


UNIVERSITY OF MUMBAI

No. UG/116 of 2016-17

CIRCULAR:-

A reference is invited to the Syllabi relating to the B.Sc. degree course , **vide** this office Circular No. UG/126 of 2011, dated 13th June, 2011 and the Principals of affiliated Colleges in Science are hereby informed that the recommendation made by Ad-hoc Board of Studies in Biotechnology at its meeting held on 18th February, 2016 has been accepted by the Academic Council meeting held on 24th June, 2016 **vide** item No. 4.88 and that in accordance therewith, the revised syllabus as per the Choice Based Credit System for F.Y. B.Sc. Biotechnology (Sem. I & II), which are available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2016-17.

MUMBAI – 400 032
October, 2016


(Dr.M.A.Khan)
REGISTRAR

To,

The Principals of the affiliated Colleges in Science.

A.C/4.88/24.06.2016


No. UG/116 -A of 2016

MUMBAI-400 032

24 October, 2016

Copy forwarded with Compliments for information to:-

- 1) The Deans, faculties of Science,
- 2) The Convener, Ad-hoc-Committee in Biotechnology,
- 3) The Professor-cum-Director, Institute of Distance & Open Learning (IDOL)
- 4) The Director, Board of College and University Development,
- 5) The Co-Ordinator, University Computerization Centre,
- 6) The Controller of Examinations.


(Dr.M.A.Khan)
REGISTRAR

PTO..

SEMESTER I

Chemistry I

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|---|--|-------------|----------------|
| USBT | Basic Chemistry I | 2 | |
| Unit I Nomenclature and Classification | <p>Nomenclature and Classification of Inorganic Compounds: Oxides, Salts, Acids, Bases, Ionic, Molecular and Coordination Compounds</p> <p>Nomenclature and Classification of Organic Compounds: Alkanes, Alkenes, Alkynes, Cyclic hydrocarbons, Aromatic compounds, Alcohols and Ethers, Aldehydes and Ketones, Carboxylic acids and its derivatives, Amines, Amides, Alkyl halides and Heterocyclic compounds</p> | 15 lectures | |
| Unit II Water and Buffers | <p>Chemistry of Water: Properties of Water, Interaction of Water with solutes (Polar, Non-polar, Charged), non-polar compounds in water – change in its structure and the hydrophobic effect, role of water in biomolecular structure and function and water as a medium for life</p> <p>Solutions: Normality, Molarity, Molality, Mole fraction, Mole concept, Solubility, Weight ratio, Volume ratio, Weight to volume ratio, ppb, ppm, millimoles, milliequivalents (Numericals expected).</p> <p>Primary and Secondary Standards: Preparation of standard solutions Principle of Volumetric Analysis.</p> <p>Acids and Bases: Lowry-Bronsted and Lewis Concepts. Strong and Weak Acids and Bases - Ionic product of Water - pH, pK_a, pK_b. Hydrolysis of Salts.</p> <p>Buffer solutions – Concept of Buffers, Types of buffers, Derivation of Henderson equation for acidic and Basic buffers, Buffer action, Buffer capacity. (Numericals expected.) pH of buffer solution.</p> | 15 lectures | |
| Unit III Titrimetry and Gravimetry | <p>Titrimetric Analysis: Titration, Titrant, titrand, End point, Equivalence point, Titration Error, Indicator, Primary and Secondary standards characteristics and examples</p> <p>Types of Titration – Acid –Base, Redox.</p> | 15 lectures | |

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| | <p>Precipitation, Complexometric titration. Acid – base titration.-Strong Acid Vs Strong Base -Theoretical aspects of titration curve and end point evaluation.</p> <p>Theory of Acid –Base Indicators, Choice and suitability of Indicators.</p> <p>Gravimetric Analysis: Solubility and Precipitation, Factors affecting Solubility, Nucleation, Particle Size, Crystal Growth, Colloidal State, Ageing/Digestion of Precipitate. Co-Precipitation and Post-Precipitation. Washing, drying and ignition of Precipitate. (NumericalsExpected).</p> | | |
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Chemistry II

