
| B 210 | Plant Tissue Culture & Nutrition | <p>Sexual & vegetative propagation of plants- Hormones- differentiation and control of proliferation in cell and protoplast cultures- Morphogenesis in vitro: studies on regeneration- Isolation- culture and fusion of protoplasts from higher plants- Secondary metabolism in tissue cultures- Embryo and organ culture</p> <p>Nutrient cultures: Types & composition of nutrient cultures-Specifications and factors affecting nutrient cultures.</p> | 1 | 2 | - | 2 |

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| <p>B 207</p> | <p>Mineral nutrition and Physiology of Plant Growth, Development</p> | <p>Germination & dormancy</p> <ul style="list-style-type: none"> – Growth: definitions & growth curves – growth conditions – Physiology of flowering, fruiting & yield. Growth hormones: definitions, properties – Classification and mode of action & metabolism. <p>Mineral nutrition: Mineral composition of plant ash-</p> <p>Essential & non-essential elements-availability</p> <p>- Functions-</p> <p>Deficiency symptoms of major and minor elements</p> <p>- Mineral salt absorption and translocation.</p> | <p style="text-align: center;">2</p> | <p style="text-align: center;">2</p> | <p style="text-align: center;">-</p> | <p style="text-align: center;">3</p> |
| <p>B 209</p> | <p>Phycology & Lichens</p> | <p>Algae in biotic associations</p> <ul style="list-style-type: none"> - Algal diversity – taxonomy, systematic - Phytoplankton ecology Macroalgae and Periphyton Ecology - Nutrition & growth – Lichen classification & structure | <p style="text-align: center;">1</p> | <p style="text-align: center;">2</p> | <p style="text-align: center;">-</p> | <p style="text-align: center;">2</p> |

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| B 208 | Plant Molecular Biology | <p>The discipline of plant molecular biology uses genetic, genomic, biochemical, cell biological, and computational approaches to understand plant growth, physiology, and development at a molecular level.</p> <p>Transfer of molecules across membranes</p> <ul style="list-style-type: none"> - molecular machines that mediate membrane transport - interactions among transport proteins - Factors affecting transport processes. | 2 | 2 | - | 3 |
| B 211 | Nucleic Acids Metabolism | <p>Nucleic acid structure, <i>in-vivo</i> and <i>in-vitro</i> biosynthesis of nucleic acids, degradation of nucleic acids, diseases associated with nucleic acid metabolic disorders.</p> | 2 | 2 | 1 | 3 |
| B 212 | Soil Microbes & Biofertilizers | <p>Soil formation- the soil profile and its layers- Soil classification, physical properties- chemical properties</p> <ul style="list-style-type: none"> - Soil biology and ecology- <p>Essential plant nutrients, bioavailability.</p> <p>Biofertilizers, types, production, biofertilizer</p> <ul style="list-style-type: none"> -plant interaction, Role of biofertilizers in plant growth and development | 1 | 2 | 1 | 2 |
| B 213 | Environmental pollution | <p>It deals with the following areas: water, air, soil, solid wastes, radioactive pollution. The course also focus on pollution and environmental management topics. The course also includes an introduction to practical aspects of the characterization of pollution, based on field collection and laboratory analysis of water samples.</p> | 1 | 2 | 1 | 2 |

Third Level

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| Math 301 | Biomathematics | <p>Descriptions: Single species population dynamics: Models in discrete and continuous time: basic reproductive number; compensatory and dispensatory competition; transcritical, tangent and period doubling bifurcations, chaos. Harvesting: maximum sustainable yield; yield effort curves. Population dynamics of interacting species: host-parasitoid interactions: Nicholson-Bailey model; Jury conditions and Naimark-Sacker bifurcations. Predator-prey models: Lotka-Volterra model; phase plane analysis; Routh-Hurwitz conditions and Hopf bifurcations; Poincare-Bendixon theorem, Dulac condition; Lyapunov functions; Volterra's principle.</p> | 2 | - | 2 | 3 |
| T 301 | Biotechnology and protein production in Bacteria and Fungi | <p>Different cloning and strategies into bacteria and fungi. Boosting gene expression in the producing microbe, genetic modifications of cloned genes, tags necessary for protein purifications. Quantification of the product.</p> | 2 | 2 | - | 3 |
| B 301 | Physiology of Microorganisms | <p>*Structural organization and molecular architecture of microbial cell *Microbial growth: assessment, kinetics & mechanism * Microbial metabolism * Biodegradation of natural substances * Fermentation & biotechnology.</p> | 2 | 2 | - | 3 |
| B 302 | Genetic Engineering and Gene delivery into Plants, animals and microbes | <p>General introduction to the concepts of genetic engineering -Use of various enzymes in recombinant DNA work - Vectors in gene cloning-plasmids,bacteria phages, shuttle vectors, Ti plasmid, expression vectors, shotgun cloning and cDNA cloning techniques. - Selection of recombinant DNA clones.</p> | 2 | 2 | - | 3 |

