

BUNDELKHAND UNIVERSITY, JHANSI-284 128
COURSE CURRICULUM
B.Sc. (H) BIOTECHNOLOGY

YEAR	PAPER CODE	TITLE OF THE THEORY PAPER OR PRACTICAL	AA M. M	IA M. M	TOTAL MARKS
1 st Yr	BT-11	GENERAL MICROBIOLOGY	70	30	100
	BT-12	ELEMENTS OF BIOCHEMISTRY	70	30	100
	BT-13	BIOCHEMICAL TECHNIQUES	70	30	100
	BT-14	BIOMATHEMATICS AND BIOSTATISTICS	70	30	100
	BT-15	MICROBIOLOGY PRACTICALS	100	---	100
	BT-16	BIOCHEMISTRY PRACTICALS	100	---	100
2 nd Yr					
	BT-21	CELL BIOLOGY AND GENETICS	70	30	100
	BT-22	MOLECULAR BIOLOGY AND PROTEOMICS	70	30	100
	BT-23	GENETIC ENGINEERING AND GENOMICS	70	30	100
	BT-24	ANIMAL CELL CULTURE	70	30	100
	BT-25	GENERAL CHEMISTRY	70	30	100
	BT-26	CELLULAR AND MOLECULAR BIOLOGY PRACTICALS	100	---	100
3 rd Yr					
	BT-31	AGRICULTURAL BIOTECHNOLOGY	70	30	100
	BT-32	ENVIRONMENTAL BIOTECHNOLOGY	70	30	100
	BT-33	PLANT BIOCHEMISTRY	70	30	100
	BT-34	IMMUNOLOGY	70	30	100
	BT-35	IMMUNOLOGICAL AND TISSUE CULTURE PRACTICALS	100	---	100
		GRANT TOTAL MARKS	----	---	1700

BT-11 GENERAL MICROBIOLOGY

Unit I Introduction.

History of microbiology.

Cellular organization of Prokaryotes and Eukaryotes.

Unit II Classification , Morphology and Physiology of Bacteria.

Classification of bacteria: Phylogenetic, Adamsonian or Numerical and Genetic classification.

Morphology: Size, Shape, Capsule, Pili and flagella. Structure of Gram +ve and Gram –ve Cell wall.

Bacterial Growth: Growth Curve, Generation time, Quantitative measurements of bacterial growth. Continuous and Synchronous growth.

Bacterial toxins: Exo and Endotoxins. Endospore forming bacteria: Aerobic and Anaerobic spore formers, endospore formation

Nitrogen fixing bacteria: Symbiotic and Non-Symbiotic nitrogen fixers.

Unit III Microbial Genetics

Recombination in bacteria : Transformation, Conjugation, transduction and transfection.

Plasmids: Copy number, incompatibility.

F- Plasmids, R- Plasmids, Degradative, Col, Cryptic, Heavy metal

Resistance, Ti-Plasmids and Episomes. Plasmids in Eukaryotes.

Unit IV Pathogenicity and infection.

Important bacterial diseases of man.

Food borne infection, food spoilage, sewage disposal.

Bacteriology of water, milk and air.

Unit V Sterilization and disinfection.

Methods of sterilization: Dry heat, wet heat, radiation, chemical, filtration and gaseous process. Principles and procedures. Antiseptics and disinfectants. Gases and chemicals.

Unit VI Antimicrobial Chemotherapy.

Mechanisms of action of drugs. Antimicrobial drugs. Drug resistance. Types.

Mechanism of drug resistance. Drug sensitivity tests. Disc and tube dilution method.

Unit VII Virology.

Morphology and replication of viruses.

General characteristics and structure. symmetry, capsids, envelope.

Outline classification of Animal and plant viruses.

Replication of viruses. Negative strand, positive strand. RNA and DNA tumor viruses.

Bacteriophages. Lytic and Lysogenic cycle.

Cultivation of viruses. Viral assays. Interferon. Viroids. Prions. Virinos.

Important viral diseases of man. Vaccines.