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|------------------------------------|---|-------------|----------------|
| USBT | Bioorganic Chemistry I | 2 | |
| Unit I Chemical Bonds | <p>Chemical Bonds: Ionic bond: Nature of Ionic bond, structure of NaCl, KCl and CsCl, factors influencing the formation of ionic bond.</p> <p>Covalent Bond: Nature of covalent bond, structure of CH₄, NH₃, H₂O, shapes of BeCl₂, BF₃</p> <p>Coordinate Bond: Nature of coordinate bond,</p> <p>Non Covalent bonds: van Der Waal's forces: dipole - dipole, dipole - induced dipole.</p> <p>Hydrogen Bond: Theory of hydrogen bonding and types of hydrogen bonding (with examples of RCOOH, ROH, salicylaldehyde, amides and polyamides).</p> | 15 lectures | |
| Unit II Stereochemistry | <p>Isomerism – Types of isomerism: constitutional isomerism (chain, position and functional) and stereoisomerism, Chirality.</p> <p>Geometric Isomerism and Optical Isomerism: Enantiomers, diastereomers, and racemic mixtures cis-trans, threo, erythro and meso isomers. Diastereomerism (cis-trans isomerism) in alkenes and cycloalkanes (3 and 4 membered ring)</p> <p>Conformation: Conformations of ethane. Difference between configuration and conformation.</p> | 15 lectures | |

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| | <p>Configuration, asymmetric carbon atom, stereogenic/ chiral centers, chirality, representation of configuration by “flying wedge formula”</p> <p>Projection formulae – Fischer, Newman and Sawhorse. The interconversion of the formulae.</p> | | |
| <p>Unit III Analytical Techniques</p> | <p>Methods of Separation Precipitation, Filtration, Distillation and Solvent Extraction.</p> <p>Analytical Techniques Chromatography: Definition, Principles of Chromatography. Types of Chromatography: Introduction to Paper Chromatography, Thin Layer Chromatography, Column Chromatography and its Applications.</p> <p>Colorimetry: Principle, Beer-Lambert’s law.</p> | 15 lectures | |

SEMESTER I

Basic Life I

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|---|--|-------------|----------------|
| USBT | Biodiversity and Cell Biology | 2 | |
| <p>Unit I Origin of Life and Biodiversity (Animal, Plant, Microorganism)</p> | <p>Origin of Life, Chemical and Biological Evolution, Origin of Eukaryotic cell.</p> <p>Concept of Biodiversity, Taxonomical, Ecological and Genetic Diversity and its Significance</p> <p>Introduction to Plant Diversity: Algae, Fungi, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms (with one example each)</p> <p>Introduction to Animal Diversity: Non-Chordates and Chordates with at least one representative examples.</p> | 15 lectures | |

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| | Introduction to Microbial Diversity Archaeobacteria, Eubacteria, Blue-green Algae, Actinomycetes, Eumycota-habitats, Examples and Applications. | | |
| Unit II Ultra Structure of Prokaryotic and Eukaryotic Cell. | <p>Ultrastructure of Prokaryotic cell: Concept of Cell Shape and Size. Detail structure of Slime Layer, Capsule, Flagella, Pilli, Cell Wall (Gram Positive and Negative), Cell Membrane, Cytoplasm and Genetic Material Storage Bodies and Spores</p> <p>Ultrastructure of Eukaryotic Cell: Plasma membrane, Cytoplasmic Matrix, Microfilaments, Intermediate Filaments, and Microtubules Organelles of the Biosynthetic-Secretory and Endocytic Pathways – Endoplasmic Reticulum & Golgi Apparatus. Lysosome, Endocytosis, Phagocytosis, Autophagy, Proteasome Eucaryotic Ribosomes, Mitochondria and Chloroplasts Nucleus –Nuclear Structure, Nucleolus</p> <p>External Cell Coverings: Cilia And Flagella</p> <p>Comparison Of Prokaryotic And Eukaryotic Cells</p> | 15 lectures | |
| Unit III Bacteria and Viruses | <p>Bacteria : Classification, Types, Morphology (Size, Shape and Arrangement) Cultivation of Bacteria. Reproduction and Growth (Binary Fission, Conjugation and Endospore formation) Growth kinetics. Isolation and preservation. Significance of Bacteria</p> <p>Viruses :General characters, Classification (Plant, Animal and Bacterial Viruses) Structure and Characterization of Viruses and Significance</p> | 15 lectures | |

