

BIOTECHNOLOGY
B.Sc. Part -I
PAPER – I
BIOCHEMISTRY, BIOSTATISTICS AND COMPUTERS (BBT01)

UNIT-I

1. Introduction to Biochemistry: History, Scope and Development.
2. **Carbohydrates:** Classification, Structure and Function of Mono, Oligo and Polysaccharides.
3. **Lipids:** Structure, Classification and Function.

UNIT –II

1. **Amino acids and Proteins:** Classification, Structure and Properties of amino acids, Types of Proteins and their Classification and Function.
2. **Enzymes:** Nomenclature and Classification of enzyme, Mechanism of enzyme action, Enzyme Kinetics and Factors affecting the enzymes action. Immobilization of enzyme and their application.

UNIT –III

1. **Hormones:** Plant Hormone-Auxin and Gibberellins and Animal Hormone-Pancreas and Thyroid.
2. **Carbohydrates, Proteins and Lipid Metabolism** - Glycolysis, Glycogenesis, Glyconeogenesis, Glycogenolysis and Krebs cycle. Electron Transport Chain and β - oxidation of Fatty acids.

UNIT-IV

1. Scope of Biostatistics, Samples and Population concept, Collection of data-sampling techniques, Processing and Presentation of data.
2. Measures of Central Tendency: Mean, Median and Mode and Standard Deviation.
3. Probability Calculation: Definition of probability, Theorem on total and compound probability.

UNIT-V

1. Computers - General introduction, Organization of computer, Digital and Analogue Computers and Computer Algorithm.
2. Concept of Hardware and Software, Input and Output Devices.
3. Application of computer in co-ordination of solute concentration, pH and Temperature etc., of a Fermenter in operation and Internet application.

List of Books

1. Nelson and Cox (2005) Principles of Biochemistry, Fourth Edition
2. Todd and Howards Mason (2004) Text book of Biochemistry, Fourth Edition
3. Lubert Stryer and Berg ((2004) Biochemistry, Fifth Edition
4. Diana Rain, Marni Ayers Barby - (2006) Textbook on Q level Programming. 4th Edition.
5. Karl Schwartz: (2006) Guide of Micro Soft. Marina Raod, 4th Edition.
6. E Balaguruswamy by Programming in BASIC(1991).
7. RC Campbell by Statistics for Biologists..
8. P Cassel et al by Inside Microsoft Office,
9. Statistical Methods, GW Snedecor and WG Cochran.
10. AC Wardlaw by Practical Statistics for Experimental Biologists,
11. JH Zar by Bio-statistical analysis
12. RR Sokal FJ Rohlf by Introduction to Biostatistics
13. L Y Kun (2003) Microbial Biotechnology: Principles and applications
14. Khan and Khanum (1994) Fundamental of Biostatistics

PAPER – II
CELL BIOLOGY, GENETICS AND MICROBIOLOGY (BBT02)

UNIT-I

1. Concept of life, Cell as a basic unit of living system and Cell theory.
2. Diversity of Cell shape and size.
3. Prokaryotic cell structure: Function and ultra-structure of cell (Gram positive and Gram-negative Bacteria), Plasma membrane, Flagella, Pili, Endospore and Capsule.
4. Eukaryotic cell: Plant cell wall and Plasma membrane.

UNIT-II

1. Cytoplasm: Structure and Functions of Endoplasmic reticulum, Ribosome, Golgi complex, Lysosomes, Nucleus, Mitochondria and Chloroplast.
2. Cytoskeleton: Microtubules, Microfilaments and Intermediate filaments.
3. Cell division: Mitosis and Meiosis.
4. Programmed Cell Death.

UNIT-III

1. Mendel's Laws of Inheritance.
2. Linkage and crossing over.
3. Chromosome variation in number and structure: Deletion, Duplication, Translocation, Inversion and Aneuploidy, Euploidy (Monoploidy and Polyploidy and its importance).

UNIT-IV

1. History, Scope and Development of Microbiology.
2. Basic techniques of Microbial Culture
3. Microbial Growth & Nutrition of Bacteria: Isolation, media sterilization- physical and chemical agents, pure culture-pour plate method, streak plate method and spread plate method.
4. General features and Economic importance of Fungi, Algae and Protozoa etc.