Books/Authors

1. Microbiology. Prescott, L.M., Harley, J.P. and Klein, D.A
2. Microbiology. Pelczar, H.M.J., Chan, E.C.S and N.R. Krieg
3. General Microbiology. Stanier
3. Microbial Metabolism. Doelle
4. Microbiology. Fundamentals and applications. Atlas. R.M.
5. A text Book of Microbiology. Chakraborty, P.
6. Microbiology an Introduction. Tortora.
7. A text Book of Microbiology. Dubey, R.C. and Maheshwari.

BT-12 ELEMENTS OF BIOCHEMISTRY

Unit I Introduction and History of Biochemistry.

UNIT II Biomolecules

Carbohydrates: classification, biological significance and mutarotation.

Structure of glucose, fructose, mannose, galactose, lactose, maltose, cellulose, starch and glycogen.

Stereoisomers, diastereomers, enantiomers, epimers, reducing and non-reducing sugars.

Lipids: classification, biological significance, classification of fatty acids, essential fatty acids

Proteins: classifications, structure, and forces involved in stabilizing the structures

Amino Acids: classifications, essential and non-essential amino acids, structure of amino acids.

Nucleic Acids. DNA and RNA: structure and conformations. Double helix.

Unit III Enzymology

History. Nomenclature, Classification. Holoenzyme, coenzymes, cofactors and activators. Isoenzymes, enzyme specificity, monomeric oligomeric and multienzyme complexes. Definition of IU and katal, enzyme turnover number and specific activity.

Role of vitamins as coenzyme precursors

Enzyme regulation: Allosteric and covalently modulated enzymes, Activation of Zymogens.

Enzyme kinetics: Derivation of Michaelis-Menten equation for unisubstrate reactions.

Factors affecting enzyme activity. K_m and its significance. Line weaver burk plot and its limitations.

Enzyme inhibition: Irreversible, reversible, competitive, non-competitive, Uncompetitive.

Unit IV Intermediary metabolism.

Metabolism of carbohydrates and lipids.

Glycolysis. Alcoholic fermentation, PPP, Gluconeogenesis, Glycogenesis,

Glycogenolysis, TCA cycle. Regulatory enzymes in glycolysis and Citric acid cycle and their regulation.

β Oxidation of saturated fatty acids. Biosynthesis of fatty acids. Glyoxalate cycle.

Unit V Electron Transport chain and oxidative phosphorylation.

Structure of mitochondria. Chemiosmotic theory. Net ATP generation. Malate aspartate shuttle. Glycerol Phosphate Shuttle. Inhibitors and uncouplers of oxidative phosphorylation. Transport of reducing potentials in to mitochondria.

Unit VI pH and Buffers:

pH Scale. Henderson-Hasselbalch equation. Biological buffer systems.

Books/Authors

1. Lehninger principles of Biochemistry. Nelson, D.L. and Cox, M.M.
2. Fundamentals of Biochemistry. J.L. Jain.
3. Fundamentals of Biochemistry. Deb, A.C.
4. General enzymology. Kulkarni and Deshpande.

BT-13 BIOCHEMICAL TECHNIQUES.

Unit I Principles and Applications of Microscopy.

Principles and use of light, fluorescence, phase contrast, dark field, bright field and electron microscopy(TEM and SEM) , Resolution and Resolving power

Unit II Spectroscopic techniques.

Beer-Lambert law.

Photometry- basic principles of uv-vis spectrophotometry and colorimetry, instrumentation and application. Principles and applications of Mass spectroscopy, Fluorescent and Emission spectroscopy.

Unit III Electrophoretic Methods of Separation.

Principle, types, instrumentation and applications (PAGE) and agarose gel electrophoresis.

Polyacrylamide(native & SDS-

Unit IV Chromatography. Principles and Practice.

Principle, types and applications : paper, thin layer, HPLC

adsorption, ion-exchange, GC,

Unit V Hydrodynamic techniques.

Centrifugation-principle, types and applications, sedimentation coefficient and factors affecting sedimentation. Velocity, preparative and analytical ultracentrifugation techniques.

Unit VI Radioisotopic Techniques.