Basic Life II

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|-------------|----------------------|---------|----------------|
| USBT | Microbial Techniques | 2 | |

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| <p align="center">Unit I Microscopy and Stains</p> | <p>Microscopy and Stains Microscope- Simple and Compound: Principle. Parts, functions and applications. Dark field and Phase contrast microscope Stains and staining solutions-Definition of dye and chromogen. Structure of dye and chromophore. Functions of mordant and fixative. Natural and synthetic dyes. Simple staining, Differential staining and acid fast staining with specific examples</p> | <p>15 lectures</p> | |
| <p align="center">Unit II Sterilization Techniques</p> | <p>Sterilization and Disinfection Definition : Sterilization and Disinfection. Types and Applications Dry Heat, Steam under pressure, Gases, Radiation and Filtration Chemical Agents and their Mode of Action - Aldehydes, Halogens, Quaternary Ammonium Compounds, Phenol and Phenolic Compounds, Heavy Metals, Alcohol, Dyes, and Detergents Ideal Disinfectant. Examples of Disinfectants and Evaluation of Disinfectant</p> | <p>15 lectures</p> | |
| <p align="center">Unit III Nutrition, Cultivation and Enumeration of Microorganisms</p> | <p>Nutrition and Cultivation of Microorganisms Nutritional Requirements : Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulphur and Growth Factors. Classification of Different Nutritional Types of Organisms. Design and Types of Culture Media. Simple Medium, Differential, Selective and Enrichment Media Concept of Isolation and Methods of Isolation. Pure Culture Techniques Growth and Enumeration Growth phases, Growth Curve. Arithmetic Growth and Growth Yield. Measurement of Growth. Chemostat and Turbidostat Enumeration of Microorganisms- Direct and Indirect Methods Preservation of Cultures- Principle and Methods. Cryogenic Preservation Advantages and Limitations</p> | <p>15 lectures</p> | |

Biotechnology I

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|---|---|-------------|----------------|
| USBT | Introduction to Biotechnology | 2 | |
| Unit I Scope and Introduction to Biotechnology | History and Introduction Of Biotechnology What is Biotechnology? Definition of Biotechnology, Traditional and Modern Biotechnology, Branches of Biotechnology- Pharmaceutical Biotechnology, Plant, Animal Biotechnology, Marine Biotechnology, Industrial Biotechnology, Environmental biotechnology. Biotechnology research in India. Biotechnology in context of developing world. Public perception of Biotechnology Ethics in biotechnology and IPR | 15 lectures | |
| Unit II Introduction to Industrial Biotechnology | -Industrial production of Antibiotics , enzymes, organic acids ,vitamins, amino acids, beverages and single cellproteins | 15 lectures | |
| Unit III Introduction to Food Biotechnology | Food Biotechnology Biotechnology application to food stuffs Career in Food Biotechnology Activities of Food Biotechnologist Unit Operation in Food Processing Quality Factors in Preprocessed Food Food deterioration and its control Rheology of Food products Microbial role in food products Yeast, Bacterial and other microorganisms based process and products Modern Biotechnological regulatory aspects in food industries Biotechnology and Food : A Social Appraisal | 15 lectures | |

Biotechnology II

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|-------------------------------|--|-------------|----------------|
| USBT | Molecular biology | 2 | |
| Unit I Replication | DNA replication in prokaryotes and eukaryotes- Semi-conservative DNA replication, DNA polymerases and its role, E.coli chromosome replication, Bidirectional Replication of circular DNA molecules. Rolling circle replication, DNA replication in Eukaryotes DNA recombination – Holliday model for Recombination | 15 lectures | |
| Unit II | Definition and Types of Mutations. Mutagenesis and Mutagens.(Examples of P | | |