UNIT-V

1. Bacterial Reproduction: Conjugation, Transduction and Transformation.
2. Mycoplasma – History, Classification, Structure reproduction & Diseases.
3. Viruses – Basic features, Structure, Classification, Multiplication, Bacteriophages (Morphology, life cycle, infection and medicinal importance).

List of Books

1. C.B. Power- Cell biology, First Edition (2005), Himalaya PublishingHouse.
2. Gereld Karp - Dell and molecular biology, 4th Edition(2005)
3. P.K. Gupta - Cell and molecular biology, Second Edition (2003), Restogipublications.
4. C.B., Oowar - Cell biology, Third Edition (2005) Himalaya PublishingHosue.
5. S.S. Purohit - Microbiology : Fundamentals and Applications, 6th Edition(2004)
6. R.C. Dubey and D.K. Maheshwari: Practical Microbiology. S.ChandPublication.
7. R.C. Dubey and D.K. Maheshwari, Microbiology (2006). S.ChandPublication.
8. Tortora, Funke and Case - Microbiology, An introduction, sixth Edition(1995), Benjamin/Cummings PublishingCompany.
9. Prescott, Harlyey and Klein - Microbiology, Third Edition, Wm. C. Brown Publishers(1996).
10. P. Chakraoborthy - Textbook of microbiology, Second Edition(2007).
11. Prescott, Harley and Klein - Microbiology. Third Edition. Wm. C.Brown.
12. Microbial Genetics, David Freifelder, John F Cronan, Stanley R Maloy, Jones andBartlett Publishers.
13. Elements of Human Genetics. I.I. cavalla-Sfoeza, WA Benjamin Advanced BookProgram.
14. S.K Jadhav and P.K. Mahish (2018) PrayogtmakJaivprodyogikiawamSukshmjivigyan-Chhattisgarh Hindi Granth Academy,Raipur.

PRACTICAL LIST

MICROBIOLOGY AND BIOCHEMICAL TECHNIQUES

(1) Laboratory rules, Tools, Equipment and Other requirements in Microbiological laboratory.

(2) Micrometry – Use of ocular & stage micrometer.

(3) Counting of bacteria by counting chamber, by plate count.

(4) Preparation of media and cultivation techniques:

- (a) Basic liquid media (broth)
- (b) Basic Solid media, (agar slants and deep tubes)
- (c) Demonstration of selective and differential media
- (d) Isolation and enumeration of microorganisms
- (e) Isolation from air and soil

(5) Smears and staining methods:

- (a) Preparation of bacterial smear
- (b) Gram Negative & Positive staining

(6) Methods of obtaining pure cultures

- (a) Streak plate method
- (b) Pure plate method
- (c) Spread plate method
- (d) Broth cultures

(7) Growth & Biochemical techniques

- (a) Determination of bacterial growth curve
- (b) Amylase production test
- (c) Cellulose production test
- (d) Estimation of Sugar in given solution
- (e) Extraction and separation of lipids
- (f) Estimation of proteins
- (h) Mitosis and Meiosis

(8) Biostatistics:

- (a) By Manual and by computer.
- (b) Problems on mean, mode and median.

BIOTECHNOLOGY

B.Sc. Part -2

PAPER – I

MOLECULAR BIOLOGY AND BIOPHYSICS (BBT03)

UNIT-I

1. **Nucleic Acid:** Bases, Nucleosides and Nucleotides, DNA and RNA structure.
2. **Plasmids.**
3. **Transposons: Repetitive elements, LINEs & SINEs, Structure of Gene.**

UNIT-II

1. DNA Replication: Enzymes involved and mechanism of DNA Replication in Prokaryotes.
2. **Mutation:** Molecular level of Mutation, Types of Mutagens, Spontaneous and Induced Mutation.
3. **DNA Repair:** NER, BER and Mismatch Repair.

UNIT-III

1. **Genetic Code:** Features, Condon Assignment and Wobble hypothesis.
2. **Transcription: Initiation, Elongation and Termination in Prokaryotes.**
3. **Translation: Initiation, Elongation and Termination Translation machinery in Prokaryotes.**
Operon-Concept of Operator, Regulator, Promoter gene, Inducer and Co-repressor.