Types of radioisotopes, half life, units of radioactivity measurements. Techniques used to measure radioactivity. Geiger Mueller counter, Liquid Scintillation counter. Isotopes commonly used in Biochemical studies. ^{32}P , ^{14}C , ^{35}S , and ^3H . (Autoradiography. Biological hazards of radiation and safety measure in handling radioisotopes.)

Unit VII Measurement of pH

Principles of glass and reference electrodes, types of electrodes, complications of pH measurement. Use of pH meter.

Books/Authors

- 1.A Biologists guide to principles and techniques of practical biochemistry. Wilson and Goulding.
- 2.Instrumental methods of chemical analysis, Chatwal and Anand
3. Essentials of Biophysics. Narayanan, P.
4. Bioseparations. Principles and practices. Sivasankar, B.

BT-14 BIOMATHEMATICS AND BIOSTATISTICS

PART A. MATHEMATICS

UNIT I Differentiation.

Derivative of important functions. Product rule for differentiation. Quotient rule for differentiation. Derivative of function of a function.

UNIT II Integration.

Indefinite integrals as antiderivatives. Integration by substitution. Integration by parts. Integration by partial fractions. Some special type of integrals.

UNIT III Differential equations.

Definition and formation. Solutions (Variable-separable form and homogenous forms)

UNIT IV Matrices and determinants.

Types of matrices. Operation on matrices (Addition, Subtraction and multiplication). Determinants. Adjoint and inverse of a matrix.

PART B. BIOSTATISTICS

UNIT I Measures of central tendency.

Mean, Median, Mode, AM, GM, HM, Quartiles.

UNIT II Measures of central dispersion.

Range mean deviation, Mean absolute deviation, Mean squared deviation (variance), Root-mean square deviation (Standard deviation). Coefficient of deviation Quartile deviation.

UNIT III Probability and distributions.

Introduction, Random experiment, Sample space, Events.

Theorems of probability (Addition and Multiplication).

Conditional probability. Bayes theorem.

Random variable and probability distributions. Binomial distribution. Poisson distribution. Applications of probability and distributions.

UNIT IV Tests of significance

Based on T, F, Z and chi square distributions.

UNIT V Analysis of variance

One-way and Two way classification.

UNIT VI Correlation and Regression.

Regression lines (Y on x and x on Y). Regression coefficient.

Books and authors

1. Methods in Biostatistics. Mahajan, B.K.
2. Biostatistics. Arora, P.N. and Mahajan, P.K.
3. Elements of Biostatistics. Prasad, S.
4. Practicals in Statistics. Sharma, H.L.
5. Fundamentals of Mathematical Statistics. Gupta, S.C., Kapoor, V.K.
6. Differential Calculus. Shanti Narayan
7. Integral Calculus. Shanti Narayan

BT- 15 MICROBIOLOGY PRACTICALS

1. Culture methods.

Washing of glass wares. Bacterial culture, isolation of microbes. Fungal culture, media preparation, sterilization. Streaking, total and viable counts. Serial dilution and pour plating. Minimal media, rich media, strain revival. Slants and slabs. Replica plating.

2. Staining methods:

- (a) Simple staining
- (b) Differential staining
 - Gram staining
 - Negative staining
 - Endospore staining
 - Viability staining
 - Capsule staining
 - Nuclear staining
 - Acid fast staining
 - Staining of fungi.

1. Biochemical tests:

IMViC tests

- i. Indole production tests.
- ii. Methyl red tests.
- iii. Voges-proskauer tests.
- iv. Citrate utilization tests.
- v. H₂S production
- vi. Catalase test.