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| Mutation and DNA repair | Physical, Chemical and Biological Mutagens) Mutation- Definition, Classification of Mutation, Types of Point Mutations, Mutagen- Physical and Chemical Mutagens and Mode of Action Photoreversal, Base Excision Repair, Nucleotide Excision Repair, Mismatch Repair, SOS Repair and Recombination Repair. | 15 lectures | |
| Unit III r-DNA technology | Experimental evidences for DNA and RNA as genetic material. Chromosome Structure in Prokaryotes and Eukaryotes : Structure of Functional state of E.coli Chromosome, Chemical Composition of Eukaryotic Chromosomes, Levels of DNA Packaging in Eukaryotic Chromosomes, Nucleosome, Centromere and Telomeres . Chromosome Banding Control of gene expression and gene complexity in Prokaryotes and Eukaryotes., Genetic Engineering in Ecoli and other Prokaryotes, Yeast, Fungi and Mammalian Cells Enzymes- DNA Polymerases, Restriction Endonucleases, Ligases, Reverse Transcriptases, Nucleases, Terminal Transferases, Phosphatases Cloning Vectors-Plasmids, Bacteriophage Vectors, Cosmids, Phagemids, Vectors for Plant and Animal Cells, Shuttle Vectors, YAC Vectors, Expression Vectors Isolation and Purification of DNA (Genomic, Plasmid) and RNA,, Isolation of Gene of Interest- Restriction Digestion, Electrophoresis, blotting,, Cutting and Joining of DNA,, Methods of Gene Transfer in Prokaryotic and Eukaryotic Cells Model Organism for Genetic Analysis of Development. Development results from Differential Gene expression. Genetic study: Genetic Regulation of the development of the Drosophila body plan | 15 lectures | |

SEMESTER II

Chemistry I

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|---|---|-------------|----------------|
| USBT | Bioorganic Chemistry | 2 | |
| Unit I Biomolecules: Carbohydrates and Lipids | <p>Carbohydrates: Structure, Function, Classification, Characteristic Reactions, physical and Chemical properties, D & L Glyceraldehydes, structure of monosaccharide, disaccharides, and polysaccharides. Isomers of monosaccharides, chemical/physical properties of carbohydrate, chemical reactions for detection of mono., di and polysaccharides,</p> <p>Lipids: Classification of Lipids, Properties of saturated, unsaturated fatty acids, rancidity, and hydrogenation of oils Phospholipids: lecithin cephalin, plasmalogen Triacylglycerol: structure and function Sterols: Cholesterol: structure and function, Lipoproteins: structure and function, Storage lipids, Structural lipids, Action of phospholipases, Steroids</p> | 15 lectures | |
| Unit II Biomolecules: Proteins and Amino acids | <p>Proteins and Amino acids: Classification, preparation and properties, isoelectric point, peptide synthesis Proteins: Classification based on structure and functions, primary structure, N-terminal (Sanger and Edmans method) and C-terminal analysis (enzyme), Reactions of amino acids, Sorenson's titration, ninhydrin test. Denaturation of protein Structure of peptides. Titration curve of amino acids. Concept of Isoelectric pH, zwitter ion. Glycoproteins</p> | 15 lectures | |
| Unit III Biomolecules: Nucleic Acids | <p>Nucleic Acids: Structure, function of Nucleic acids, properties and types of DNA, RNA. Structure of Purine and Pyrimidine bases Hydrogen bonding between nitrogenous bases in DNA Differences between DNA and RNA, Structure of nucleosides, nucleotides and polynucleotides.</p> | 15 lectures | |

Chemistry II

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|-------------|--------------------------------|---------|----------------|
| USBT | Basic Chemistry | 2 | |
| | Thermodynamics: System, | | |