UNIT –IV

1. **Biophysics: Introduction, Scope and Application**
2. Principle, Structure, Functions of the following:
 - a. **Microscopy**
 - b. **Colorimeter and Spectroscopy**
 - c. **Electrophoresis**
 - d. **Centrifugation**
 - e. **Chromatography.**

UNIT –V

1. **Radioisotope's techniques: Measurement of radioactivity, Ionization Chambers, Geiger Muller and Scintillation Counter.**
2. **Autoradiography and DNA Fingerprinting.**
3. **Biosensor.**

List of Books

1. Gerald Karp - Cell and Molecular biology, 4th Edition(2005).
2. Lewis J.Klein Smith and Valerie M.Kish-Principles of cell and molecularbiology-Third
3. Edition (2002)
4. P.K. Gupta- Cell and molecular biology, Second Edition (2003), Rastogipublications.
5. Richard M-Twyaman-Advanced Molecular Biology, First South Asian Edition (1998),
VivaBooks Pvt.Ltd.
6. K. Wilson and J.Walker (2012) Principle and Techniques of Biotechnologyand
MolecularBiotechnology.
7. Upadhya and Upadhya : BiophysicalChemistry.
8. David, I. Nelson and Michael M.Cox :Lehniger : Principal of Biochemistry 4th Edition.W.H.
Freeman and Company, NewYork.
9. Buchanan, Gruissemen& Jones (2015) Biochemistry & Molecular Biology ofPlant,
2ndedition.

PAPER – II

RECOMBINANT DNA TECHNOLOGY (BBT04)

UNIT-I

1. **Recombinant DNA technology**: General concept. Steps in gene cloning and application.
2. Host controlled Restriction Modification System, Ligases and Polymerases, Klenow fragment, Taq, Pfu polymerase and Nuclease (Endo, Exo and restriction endonuclease).
3. Modification Enzyme (Kinase, Phosphates and terminal deoxynucleotidyltransferase). Reverse Transcriptase.

UNIT –II

1. **Vectors**: Plasmid, Bacteriophages, Cosmid, SV40 and Expression vectors.
2. **Gene Library**: Genomic and cDNA library.
3. **Selection and Screening of Recombinants: Genetic and Hybridization methods**.

UNIT –III

1. **PCR: Types of PCR, Steps (Denaturation, Annealing and Extension); Applications, Advantages and Limitation of PCR**.
2. **Molecular Marker-RFLP, RAPD and Microarray**.
3. **Human Genome Project**.

UNIT-IV

1. **Basic concept of Gene Transfer Methods**: Microinjection, Electroporation, Lipofection and Microprojectile.
2. **Gene Therapy**: *In vivo* and *Ex vivo*, Germ line and Somatic gene therapy.
3. **Basic idea of Stem cell technology**: Types of stem cell cultures and their significance.

UNIT-V

1. Introduction to Bioinformatics: History, Objective and Application.
2. **Major Bioinformatics Resource – NCBI, Types of Databases (Primary and Secondary Databases), BLAST and FASTA**
3. **Basic concept of Genomics and Proteomics**

List of Books

1. B.D. Singh (2004) Biotechnology, Expanding Horizons. First Edition. Kalyani Publishers, Ludhiana.
2. P.K. Gupta (2005) Biotechnology and Genomics, Rastogi Publication, Meerut.

3. Stan bury and Whittaker - Principles of Sterilization techniques, First Indian reprintEdition (1997). Aditya Book (P) Ltd. NewDelhi.
4. L.E. Casida (1994)Industrial Microbiology Edition.
5. A.H. Patel (2003) Industrial Microbiology 4thEdition.
6. K.S. Bilgrami and A.K. Pandey(1998) Introduction to Biotechnology Edition 2nd(1998)
7. U Satyanarayan (2005) Biotechnology, First Edition Books and Allied (P) Ltd.Kolkata.
8. Atulkumar and VandanaA.Kumar (2004) Plant Biotechnology and tissue culture, Principle and Perspectives, International Books Distributing Co. Lucknow.
10. S Choudhuri, and DB Carlson (2008) Genomics: Fundamentals and applications, 1stedition.
11. TK Attwood and DJ Parry (2009) Introduction ofBioinformatics.
12. Philip E Bourne Helge Whisking (2003) StructuralBioinformatics.
13. Des Higgins and Willie Taylor (2000) Bioinformatics Sequence, Structure andDatabanks.