2. Antibiotic sensitivity tests.

3. Bacteriological analysis of water.

Books/ Authors

- 1. Microbiology A lab Manual. Cappucino, J.G., Sharman and Weseley, A.
- 2. Experiments in Microbiology. Aneja, K.R.
- 3. Microbes in Action. Kennedy, D and Parke, R. B. 1971

BT-16 BIOCHEMISTRY PRACTICALS

1. Buffers
Washing of glasswares. Preparation of buffers of different pH values and determination of pH of a solution.
2. quantitative estimation of sugars
Tests for reducing and non-reducing sugars.
Molisch test
Fehlings test
Benedicts test
Bardfoeds test
Estimation of carbohydrates by anthrone method.
Estimation of sugar in urine and blood.
3. Estimation of proteins
Lowry's and Biuret methods.
Xanthoproteic reaction
Estimation of Aminoacids by ninhydrin method
4. Estimation of DNA and RNA
Estimation of DNA by Diphenylamine method.
Estimation of RNA by Orcinol method.
5. Chromatography
Separation of amino acids and sugars by paper chromatography
6. Electrophoresis

Books /Authors

1. Biochemical calculations. Segel, I.H.
2. Biochemical Methods. Sadasivam, S. and Manikam, A
3. A lab manual of Biochemistry. Jayaraman
4. An introduction to practical biochemistry. Plummer, D.T.
5. Introductory practical biochemistry. Sawhney, S.K. and Singh, R.
6. Bioseparations. Principles and Applications. Sivasankar, B.

BT-21 CELL BIOLOGY AND GENETICS

A. CELL BIOLOGY

Unit I Introduction

Cell as a basic unit of living organisms. Cell theory. Prokaryotic and Eukaryotic cells. Difference between animal and plant cells.

Unit II Structure and function of cell organelles.

Golgi bodies. Endoplasmic reticulum. Mitochondria, Ribosomes, Lysosomes, Chloroplast, Peroxisomes, Glyoxisomes, Cytoskeletal elements. Nuclear membrane, Nucleolus.

Unit III Biological membranes and transport.

Types and cellular location. Chemical composition. Function of biomembranes. Energy transduction. Signal transduction. Nutrient transport across membranes. Porins and facilitated diffusion. Symport, antiport and uniport. Active transport, proton and Na⁺-K⁺ pumps.

Unit IV Cell cycle

Cell cycle and cell division-mitosis and meiosis.

B. GENETICS

Unit I Introduction.

History of genetics. Germplasm theory, genotype-phenotype concept. Phenocopies. Pangenesis. Mendel's experiments. laws of inheritance. Deviations from Mendel's findings.

Unit II Sex linked inheritance.

Sex determination in plants and animals. Sex linkage. Chromosome theory of inheritance

Unit III Linkage and Crossing over.

Coupling and repulsion hypothesis, test cross, back cross. The mechanism of crossing over, linkage maps, cytological basis of crossing over.

Unit IV Chromosomes.

Chemical composition. Chromatin, nucleosomes. Solenoid. Eu and heterochromatin. Polytene and lampbrush chromosomes. Banding patterns in human chromosomes. Structural and numerical aberrations involving chromosomes. Euploidy, Aneuploidy. Hereditary defects. Klinefelters, Turners, Cri-du-chat and Down's syndrome.

Unit V Mutations.

Genes-Split genes and Overlapping genes. Gene mutations. Base pair substitutions, Frameshift, Missense, Nonsense, Silent. Spontaneous and induced. Chemical and physical mutagens. Mutator genes. Hot spots. Reversion.

Books / Authors.

1. Principles of Genetics. Gardiner, Simmons and Snustard.

2. Genetics. Gupta, P.K.

3. Cell and Molecular Biology. Robertis, E.M.P.

4. Molecular Biology of the cell. Alberts et al.

5. Fundamentals of Genetics (2007)

B. D. Singh

Kalyani Publishers

BT-22 MOLECULAR BIOLOGY AND PROTEOMICS

Unit I Nucleic Acids

History, Nucleic acids as genetic material, transformation. Hershey and Chase experiments, Chargaff's rule, structure of DNA, forms of DNA, palindromic DNA. Hairpin and Cruciform, Satellite DNA, structure of RNA (tRNA, mRNA, rRNA), melting of DNA, renaturation, Cot curves, evidence for Hydrogen bonds and Hydrophobic interactions in DNA, Circular and superhelical DNA.

Unit II DNA Replication.