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| | | <ul style="list-style-type: none"> - Construction of genomic and cDNA libraries. - Identification and characterization of insert DNA fragments. -Restriction mapping. - Chromosome walking and chromosomal localization of genes. <p>RFLP and other uses of cloned sequences.</p> <ul style="list-style-type: none"> -Cloning of microbial genes PCR-based analysis, microcloning, DNA fingerprinting. | | | | |
| Chem 301 | Spectral & Quantitative Analysis | Principles and applications of digital spectral analysis, least squares, random sequences, parametric, and nonparametric methods for spectral estimation | 2 | 2 | - | 3 |
| B 303 | Flora & Medicinal Plants | <p>Ecological characteristics of Egypt, Historical notes on the flora of Egypt, Western desert & its flora, The Sinai peninsula & its flora, The Nile region & its flora. Phytodiversity & Conservation in Egypt</p> <ul style="list-style-type: none"> - Ethnobotany & Traditional Systems of medicine - Pharmacognosy of Medicinal Plants - Plantation | 2 | 2 | - | 3 |
| T 302 | Molecular Genetics | <p>-Molecular Cloning Methods - Molecular tools- Prokaryotic Transcription - Gene regulation in prokaryotes - Prokaryotic transcription</p> <p>Genetics and Evolution - DNA Protein Interactions - DNA Protein Interactions - Eukaryotic RNA polymerases/promoters - General Transcription Factors - Chromatin structure - RNA processing - Genome Organization, Basic Diploid Genetics</p> <p>T Molecular Evolution/bioinformatics, reverse genetics/gene expression - DNA Replication II - Evolutionary Biology</p> | 2 | 2 | - | 3 |

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| T 303 | Technology of Plant Breeding | <ul style="list-style-type: none"> - Importance of genetic resources and plant breeding for sustainable and successful plant growing. - Genetic variation and gene erosion in horticultural plant species. - Collections and international aspects of genetic resources. - Biotechnological tools and their use in plant breeding. - DNA markers and their use in plant breeding. - Case studies on e.g. disease resistance or product quality and how these characteristics can be genetically altered and improved. Case studies to be reported in writing and orally. - Excursions to institutes or companies involved in plant breeding. | 2 | 2 | - | 3 |
| T 304 | Biotechnology & Natural Resource Management | <p>Substrates for biotechnology, genetics & biotechnology, bioprocess/fermentation technology, enzyme technology, biological fuel generation, single cell protein.</p> <p>Biotechnology and medicine.</p> <p>Biotechnology in agricultural and forestry industries, Food and beverage biotechnology.</p> <p>Biotechnology and production of biopolymers from higher plants and from microorganisms.</p> <p>Technology & Resource Management</p> <ul style="list-style-type: none"> - Aromatic Plants, Nutraceuticals And cosmeceuticals - Marketing Management - Downstream processing of herbal drugs | 2 | 2 | - | 3 |

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| | | - Financial Management. | | | | |
| B 305 | Technology of Biofuel Production | <ul style="list-style-type: none"> Feedstock economics - Ethanol dry milling production - Ethanol cellulosic technology -Biobutanol and other alcohols - Biodiesel Transesterification - Biodiesel Thermaldepolymerization - Pipeline operations-Boutique fuels - Terminal operations - Fuel-retailing economics - World oil/alternatives environment - Clean Air/Energy Policy Act - Fuel specifications - Global influences - Risk management | 2 | 2 | - | 3 |
| T 304 | Biotechnology and Food Production | <ul style="list-style-type: none"> - Biotechnology for fermented food. - Food additives - Protein production - Enzymes processed meats | 2 | 2 | - | 2 |