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| <p align="center">Unit I Thermodynamics</p> | <p>Surrounding, Boundaries Sign Conventions, State Functions, Internal Energy and Enthalpy: Significance, examples, (Numericals expected.)</p> <p>Laws of Thermodynamics and its limitations, Mathematical expression. Qualitative discussion of Carnot cycle for ideal gas and mechanical efficiency. Laws of thermodynamics as applied to biochemical systems.</p> <p>Concept of Entropy, Entropy for isobaric, isochoric and isothermal processes.</p> | <p>15 lectures</p> | |
| <p align="center">Unit II Chemical Kinetics</p> | <p>Reaction kinetics: Rate of Reaction, rate constant, Measurement of Reaction Rates Order & Molecularity of reaction, Integrated rate equation of first and second order reactions (with equal initial concentration of reactants). (Numericals expected) Determination of order of reaction by a) Integration method b) Graphical Method c) Ostwald's Isolation Method d) Half Time method. (Numericals expected).</p> | <p>15 lectures</p> | |
| <p align="center">Unit III Oxidation Reduction reactions</p> | <p>Atomic Chemistry Principals of Oxidation & Reduction Reactions -Oxidising and Reducing agents, Oxidation number, Rules to assign Oxidation numbers with examples ions like oxalate, permanganate and dichromate. Balancing redox reactions by ion electron method Oxidation, Reduction, Addition and Substitution, Elimination Reactions. Synthesis of molecules</p> | <p>15 lectures</p> | |

SEMESTER II

Basic Life I

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|-------------|-------------------------------|---------|----------------|
| USBT | Physiology and Ecology | 2 | |
| | Photosynthesis ,Intracellular | | |

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| <p>Unit I Plant Physiology</p> | <p>organization of photosynthetic system. Fundamental reactions of photosynthesis, photosynthetic pigments, role of light. Hill reaction and its significance, light reactions, cyclic and non-cyclic photo induced electron flow, energetics of photosynthesis, photorespiration, dark phase of photosynthesis, Calvin cycle, C-4 pathway</p> <p>Plant hormones - Auxin ,Gibbrellins, Cytokinins, Ethylene, Abscissic acid Introduction to Secondary Metabolites</p> | <p>15 lectures</p> | |
| <p>Unit II Animal Physiology</p> | <p>Physiology of Digestion</p> <p>Movement of food and absorption, Secretary functions of alimentary canal, digestion and absorption in gut</p> <p>Digestion in Ruminant and Monogastric Animals</p> <p>Excretion and Osmoregulation,</p> <p>Physiology of Respiration, Mechanism of Respiration</p> <p>Physical principles of gaseous exchange transport of O₂ and CO₂ in the blood and body fluids</p> <p>Respiration in Birds</p> <p>Blood and Circulation :Blood composition, Structure and Function of its Constituents Blood Coagulation and anti-coagulants Hemoglobin and its Polymorphism Regulation of the circulation Mechanism and working of Heart in human.</p> <p>Reproduction : Gonidal Hormones and their Function in Male and Female, Reproductive Cycle in Animals, Asexual Reproduction:Fission, Fragmentation and Budding. Sexual reproduction Study of Reproductive Organs in Earthworm</p> | <p>15 lectures</p> | |
| <p>Unit III</p> | <p>Ecology and Biogeography. Ecosystems, Definition and Compone</p> | | |

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| Ecosystem and Interactions | <p>nts, Structure and Function of Ecosystems. Aquatic and terrestrial ecosystems, Biotic and Abiotic factors, Trophic levels, Food chain and Food web, Ecological Pyramids (Energy, biomass and Number) Nutrient Cycle and Biogeochemical cycles: water, Carbon, Oxygen, Nitrogen and Sulphur. Interactions: Commensalism, Mutualism, predation and Antibiosis, Parasitism.</p> | 15 lectures | |
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Basic Life II

