

**General Outline of courses/papers offered for Degree in B. Sc.
Biotechnology (Optional).**

Sr. No	Paper/Course code	Title of the course / Paper	Credits	Marks
B. Sc. First Year, Semester I				
1	I-MBO	Microbiology	3	50
2	II-BCB	Biomolecules & Cell Biology	3	50
3	III-LC1	Microbiology	1.5	50
4	IV-LC2	Biomolecules	1.5	50
B. Sc. First Year, Semester II				
5	V-GTS	Genetics	3	50
6	VI-BMT	Biomathematics & Biostatistics	3	50
7	VII-LC3	Cell Biology	1.5	50
8	VIII-LC4	Genetics	1.5	50
B. Sc Second Year, Semester III				
9	IX-MTB	Metabolism	3	50
10	X-MOG	Molecular Genetics	3	50
11	XI-LC-5	Metabolism	1.5	50
12	XII-LC-6	Molecular Genetics	1.5	50
B. Sc. Second Year, Semester IV				
13	XIII-EBT	Environmental Biotechnology	3	50
14	XIV-EZY	Enzymology	3	50
15	XV-LC-7	Environmental Biotechnology	1.5	50
16	XVI-LC-8	Enzymology	1.5	50
B. Sc. Third Year, Semester V				
17	XVII-MBT	Microbial Biotechnology	3	50
18	XVIII-GEN	Genetic Engineering	3	50
19	XIXLC-9	Microbial Biotechnology	1.5	50
20	XXLC-10	Genetic Engineering	1.5	50
B. Sc. Third Year, Semester VI				
21	XXI-BIN	Bioinformatics	3	50
22	XXII-RDT	Recombinant DNA Technology	3	50
23	XXIII-LC-11	Bioinformatics	1.5	50
24	XXIV-LC-12	Recombinant DNA Technology	1.5	50

Theory 1 credit = 15 periods, Practical 1credit = 30 periods, LC- lab course

B.Sc. Biotechnology (Optional) First Year, I & II Semester

B. Sc. First Year, Semester I Paper I - MBO Microbiology

Credit : 03

Marks: 50

Scope of Microbiology: Microorganisms in human affairs and industry. **History of Microbiology:** Contributions of Anton van Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch and Alexander Fleming. **Prokaryotic Cell:** Cell wall. Distinction between cell wall of Gram positive and Gram negative bacteria. Cell membrane, Cytoplasm, nucleoid, endospore, flagella, pili, glycocalyx. Structure of Archaea cell.

Diversity of Microorganisms: General account of Bacteria, Fungi, Protozoa, Algae and Viruses. Taxonomy: Naming of microorganisms. Contribution of C. Linnaeus, Taxonomy hierarchy, Whittaker's five kingdom and Carl Woese's three domain classification system. Classification of bacteria and cyanobacteria: Bergery's Manual of Systematic Bacteriology. Classification of Fungi and Protistean Algae.

Visualisation of Microorganisms : Principle and structure of Light Microscope, Numerical Aperture, Resolving Power. Magnification. Principle and structure of electron microscope (SEM and TEM). Comparison between light and electron microscope. **Preparation and staining of specimens for light microscopy:** Fixation, Dyes and simple staining, Differential staining- Gram staining, acid-fast staining, Staining specific structures-negative staining, endospore staining, flagella staining.

Microbial Nutrition: Common nutrient requirements, Nutritional types of microorganisms, growth factors. Uptake of nutrients by cells. Culture Media: Synthetic or defined media. Commonly used media. Types of Media- Selective, differential and enrichment media. **Aseptic Techniques:** Disinfection, Sterilization. Cultivation of bacteria, fungi and viruses. Pure culture: Concept of pure culture. Methods of pure culture of microorganisms – Spread plate, streak plate and pour plate.

List of reference books

1. Keshav Trehan Biotechnology, Willey Eastern Ltd. New Delhi, 1990.
2. Alan Wiseman, Principles of Biotechnology, Surrey University press, 1983.
3. General Microbiology by stanier.
4. Microbiology by pelzar.
5. General Microbiology Pawar and Daginiwala.
6. Microbiology and Introduction by Tora Tora Funke, Case.
7. The world of the cell, Becker, Kleinsmith, Hardin.

Paper II - BCB Biomolecules & Cell Biology

Credit : 03

Marks: 50

Chemistry of Living Cell:-Cell & its components, Various classes of biological molecules & functions, Chemicals inside the cell-Large & small molecules Origin of life:-Origin of amino acids, Nucleotides, Urey Miller's Experiment.