Central dogma. Messelson and Stahl experiment, DNA replication in prokaryotes. Conservative, semiconservative and dispersive. DNA polymerase I, II and III, John Cairns experiment, Unidirectional and bi-directional replication, plasmid replication, D-loops, ϕ x 174 and rolling circle model of replication. DNA repair, DNA methylation.

Unit III Transcription in prokaryotes and eukaryotes.

RNA polymerase. Promoters. Initiation, elongation and termination. Inhibitors of transcription. Reverse transcriptase. Inhibition of transcription. Post transcriptional processing of RNA.

Unit IV Translation and regulation of gene regulation.

Genetic code. Basic features. Mechanism of translation in prokaryotes and eukaryotes. Initiation, Elongation, Translocation and Termination. Ribosome structure. Operons. Inducible (Lac Operon) and Repressible (Trp Operon) along with their regulation. Enzyme induction and regulation.

Proteomics

Unit I

Definition, history and scope of proteomics. Analysis of post-translational modifications of proteins.

Books/Authors.

1. Molecular Biology and genetic engineering. Gupta, P.K.
2. Lehninger principles of Biochemistry. Nelson and Cox.
3. Biotechnology and Genomics. Gupta, P.K.
4. Proteomics and genomics. Gupta, P.K.

BT-23 GENETIC ENGINEERING AND GENOMICS

Unit-I Introduction.

Basic concept of recombinant DNA and principles of cloning
DNA and RNA extraction from bacterial, plant and animal cells
and its purification.

Nucleases and restriction endonucleases

Unit-II Cloning vectors for E.coli, yeast, fungi, plant and animal cells.

Plasmid, Bacteriophage, cosmid, and viral vectors.

Shuttle and expression vectors

Methods of gene transfer- electroporation, calcium phosphate precipitation,
microinjection, gene gun

Unit III

DNA libraries- types, advantages and disadvantages of different types of libraries,
construction of genomic and full-length cDNA libraries

Unit-IV

Techniques- PCR, amino acid sequencing and blotting. Southern, Northern Western.

Unit -V

Applications of genetic engineering in environmental mining, agriculture, medicine,
research and industries

Genomics

Unit I

Introduction. Definitions. Historical. General techniques involved in Sequencing of
genomes. Definitions of structural, pharmaco, comparative and Functional genomics.
Commercial scope of genomics.

Transcriptome. Transcriptomics.

Books/Authors

1. Biotechnology and Genomics. Gupta, P.K. (2008) Rashgi Publications.
2. Gene Biotechnology. Jogdand, S.N.
3. Molecular Biology and genetic engineering. Gupta, P.K.
4. Principles of gene manipulation. Old and Primrose.
5. Biotechnology. Singh, B.D.

BT-24 ANIMAL CELL CULTURE

UNIT I Introduction

History of development of cell cultures. Choice of materials.

Organ culture. Cell culture.

Source of tissue. Embryo or adult. Normal or neoplastic.

Subculture.

Finite or continuous cell lines.

Selection of medium.

Role of serum in cell culture. Low serum and serum free media.

Importance of growth factors of the serums.

Coating of cell culture surface.

UNIT II

Scaling up of cell cultures.

Primary cultures. Anchorage dependence of growth. Non anchorage dependent cells.

Secondary cultures. Transformed animal cells. Continuous cell lines. Commonly used

animal cell lines. Their origin and characteristics. Growth kinetics of cells in culture.

Cytotoxicity and viability assays.

UNIT III

Applications of animal cell cultures for studies on gene expression. Organ culture.

Transfection of animal cells. Selectable markers. HAT selection. Antibiotic resistance etc.

UNIT IV

Cell fusion.

Transplantation of cultured cells.