PRACTICAL

LIST EXPERIMENTS

1. Isolation of DNA from Plantcell.

2. Estimation of DNA by DPAMethod.

3. Isolation RNA from yeast cells

Experiment basedon-

4. Centrifugation

5. Spectrophotometer/Colorimeter

6. Electrophoresis

7. Paperchromatography/TLC

Experiment based on Bioinformatics -

8. Retrieve DNA /Protein sequence from Biological Data Bases(NCBI).

9. Use of toolsstudied

BIOTECHNOLOGY

B.Sc. Part -3

PAPER – I

GENERAL BIOTECHNOLOGY (BBT05)

- UNIT– 1**
1. Plant cell and tissue culture: General introduction, History and Scope.
 2. Application of Tissue culture.
 3. Concept of cellular differentiation.
 4. Agrobacterium, Ti and Ri Plasmid.
 5. Bt gene, Molecular markers (RFLP, RAPD), Edible Vaccine.
- UNIT– 2**
1. Organogenesis, Embryogenesis, Protoplast isolation and fusion.
 2. Germplasm storage and Cryopreservation.
 3. Anther and Ovary culture.
- UNIT– 3**
1. General introduction and scope of environmental biotechnology.
 2. Environmental pollution and its types.
 3. Control of pollution through biotechnology.
 4. Waste water treatment : Physical, Chemical and Biological.
- UNIT– 4**
1. Bio-fertilizer, Bio-pesticides, IPR.
 2. Global environmental problems: General introduction, Ozone depletion, Acid rain, Green house effect.
- UNIT– 5**
1. Bioreactors and its types.
 2. Fermentation (Lactic acid, Alcohol).
 3. Maintenance of industrial microorganisms.
 4. Food technology : Introduction, Canning, Packing and Food preservation.

IMMUNOLOGY (BBT06)

- UNIT– 1**
1. Immunology – General concept, history and development.
 2. Immune system and immunity, Organization of immune system.
 3. Antigen – Antibody and its types.
- UNIT– 2**
1. Cell involved in immune system, Type and cells, Basic structure and Function, Cytokines.
 2. Cell mediated immunity, Interferons, Hypersensitivity.
- UNIT– 3**
1. Antigen – Antibody interaction, Principle and its types.
 2. Immunohematology – General concept, Blood group system, Rh factor, Medical application of blood group.
- UNIT– 4**
1. Origin and diversity in immune system.
 2. Effector mechanisms.
 3. Immunity of infectious disease, Monoclonal antibodies.
- UNIT– 5**
1. Autoimmune diseases : Hemolytic anaemia, Rheumatoid arthritis, Insulin independent diabetes, Myasthenia gravis.
 2. Organ transplantation, Immunodeficient diseases, Cancers, AIDS.

List of Books

1. Immunology –Kuby.
2. Text book of microbiology –Anantnarayan&Panikar.
3. Immunology –Roitt.
4. Immunology –NandiniSethi.
5. Biotechnology – Fundamental &Application : S.S. Purohit.
6. Plant Tissue Culture –Rojdov.
7. Plant Tissue Culture (Practical) – H.S.Chawla.
8. Fundamental of Immunology –W.Paul.
9. Plant Biotechnology – B.D. Singh, KalyaniPublication.
10. Plant Biotechnology – R.S. Chawla – Oxford and IBH Publishing Co. Pvt.Ltd.
11. Fundamental of Microbiology &Immunology –Ajit Kr. Banerjee, Nirmala Banerjee,New Central Book Agency (P) Ltd.Kolkata.
12. A text book of Biotechnology – InduShekhar Thakur, I.K. International Pvt. Ltd (New Delhi).

PRACTICAL LIST

EXPERIMENTS

Plant:

1. Sterilization of plant materials.
2. Preparation of tissue culture media.
3. Plant tissue culture by plant parts.

Environment:

1. Determination of total dissolved solids of water.
2. Determination of DO, BOD, COD of water.
3. MPN test.

Industrial:

1. Food preservation techniques.
2. Application of biopesticides on microorganisms.
3. Production of Citric acid by microorganisms.

Immunology:

1. Blood grouping in relation to antigen antibody interaction.
2. Rh factor determination.
3. Widal test.
4. VDRL test.
5. Double diffusion experiment.
6. ELISA test.