Amino acid & Protein:- Structural classification of amino acids based on R side chain , Structural levels of Proteins, Classification of Proteins based on Composition, Functions of Proteins. Carbohydrates:- General classification of Carbohydrates, Structural Classification of Monosaccharides, Ring formation in Monosaccharides, Mutarotation ,Oligosaccharide Glycosidic bond, Disaccharides (Sucrose,Maltose,Lactose) Polysaccharides (e.g Starch,Glycogen,Cellulose,Heparin,Pectin), Biological functions of Carbohydrates. Molecules involved in generation of Mechanical Stability:- Peptidoglycan, Polysaccharide (Cellulose in Plant).

Membrane lipid, Definition of lipid. Examples of membrane lipid Phospholipids, Sphingolipid. **Membrane models**- Overton's lipid nature of membrane, Langmuir's lipid monolayer, Gorter and Grendel's lipid bilayer, Davson and Danielli's lipid bilayer plus protein sheet, Robertson's Unit membrane, Singer and Nicolson's fluid mosaic. **Membrane structure**- 2D Lipid bilayer, composition of lipid bilayer, asymmetric nature, fluidity , membrane proteins and their function.

Membrane Transport: Movement across membranes- **Passive transport**: simple diffusion, facilitated diffusion-transporters (uniporters and cotransporters) and channel proteins. **Active transport**: Pumps, Group Translocation and Electrochemical Gradients. Protein sorting and intracellular compartments- Vesicular transport; transport of proteins into mitochondria, Vesicular traffic in the secretory and endocytic pathway

Structure and Functions of Organelles: Endoplasmic Reticulum, Lysosome, Golgi Complex, Peroxisome (Microbody), Centriole, Mitochondria, Cytoskeleton- microtubules, intermediates filaments, actin filaments, mechanism of muscle contraction, motors and movements, Cilia & Flagella, Nucleus, Cell division& cell cycle: i) Mitosis ii) Cell cycle- a) interphase b) G1 Phase c) G2 Phase d) Mitosis iii) Meiosis

List of reference books -

1. Outline of Biochemistry V edn Conn and Stumpf. John Willey and sons.
2. Biochemistry S.C. Rastogi, Tata Mograw Hill pub. Co, New Delhi.
3. Cell and molecular biology- Arumugham.
4. Cell and molecular biology- De Robertis
5. Cytology genetics and evolution- Agarwal and varma
6. Cell biology- C.B.Pawar

Paper III - LC1 Microbiology

Credit : 1.5

Marks: 50

1. Basic staining techniques-Monochrome staining, Differential staining
Grams staining., Acid fast staining
2. Preparation of nutrient media-Nutrient broth, Nutrient agar,
3. Mac Conky's agar.
4. Study of aerobic microflora.
5. Study of anacrobic microflora
6. Study of yeast.
7. Study of fungi.
8. Isolation technique, streak, pour, spread plate.
9. Effect of pH on growth of bacteria.
10. Isolation of alkalophilic, halophilic and thermophilic organisms.
11. Enumeration of bacteria by Breed's count method.

Paper IV - LC2 Biomolecules

Credit : 1.5

Marks: 50

1. Estimation of amino acid by ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of protein by Lowry method.
4. Estimation of glucose by DNS method.
5. Estimation of glucose by Benedict's titrimetric method.
6. Estimation of total carbohydrates by anthrone method.
7. Isolation of egg albumin from egg white.
8. Isolation of cholesterol from egg yolk.
9. Isolation of starch from potatoes.
10. Isolation of casein from milk.
11. Separation of amino acids by paper chromatography.
12. Determination of exchange capacity of resin by titrimetry.
13. Separation of serum proteins by paper electrophoresis.
14. Separation of plant pigments by TLC.

B. Sc. First Year, Semester II
Paper V- GTS Genetics

Credit : 03

Marks: 50

Introduction to genetics: Genotype and Phenotype. A brief overview of Mendel's Laws of Inheritance. DNA as Genetic material- Experimental proof. Structure and types of DNA and RNA. Properties of nucleic acids.

Physical Basis of inheritance : Chromosome theory of inheritance. Eukaryotic Chromosome – Macro – molecular Organization. Chromosome types –primary and secondary constrictions., Sat – bodies, Telomeres. Heterochrom at in and Euchromatin and its significance. Ultrastructure of Chromosome – Karyotype and Idiogram. Special types of chromosomes Polytene chromosomes – Salivary gland chromosomes in Drosophila, Lampbrush Chromosomes in amphibian Oocytes & B Chromosomes.