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|---|---|----------------|-----------------------|
| USBT | Genetics | 2 | |
| Unit I Genetics Fundamentals | <p>Mendel's Laws of heredity Monohybrid cross: The principle of dominance and segregation. Dihybrid cross: The principle of Independent assortment. Application of Mendel's Principles Punnett Square. Mendel's Principle in Human Genetics. Incomplete dominance and codominance. Multiple alleles. Allelic series. Variations among the effect of the mutation. Genotype and phenotype. Environmental effect on the expression of the Human Genes. Gene Interaction. Epistasis.</p> | 15 lectures | |
| Unit II Microbial Genetics | <p>Microbial Genetics Genetic analysis in bacteria- prototrophs, auxotrophs. Bacteriophages: lytic and lysogenic development of phage. Mechanism of genetic exchange in Bacteria: Conjugation; Transformation; Transduction; (Generalized transduction, Specialized Transduction) Bacterial transposable elements.</p> | 15 lectures | |
| Unit III Population Genetics | <p>Population Genetics Genetic structure of populations – genotypic frequencies and allelic frequencies,</p> | | |

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| | <p>Hardy- Weinberg law and its assumptions</p> <p>Genetic variations in populations- Measuring genetic variation at protein level and measuring genetic variations at DNA level</p> <p>Natural Selection.</p> <p>Genetic Drift</p> <p>Speciation</p> <p>Role of population genetics in Conservation biology</p> | 15 lectures | |
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SEMESTER II

Biotechnology I

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|--|---|-------------|----------------|
| USBT | Tissue Culture and Communication Skills | 2 | |
| Unit I Plant Tissue Culture | <p>Basics of Plant Tissue Culture Cell theory, Concept of cell culture, cellular totipotency,</p> <p>Organization of plant tissue culture laboratory : Equipments and instruments Aseptic techniques: Washing of glassware, Media sterilization, Aseptic workstation, Precautions to maintain aseptic conditions.</p> <p>Culture medium: Nutritional requirements of the explants, PGR's and their in vitro roles, Media preparation Callus culture technique: Introduction, principle, protocols, Genetic variation and applications.</p> | 15 lectures | |
| Unit II Animal Tissue Culture | <p>Basics of Animal Tissue Culture Introduction Cell culture techniques, Equipment and sterilization methodology. Introduction to animal cell cultures: Nutritional and physiological: Growth factors and growth Parameters. General metabolism and Growth Kinetics Primary cell cultures : Establishment and maintenance of primary cell cultures of adherent and non-adherent cell lines with examples.</p> | 15 lectures | |

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| | Application of cell cultures : | | |
| Unit III Scientific Writing and Communication Skills | <p>Communication Skills Introduction to communication -- Elements, definitions, scope of communication and communication as part of science Communication elements --Verbal and nonverbal communications. Principles of effective communication, Oral presentations Scientific reading, writing & presentation Scientific writing Process of Scientific writing: thinking, planning, rough drafts and revising context.</p> <p>Introduction to scientific reports and writings Compilation of experimental data, Communication methods in science, Examples of Scientific and Unscientific writing. Writing papers, reviews, Bibliography Plagiarism--Introduction to Plagiarism , Examples of Plagiarism.</p> | 15 lectures | |

Biotechnology II

| COURSE CODE | TITLE | CREDITS | Notional Hours |
|-------------------------------|---|-------------|----------------|
| USBT | Enzymology, Immunology and Biostatics | 2 | |
| Unit I Enzymes | <p>Definition, Classification, Nomenclature, Chemical Nature, Properties of Enzymes, Mechanism of Enzyme action, Active sites, Enzyme specificity, Effect of pH, Temperature, substrate concentration on enzyme activity, enzyme kinetics, Michelis-Menten equation, types of enzyme inhibitions-Competitive, Uncompetitive, Non-competitive, allosteric modulators Co-Factors,Zymogens, Immobilized Enzymes Application of enzymes</p> | 15 lectures | |
| Unit II Immunology | <p>Introduction to Immunology Overview of Immune Systems, Cell and Organs involved, T and B cells. Innate immunity, Acquired immunity,</p> | 15 | |