Books/Authors

1. Culture of Animal cells. Freshney, R.T.

2. Animal cell culture and technology: Basics from background to bench. Butler, M.

3. Biotechnology. Singh, B.D.

BT-25 GENERAL CHEMISTRY

PART A Inorganic chemistry

UNIT I Chemical bonding:

Ionic bond. Energy changes. Lattice energy. Born Haber cycle. Covalent bond-energy changes. Potential energy curve for H₂ molecule. Characteristics of covalent, co-ordinate bonds. Warners theory, effective atomic numbers. Isomerism in co-ordinate compounds. Hydrogen bonding, Vander waals, hybridization and resonance. Valence shell Electro repulsion theory. Discussion of structures H₂O, NH₄, SiF₄. molecular orbital theory, linear combination of atomic orbitals method. Structure of simple homonuclear diatomic molecules like H₂, N₂, O₂. and heteromolecular diatomic molecule like CO, NO, and CN.

UNIT II Co ordination chemistry. Classification, Nomenclature of co-ordination compounds. Werners theory. Isomerism in coordinate compounds.

PART B Physical Chemistry.

UNIT I. Thermochemistry: Hess's law, heat of reaction, effect of temperature on heat of reaction at constant pressure (Kirchoff equation) heat of dilution, heat of hydration, heat of neutralization and heat of combustion. Flame temperature.

UNIT II. Reaction kinetics: Significance of rate of law and rate equations, order and molecularity. Determination of order of simple reaction-experimental method. Equilibrium constant and reaction rates-Linderman, colles Activated complex theories, complex reaction of 1st order characteristics of consecutive, reversible and parallel reaction. Steady state and non steady state approach.

UNIT III. Catalysis: Criteria for catalysis. Homogeneous catalysis, acid base, enzymatic catalysis. Catalysis by metal salts, Heterogeneous catalysis. Concepts of promoters, inhibitors and poisoning. Physiosorption. Chemisorption, surface area. Industrially important process. Theories of catalysis.

PART C Organic Chemistry

UNIT 1 IUPAC nomenclature .Reactive intermediates. Generation, structure and general reactions of carbocation, carbonium, free radicals and carbeens. electrophyles and nucleophyles, concepts of acids and bases. Bronsted theory, Lewis theory persons classification. Carbon acids super acids. Hyperconjugative concepts and consequence. Field effect. Resonance effect-resonance energy and its significance. Type of Organic reaction. Cannizaro reaction, Frielal craftreaction, Reaction Tiemann reaction, Hoffmann Bromide Rearrangement.

UNIT II. Stereochemistry:

Classification of stereomers, diastereomers, separation of enantiomers. Absolute configuration (R and S). projection formulae. Stereochemistry A compound containing two asymmetric C-atoms. Elements of symmetry – center, plane, axis of symmetry,

stereochemistry of bi-phenyl and spiro-compound, confirmation. Confirmation around a C-C bond in acyclic compounds. Shultams, structure of cycloalkanes. Strain in cyclic compounds, cyclohexane confirmation, stereochemistry of disubstituted cyclohexane. Geometrical isomerism – concept. E and Z nomenclature.

UNIT III Heterocyclic compound. Classification, Nomenclature. Preparation, properties, and uses of indole, pyridine, thiophene.

Books/Authors

1. A Text book of physical chemistry. Bhel and Tuli
2. Principles of physical chemistry. Puri, Sharma and Pathania.
3. Fundamentals Inorganic chemistry. Bhel and Tuli
4. A text book of organic chemistry. Bhel and Bhel
5. A Text book of organic chemistry. Kalshi, P.L.

BT-26. MOLECULAR AND CELL BIOLOGY PRACTICALS

1.Cytological preparations

Fixation, dehydration and staining

Embedding and sectioning

2.Cell counting methods

Hemocytometer

The use of stage and ocular micrometer

3.Separation of cell organelles (from rat liver.)

Methods of cell lysis. Osmotic, chemical, enzymatic

Mechanical rupture of cells. Ultrasonic vibrations, French press

4. Centrifugation of cell organelles.

Preparation of nuclear, mitochondrial and cytoplasmic fractions.

5.Isolation and purification of chromosomal and plasmid DNA from E.coli.

Plasmid mediated transformation of E. coli.

6. Separation of proteins by SDS-PAGE

Book/Authors.

1. Bioseparations. Principles and Techniques. Sivasankar. B.

BT-31 AGRICULTURAL BIOTECHNOLOGY

A PLANT BIOTECHNOLOGY

UNIT I Plant Tissue Culture.