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| <p>T 306</p> | <p>Biotechnology for primary products</p> | <ul style="list-style-type: none"> -Microbial metabolism - Microbial process development, Bioreactor systems including utilities, Fluid flow and mixing - Flow behavior, mixing, power consumption and shear properties of Rushton turbine, helical, anchor, bubble column, external loop, airlift etc. Heat transfer – different modes of heat transfer, Mass transfer in microbial processes, -Enzyme Kinetics – Determination of rate parameters and reaction kinetics, - Bioreactor analysis – Ideal and non-ideal reactor, Modes of culture – Batch, fed batch, continuous, recycle. Fluidized bed bioreactors and immobilized bioreactors, Scale up of microbial processes with case studies related applications in various biotech and biopharma industries | <p>2</p> | <p>2</p> | <p>-</p> | <p>3</p> |
| <p>T 307</p> | <p>Nano -Biotechnology</p> | <p>Introduction to the practice and discipline of nanotechnology - Physical basis and principles of nanotechnology</p> <ul style="list-style-type: none"> - Industry applications - Carbon Nanotube Technologies (CNT) - MEMS - Micro Electro Mechanical Systems – Nanofabrication | <p>2</p> | <p>2</p> | <p>-</p> | <p>3</p> |

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| | | <ul style="list-style-type: none"> – Polymer chemistry applications in nanotechnology – Role of surfaces in nanotechnology devices | | | | |
| T 308 | Genome & Bioinformatics | <p>Scope of Bioinformatics and computational biology; Biological databases and various file formats; Sequence retrieval and submission.</p> <p>Homology search, sequence alignment and analysis using bio-algorithms such as dynamic programming.</p> <p>Gene and promoter predictions, challenges, strategies and tools evaluation.</p> <p>Phylogenetic analysis and tree evaluation. Sequence & structure analysis of RNA and Protein molecule. Applications of bioinformatics in drug discovery, pharmacogenomics, systems biology and next generation sequence.</p> | 2 | 2 | - | 3 |

Forth Level

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| T 401 | Bioreactors Technology | <p>Industrial Microbiology and Fermentation Processes</p> <ul style="list-style-type: none"> – Reactors design and dynamics – Nonideal mixing bioreactors – Immobilized biocatalysts – multiphase bioreactors – Batch fermentation reactors, continuous fermentation reactors. | 2 | 2 | - | 3 |
| T 402 | Microbial Biotechnology | <p>Downstream processing</p> <ul style="list-style-type: none"> - Methods for vitamins, amino acids, organic acids, enzymes, antibiotics, alcohols - Applications of cells in bioprocesses (lactic acid bacteria, yeasts, mixed cultures) microbes as bio-control agents and chemical factories. | 2 | 2 | - | 3 |
| T 403 | Genetically Engineered Organisms and Biosafety | <ul style="list-style-type: none"> • Genetically Modified Plants And Microorganisms - Regulation and Containment for: Field Tests of Genetically Modified Plants and Genetically Modified Microorganisms - Roles and Responsibilities of Pertinent Authorities - The National Biosafety Committee - The Institutional Biosafety Committee and the Biological Safety Officer. - Movement of Regulated Material Within or Between Institutions and countries. | 2 | 2 | - | 3 |
| Chem 401 | Chemistry of Natural Products | <ul style="list-style-type: none"> - Natural product chemistry - Classification of natural products - Isolation techniques and physiochemical data, - Terpenes, - Steroids, - Fatty acids and related compounds, - Sugars, - Carboaromatic and related compounds, | 2 | 2 | - | 3 |

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| | | <ul style="list-style-type: none"> - Alkaloids and non-alkaloids containing nitrogen. - Aspects of natural product photochemistry. | | | | |
| Chem 402 | Chemistry & Technology of Polymers | <ul style="list-style-type: none"> - Molecular Weights and Distributions - Chain Statistics and Polymer Chain Dimensions - *Thermodynamics of Polymer Solutions, Phase Behavior and Polymer Blends - *Light Scattering from Polymer Solutions - *Hydrodynamic dimensions: Intrinsic Viscosity and Principles of SEC - *Dilute Solution Dynamics: Rouse and Zimm Models. - * Semidilute Solutions: Reptation Model. | 2 | 2 | - | 3 |
| T 404 | Application of Biotechnology in Medicine and Pharmaceutical Industry | <p>Biotechnology applies the techniques of modern molecular biology to improve the efficiency and reduce the environmental impacts of industrial processes like , antibiotics, vitamins, insulin, growth hormones....etc. Biotechnical methods are now used to produce many proteins for pharmaceutical and other specialized purposes. Gene therapy</p> <p>Altering DNA within cells in an organism to treat or cure a disease, DNA fingerprinting is the process of cross matching two strands of DNA.</p> <p>In criminal investigations, Paternity determination, DNA testing is also used on human fossils to determine how closely related fossil samples are from different geographic locations and geologic areas.</p> <p>The results shed light on the history of human evolution and the manner in which human ancestors settled different parts of the world.</p> <p>Diagnosis of different diseases.</p> | 1 | - | - | 1 |
| T 405 | Biotechnological Production of Secondary Substances | <p>Upstream processing, including cell culture and fermentation</p> <ul style="list-style-type: none"> - Selection, preparation, and operation of bioreactors (in the batch, fed-batch, and perfusion modes) and related instrumentation (including optical sensors). | 1 | 2 | - | 2 |