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| | <p>Local and Herd Immunity, Humoral and Cellular immunity - Factors influencing and mechanisms of each.</p> <p>Antigens and Antibodies: Types of antigens, General properties of antigens, Haptens and Superantigens Discovery and Structure of antibodies (Framework region) Classes of immunoglobulins, Antigenic determinants.</p> <p>Antigen-Antibody Interactions Hypersensitivity Monoclonal antibodies, Vaccines (Live, Killed) and Toxoid. Problems with traditional vaccines, Impact of Biotechnology on vaccine development.</p> | lectures | |
| <p>Unit III Biostatistics</p> | <p>Defination and Importance of Statistics in Biology Types of Data, Normal and Frequency Distribution Representation of Data and Graphs (Bar Diagrams, Pie Charts and Histogram, Polygon and Curve) Types of population sampling Measures of Central tendency (For Raw, Ungroup & group Data) Mean Median Mode Measures of Dispersion Range, Variance, Coefficient of Variance. Standard Derivation. Standard Error.</p> | 15 lectures | |

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Unit I
Nomenclature and Classification

Unit II
Water and Buffers

Unit III
Titrimetry and Gravimetry

2

Unit I
Chemical Bonds

Unit II
Stereochemistry

Unit III
Analytical Techniques

7

Unit I
Biomolecules: Carbohydrates and Lipids

Unit II
Biomolecules:
Proteins and Amino acids

Unit III
Biomolecules:
Nucleic Acids

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Unit I
Thermodynamics

Unit II
Chemical Kinetics

Unit III
Oxidation Reduction reactions

SEM I

1. Characterization of organic compounds containing only C, H, O elements (no element test) - Compounds belonging to the following classes: carboxylic acid, phenol, aldehyde/ketone, ester, alcohol, hydrocarbon
2. Characterization of organic compounds containing C, H, O, N, S, halogen elements (element tests to be done)
3. Compounds belonging to the following classes: Amine, Amide, Nitro compounds, Thiamide, Haloalkane, Haloarene
- 4 to 6. Qualitative analysis of Inorganic compounds - Three experiments

1. Determination of strength of HCl in commercial sample
2. To standardise commercial sample of NaOH using KHP (Potassium hydrogen phthalate)
3. To standardise commercial sample of HCl using borax.
4. Determination of alkalinity of water sample
5. Determination of strength of HCl in commercial sample
6. Preparation of buffer solutions

1. Determination of acetic acid in vinegar by titrimetric method
2. Determination of the amount of Mg (II) present in the given solution complexometrically
3. Determination of the amount of Fe (II) present in the given solution titrimetrically
4. Determination of amount of $\text{NaHCO}_3 + \text{Na}_2\text{CO}_3$ in the given solid mixture titrimetrically
5. Determination of percent composition of BaSO_4 and NH_4Cl in the given mixture gravimetrically
6. Determination of percent composition of ZnO and ZnCO_3 in the given mixture gravimetrically

Unit volume & weight measurements

Molarity , molality , normality

pH measurement

Reagent Preparation & biochemical calculations

Optical activity of a chemical compound by polarimeter

Conductometry

Safety Measures and practices in chemistry laboratory

SEM II

1. Separation of Cu, Ni and Fe using paper chromatography
2. Amino acids - paper chromatography
3. Determination of fluoride ion using colorimetry
4. Determination of Fe (III) by using salicylic acid by colorimetric titration

1. To determine enthalpy of dissolution of salt like KNO_3
2. Determine the rate constant for hydrolysis of ester using HCl as a catalyst
3. To determine the rate constant for the hydrolysis of ester using H_2SO_4 as catalyst using scientific calculator by Regression analysis
4. To determine the rate constant for the saponification reaction between ethyl acetate and NaOH by back titration method
5. Study the kinetics of reaction between thiosulphate ion and HCl
6. Study reaction between potassium persulphate and potassium periodide kinetically and hence to determine order of reaction

1. Study the reaction between NaHSO_3 and KMnO_4 and balancing the reaction in acidic, alkaline and neutral medium
2. Study transfer of electrons (Titration of sodium thiosulphate with potassium dichromate)
3. Determination of the volume strength of hydrogen peroxide solution by titration with standardised potassium permanganate solution
4. Determination of Fe (II) and Fe (III) in the given mixture titrimetrically
5. Determination of amount of K oxalate and oxalic acid in the given solution titrimetrically