Methods of plant micro propagation. Plant tissue culture techniques. Ovary and ovule culture. Invitro pollination and fertilization. Embryo culture. Embryogenesis and organogenesis and their practical applications. Micropropagation of elite species. Axillary bud,shoot tip and meristem culture.

UNIT II

Haploids and their application. Somaclonal application and variation. Single cell cultures and their application in selection of variant/mutant with or without mutagen treatment.

UNIT III

Introduction to protoplast isolation and regeneration and its application. Various methods of fusing protoplasts-chemical,electrical.

Somatic hybridization. Introduction. Practical applications. Use of markers for selection of hybrid cells.

UNIT IV

Use of plant cell,protoplasts and tissue culture for genetic manipulation of plants.

Methods of gene transfer in to plant cells. Vectors. Transformation techniques.

Crop improvement and development of transgenic plants . Gene gun.

UNIT V

Single cell protein. SCP from waste, agricultural crops and algae. Economic implication of SCP. Biofertilizers. Mycorrhizae.

B ANIMAL BIOTECHNOLOGY

Unit I

Gene constructs. Promoters, reporter and marker genes.

Vectors for gene transfer in to animal cells. Transfection methods.

Embryonic stem cell transfer. Targeted gene transfer.

Detection of transgenics and transgene function.

Transgenic animals.

C MARINE BIOTECHNOLOGY

Books /Authors.

- 1.Biotechnology and genomics. Gupta, P.K.
- 2.Plant Biotechnology. Doods
- 3.A text Book of Biotechnology. Kumar, H.D.
4. Molecular Biology and Genetic engineering. Gupta, P.K.
5. Biotechnology. Singh, B.D.
- 6.Gene Biotechnology. Jogdand, S.N.
7. Fundamentals of Genetics. Singh. B. D. 2004. Kayani Publishers . New Delhi.

BT-32 ENVIRONMENTAL BIOTECHNOLOGY

UNIT I ECOSYSTEM APPROACH IN ENVIRONMENTAL MANAGEMENT

- 1.1 What is an ecosystem?
- 1.2 Biogeochemical cycles
- 1.3 Types of ecosystem
- 1.4 Eco-management
 - 1.4.1 Environmental Impact Assessment(EIA)
 - 1.4.2 Environmental management plan(EMP)

UNIT II WORLD OF MICROBES IN RELATION TO ENVIRONMENT

- 2.1 Bacteriology of water and sewage
- 2.2 Bacteriological examination of water
- 2.3 Indicator of index organism
- 2.4 Why Coliform?
- 2.5 Routine Bacteriological Analysis
- 2.6 Methods for differentiating Faecal from non-faecal Coliforms
- 2.7 Most probable number (MPN) Estimation

UNIT III BIOSENSOR IN ENVIRONMENTAL ANALYSIS

Type of biosensor. Environmental applications of biosensors

UNIT IV BIOTECHNOLOGICAL METHODS IN POLLUTION ABATEMENT

- 4.1 Biotechnology in the reaction of CO₂ emission
 - 4.1.1 Photosynthesis as a means of CO₂ emission
 - 4.1.2 Reducing CO₂ emission from sea water through biological calcification
- 4.2 Algal photosynthesis in waste water treatment
 - 4.2.1 Oxygen production by algae
- 4.3 Eutrophication, Algal blooms and biological Phosphorus removal
 - 4.3.1 Eutrophication
 - 4.3.2 Biological Phosphorus removal from waste water

UNIT V BIOTECHNOLOGY AND BIODEGRADATION

Biodegradation. Biodegradation of Herbicides and Pesticides. Biodegradation of Hydrocarbons

UNIT VI BIOHYDROMETALLURGY AND BIOMINING

Bioleaching. Biosorption

UNIT VII ECOFRIENDLY BIOPRODUCTS FOR ENVIRONMENTAL HEALTH

Biopesticides .Biofertilizers Bioenergy and Biofuels. Biodegradable plastics

Books/Authors.

1.Introduction to environmental Biotechnology. Chatterji, A.K.