Sex Linkage : Meiotic behaviour of chromosomes and non-disjunction. Bridges theories of non-disjunction . Sex-linkage in Drosophila. Sex linked genes in Poultry and Moths. Sex related genes in maize. Attached X-chromosome . Linkage : Coupling and repulsion hypothesis. Linkage in maize and Drosophila, Linkage groups, Complete linkage, incomplete linkage, factors affecting linkage – distance, age, temperature, X-rays, etc. Theories of linkage, differential multiplication theory and chromosome theory. Measurement of linkage from T2 Bacteriophage. Cis-Trans arrangement. Linkage maps in Maize and Drosophila.

Crossing over : Mechanism of crossing over. Cytological theories of crossing over. Germinal and Somatic crossing over. Crossing over in Drosophila, absence of crossing over in male Drosophila. Frequency and percentage of crossing over. Tetrad analysis in Neurospora. Interference and Coincidence. Construction of genetic maps (Drosophila and Maize)

Chromosomal aberrations : Numerical : Euploidy (Monoploidy, Hap loidy and Polyloidy) Polyploidy – autopolyploidy and allopolyploidy Aneuploidy – Monosomes, Nullisomes, & Trisomes. Structural : Deletions, Duplications, Translocations and Inversions. Evolutionary significance of chromosomal aberrations.

List of reference books

1. Genetics Peter J Russel, The Benjamin/ Qummin publishing Co.
2. Principles of Genetics by Gardner, Siemens.
3. Molecular Genetics by Friefeder.
4. Molecular biology laboratory manual 6th Edn, Cappuccino.
5. Molecular biology and the gene Watson.
6. Genetics. Strickberger M.W.
7. Genetics Goodenough U

Paper VI-BMT Biomathematics & Biostatistics

Credit : 03

Marks: 50

Maths:-

Sets:- Definition, Subset. Union, intersection, Venn Digrams, Complement of a Set, Universal Set, Distributive laws & De Morgan's Law (Verification by simple examples no proof is expected product of Sets) Functions:- Definition Graphs of 1) Linear function 2) Power function 3) Quadratic function 4) Periodic function 5) Exponential function. Use of Logarithms for simple problems (Without log tables) Binomial Theorem (Without proof) – Simple Examples

Limits of a function:- Concept of limit, Limit of function at a point, Simple algebraic limits. Derivative/ Differentiation- Derivative of simple algebraic functions. Derivatives of standard Trigometric & Logarithmic functions (without proof) Addition rules, Substraction rules, Product rule (Treatments only) Integration:- Integration as antidifferentiation, Problems involving simple polynomial functions.

Biostatistics:-

Probability:- Random Experiment, Sample space, Event, Probability of an Event, Axioms of probability. Measures of central Tendencies:- Mean, Calculation of Mean of ungrouped & grouped data Mode & Median of ungrouped data. Measures of deviation, Mean deviation & Standard deviation (For Ungrouped Data) Sampling:- Types of Sampling- Purposive sampling, Random sampling , Simple sampling & Stratified sampling.

List of reference books

1. Introduction to Mathematics for Life Science-E.Batschelet, Narosa Publishing house New Delhi,1975(IInd Edition)
2. Fundametals of Mathametical Statistics-S.C.Gupta& V.K.Kapur, S.chand Publication

Paper VII – LC3 Cell Biology

Credit : 1.5

Marks: 50

1. Study of epidermal hair system from different plants
2. Study of stomatal apparatus
3. Study of simple and complex plant tissue system
4. Study of animal tissue system
5. Mitosis and Meiosis using onion root tips
6. Study of Giant Chromosomes
7. Cell wall staining of plant cell
8. Study of cell inclusion starch
9. Study of Cyanobacteria cell with heterocyst

10. Staining the epithelial cell of mouth using Giemsa
11. Testing the viability of spores, tissues using hydrogen peroxide.

Paper VIII - LC4 Genetics

Credit : 1.5

Marks: 50

1. Floral structure of pea plant and Maize/Arabidopsis
2. Temporary squash preparations of Onion flower buds and Grasshopper tests
3. Study of variations in Pea Plant : Flower Color in Antirrhinum & Mirabilis
4. Computation of mean, mode, median, standard deviation and standard error.
5. Genetic Problems : a) Multiple alleles
6. Application of Chi-square test, t test and F test