Spot test for carbohydrates & amino acids

Isolation of starch from potato

Isolation of protein from plant source

Isolation of oil from plant source

Estimation of protein by Biuret method

Estimation of protein by Lowry method

Estimation of Reducing sugar by DNSA method

Saponification of fats

Enzyme assay (amylase)

Thin layer chromatography for lipids

Thermochemistry

Determination of an order of reaction

~~Acid~~ titrations

3

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| <p style="text-align: center;">Unit I Origin of Life and Biodiversity (Animal, Plant, Microorganism)</p> |
| <p style="text-align: center;">Unit II Ultra Structure of Prokaryotic and Eukaryotic Cell.</p> |
| <p style="text-align: center;">Unit III Bacteria and Viruses</p> |

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| <p style="text-align: center;">Unit I Microscopy and Stains</p> |
| <p style="text-align: center;">Unit II Sterilization Techniques</p> |
| <p style="text-align: center;">Unit III Nutrition, Cultivation and Enumeration of Microorganisms</p> |

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| <p style="text-align: center;">Unit I Plant Physiology</p> |
| <p style="text-align: center;">Unit II Animal Physiology</p> |
| <p style="text-align: center;">Unit III Ecosystem and Interactions</p> |

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| <p style="text-align: center;">Unit I Genetics Fundamentals</p> |
| <p style="text-align: center;">Unit II Microbial Genetics</p> |

Unit III
Population Genetics

Sem I Life Science

Cell wall staining

Growth curve of E.Coli

Preservation of culture (Glycerol stock)

Enumeration by Breed's count

Enumeration of microorganisms by serial dilution, pour plate, spread plate method

Sterilization of media using autoclave

Gram staining

Differential staining

Study of microscope and its parts

Isolation techniques: T-streak, polygon method

Sem II Life Science

Hill's reaction

Absorbance maxima of plant pigments

Blood grouping study

Study of Animal tissues

Study of pseudopodia (Amoeba)

Study of respiratory system in cockroach (trachea)

Problems in Mendelian genetics

Determination of Allelic and genotype frequencies

Study of effect of mutagens (colchicine, UV)

Earthworm practicals (nerve ring)

5

Unit I
Scope and Introduction to Biotechnology

Unit II

Introduction to Industrial Biotechnology

**Unit III
Introduction to Food Biotechnology**

6

**Unit I
Replication**

**Unit II
Mutation and DNA repair**

**Unit III
r-DNA technology**

11

**Unit I
Plant Tissue Culture**

**Unit II
Animal Tissue Culture**

**Unit III
Scientific Writing and Communication Skills**

12

**Unit I
Enzymes**

**Unit II
Immunology**

**Unit III
Biostatistics**

Sem I Biotechnology

Estimation of starch by Willstater's method

Estimation of glucose by DNSA method

Fermentative production of citric acid

Analysis of milk- Methylene blue

Resazurin test

Phosphatase test

Determination of alcohol content

Qualitative test for biomolecules-Anthrone & Molisch's test for carbohydrates

Estimation of protein by Biuret method

DNA estimation by DPA method

RNA estimation by Orcinol method

Isolation of organism causing Food spoilage

Sem II Biotechnology

PTC: Preparation of stock solutions,

Preparation of Media

Surface Sterilization of explants

Inoculation for callus culture

Media Preparation and sterilization (ATC)

Determination of cell viability by haemocytometer

Extraction of enzyme amylase

Determination of optimum pH for amylase activity

Determination of optimum Temperature for amylase activity

Effect of substrate concentration on enzyme activity

Preparation of review reports of 5 Scientific Papers and presentation (last 5 years)

Laboratory organization-layout assignment

Biostatistics: Biometric analysis for mean, median, mode, standard deviation (e.g. leaves, hair length)

Data representation, frequency polygon, histogram, pie diagram