BT-33 PLANT BIOCHEMISTRY

UNIT I Structure of Organelles involved in Photosynthesis in Plants and Bacteria.

Plastids, Chromoplasts. Leucoplasts. Chloroplasts. Pheoplasts. Rhodoplasts. Kinds of pigments present. Occurrence and functions.

UNIT II Photosynthesis.

Proton gradients and electron transport in chloroplast of plants and in purple purple bacteria.

Photosystem I and II

Evidence for PS I, PS II, LHC, ATPase. Hill reaction. Cyclic and non cyclic photophosphorylation. Light and Dark reactions. Photoinhibitors. Factors affecting photosynthesis. Regulation of photosynthesis.

C4 Syndrome. C4 plants. C4 pathway. Characteristics of C4 plants. Warburg effect. Photorespiration. Biochemistry of Photorespiration in C3 plants. CAM. Hatch-Slack Pathway.

UNIT III Plant Growth Hormones.

Cytokinins. Gibberellic acid. Auxins-I.A.A., I.B.A., N.A.A., 2-4D. Ethylene. Abscisic acid. Physiological effects of plant growth hormones. Uses of plant growth substances in agriculture and horticulture.

Phytochromes and their physiological significance.

UNIT IV Nitrogen Metabolism.

Biological nitrogen fixation and Ammonia assimilation. Nitrate and sulphate reduction and their incorporation in to their amino acids.

UNIT V

Seed germination and dormancy. Hormonal control of seed germination.

Artificial seeds. Preparation and their uses.

Books/Authors.

1. Plant physiology. Seiger, Teiz.
2. Lehninger Principles of Biochemistry. Nelson and Cox.
3. Plant physiology .Salisbury.

BT-34 IMMUNOLOGY

UNIT I Immune system –an introduction.

Basis of Immunity – innate and acquired .Characteristics and mechanism. Humoral and Cellular immune response.

Immunity – active and passive.

Organs of immune response. Primary and secondary lymphoid organs and their role in development of immune system.

Cells of immune system. Structure and functions of lymphocytes and other accessory cells of immune system.

UNIT II Antigen antibody interactions.

Antigens – Antigenicity and immunogenicity, haptens, epitopes.

Immunoglobulins – structure and functions. Clonal selection theory. Antigenic determinants. Isotypes, Allotypes.

UNIT III Complement system

components, activation pathways, its role in immune response.

UNIT IV MHC.

Major Histocompatibility complex – structure of class I and class II MHC molecules, distribution and functions, genomic organization of MHC locus .

Hypersensitivity – Type I-IV, delayed type of hypersensitivity.

UNIT V

Autoimmunity – autoimmune diseases – pathogenesis, diagnosis and treatment.

Immunodeficiencies – primary and secondary.

Book/Authors.

1. Kuby Immunology . Goldsby, R.A et al.
2. Essential Immunology Roitt, I.M.
3. Text Book of Microbiology. Ananthanarayan, R. and Jayaram Panicker, C.K.

BT-35 IMMUNOLOGICAL AND TISSUE CULTURE

PRACTICALS

Part A. Immunological Methods

1. Purification of antigen and antibodies
2. Raising polyclonal antibodies. Adjuvants
3. Conjugation and labelling of antibodies
4. ELISA. Capture, Direct, Indirect.
5. RIA
6. Immunoelectrophoresis and immuno diffusion methods Precipitation and Agglutination
7. Diagonosis of infectious diseases by immunoassays
8. Affinity chromatography.

Part B. Culture Methods

1. Plant tissue culture. Callus differentiation. Regeneration of differentiated callus.
Hardening.
Growth of plant cells in to undifferentiated mass
Induction of differentiation by modulating the hormonal balance
2. Cultivation of plant cells in suspension and regeneration.
3. Culture of lymphocytes, from blood samples
4. Preparation of media, filter sterilization, monitoring microbial contamination.
5. Fusion of cultured cells with myeloma cells, production of monoclonal antibodies
6. Demonstration/ operation of large-scale fermenters

Books/Authors.

- 1.