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| T 406 | Intellectual Property Rights and patents | Intellectual property rights (IPR) is a legal concept which refers to creations of the mind for which exclusive rights are recognized. Under intellectual property law, owners are granted certain exclusive rights to a variety of intangible assets, such as discoveries, inventions and designs. Common types of intellectual property rights include copyright, trademarks, patents, industrial design rights, trade dress, and in some jurisdictions trade secrets. Understanding Intellectual Property Rights in Egypt. | 1 | - | 2 | 2 |
| T 407 | Interactive Training in related Factory (Research Project) | Application of different feedstock's in various industries | 1 | - | - | 1 |
| T 408 | Biotechnology of Enzymology and food industries | The nature of enzymes - The application of enzymes - Genetic engineering and protein engineering of enzymes - The technology of enzyme production - Immobilized enzymes. | 2 | 2 | - | 3 |
| T 411 | Algal Biotechnology and Production of Biofertilizers | <ul style="list-style-type: none"> - Algal Metabolism, Growth and Biokinetics - Mass production of algae - Bioremediation for Soil, water Environment - Biotreatment of Metals - Biofuels - Animal feedstock - Petroleum biodegradation - Decolorization of dyes - Food supplements - Immune Enhancing factors - Anticancer activity - Soil reclamation. | 2 | 2 | - | 3 |

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| | | <ul style="list-style-type: none"> - Algal technology - Production of algal biofertilizers - Biofertilizers - Types and mode of action- - Production of biofertilizers from blue-green algae. - Application of biofertilizer and biosafety. - Advanced aspects in Algal technology. | | | | |
| T 410 | Applied Industrial Technology | <p>Aerobic and anaerobic fermentations; Kinetics of growth and product formation</p> <ul style="list-style-type: none"> - chemically structured models; mass transfer, diffusion, membrane transport; Fermentr design - operation, measurement and control in fermentation; Aeration and agitation in fermentation: Oxygen requirement, measurement of adsorption coefficients, bubble aeration, mechanical agitation, correlation between mass-transfer coefficient and operating variables, immobilized cell reactors. | 2 | 2 | - | 3 |
| T 409 | Biotechnology and Animal Breeding | <p>Animal biotechnology and the genetic improvement of domesticated animal species, for milk and meat production. animal biotechnology such as the freezing of semen, embryo transfer, in vitro fertilization, gene transfer and cloning – all of which allow scientists and breeders even greater control over future animals. The animal biotechnology industry faces a variety of scientific, regulatory, ethical and public acceptance issues.</p> | 2 | 2 | - | 3 |
| T 412 | Independent study and seminar | <p>Students will be assigned special topics to write papers and make oral presentations in special sessions</p> | 2 | - | 2 | 2 |
| T 413 | Ethical & Biotechnology | <p>One of the main areas of concern is the safety of genetically engineered food ; distinguish between technology-inherent risks and technology-transcending risks, potential ecological risks identified are increased weediness, The reduction of biodiversity, Labeling food derived from GM plants and animals is an important.</p> | 1 | - | 2 | 2 |

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| <p>T 414</p> | <p>Quality Specifications and Marketing</p> | <p>Introduction</p> <ul style="list-style-type: none"> - Quality specifications - Production of biological invitations; Patent protection. - Trade secrets. - Plant breeder's rights. - Safety in biotechnology: Interaction. - Problem of organism pathogenicity. - Problems of biological active biotechnology products. | <p>1</p> | <p>-</p> | <p>2</p> | <p>2</p> |
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