SEMESTER-I
CORE COURSE DCS -1
THEORY-I
CELL BIOLOGY AND GENETICS

1. **Unit : Cell structure and Functions**
   - 1.1. Cell as basic unit of living organisms-bacterial, fungal, plant and animal cells
   - 1.2. Ultrastructure of prokaryotic cell (cell membrane and plasmids, Nucleoid)
   - 1.3. Ultrastructure of eukaryotic cell (cell wall, cell membrane, nucleus, mitochondria, chloroplast, endoplasmic reticulum, Golgi apparatus, vacuoles)
   - 1.4. Fluid mosaic model, Sandwich model, Cell membrane permeability
   - 1.5. Structure of chromosome-morphology, components of chromosomes (histones and non-histones), specialized chromosomes (Polytene, Lampbrush)
   - 1.6. Chromosomal aberrations- structural and numerical

2. **Unit : Cell Division and Cell cycle**
   - 2.1. Bacterial cell division
   - 2.2. Eukaryotic cell cycle –phases
   - 2.3. Mitosis - Stages (spindle assembly)-significance
   - 2.4. Meiosis- Stages (synaptonemal complex)-significance
   - 2.5. Senescence and necrosis
   - 2.6. Apoptosis

3. **Unit : Principles and mechanism of inheritance**
   - 3.1. Mendel's experiments- factors contributing to success of Mendel's experiments
   - 3.2. Law of segregation- Monohybrid Ratio; Law of independent assortment- Dihybrid Ratio,Trihybrid Ratio
   - 3.3. Deviation from Mendel's laws- partial or incomplete dominance (eg: Flower Color in Mirabilis jalapa), Co-dominance (eg: MN Blood groups), Non allelic interactions-types of epistasis, modification of dihybrid ratios
   - 3.4. Penetrance and Expressivity (eg: Polydactyly, Waardenburg syndrome), pleiotropism, phenocopy- microcephaly, cleft lip
   - 3.5. Multiple alleleism (eg: Coat color in Rabbits, eye color in Drosophila and ABO Blood groups)
   - 3.6. X-Y chromosomes - Sex determination in Drosophila, Man, X-linked inheritance– Hemophilia and Color blindness; X-inactivation.

4. **Unit : Linkage, Recombination and Extension to Mendel's Laws**
   - 4.1. Linkage and recombination- Cytological proof of crossing over, phases of linkage, recombination frequency, gene mapping and map distance
   - 4.2. Non-Mendelian Inheritance – Maternal effect (Shell coilng in snail), variegation in leaves of Mirabilis jalapa
   - 4.3. Cytoplasmic male sterility in Maize.
   - 4.4. Mitochondrial inheritance in human and poky in Neurospora crassa
   - 4.5. Chloroplast inheritance in Chlamydomonas
   - 4.6. Hardy-Weinberg Equilibrium.

CORE-I: PRACTICALS

1. Microscopic observation of cells: bacteria, fungi, plant and animal
2. Preparation of different stages of Mitosis (onion root tips)
3. Preparation of different stages of Meiosis (grasshopper testis)
4. Preparation of Polytene chromosome from Drosophila salivary gland
5. Monohybrid and dihybrid ratio in Drosophila
6. Monohybrid and dihybrid ratio in Maize
7. Problems on co-dominance, epistasis, two point and three point test cross, gene mapping.
8. Statistical applications of Hardy-Weinberg Equilibrium

Spotters:

1. Prokaryotic Cell(Bacteria),
2. Mitochondria,
3. Chlorolplast,
4. Polytene Chromosomes,
5. Test Cross,
6. Blood Grouping,
7. Hemophilia Pedigree,
8. Crossing Over
9. Synaptonemal Complex,
10. Nucleosome Model.

REFERENCE BOOKS

1. Cell & Molecular Biology. E.D.D De Robertis & E.M.F De Robertis, Waverly publication
2. An introduction to Genetic Analysis by Anthony, J.F. J.A. Miller, D.T. Suzuki, R.C. Richard Lewontin, W.M-Gilbert, W.H. Freeman publication
3. Principles of Genetics by E.J.Gardner and D.P. Snusted. John Wiley & Sons, New York
4. The science of Genetics, by A.G. Atherly J.R. Girton, J.F. Mcdonald, Saundern College publication
5. Principles of Genetics by R.H. Tamarin McGrawhill
6. Theory & problems in Genetics by Stansfield, Schaum out line series McGrawhill
7. Molecular Cell Biology Lodish, H., Baltimore, D; fesk, A., Zipursky S.L., Matsudaride, P. and Darnel. American Scientific Books. W.H. Freeman, New York
8. The cell: A molecular approach. Geoffrey M Cooper, Robert E Hausman, ASM press
9. Cell and Molecular Biology, Concepts and Experiments – Gerald Karp, John Wiley & Sons, Inc.
10. Cell Biology And Genetics by P.K. GUPTA

SEMESTER-II
CORE COURSE DCS -2
THEORY-II
BIOLOGICAL CHEMISTRY AND MICROBIOLOGY

Unit 1: Biomolecules

1.1. Carbohydrates- importance, classification; structure and functions of monosaccharides (glucose & fructose), disaccharides (sucrose, lactose & maltose) and polysachharides (starch, glycogen & insulin)

1.2. Amino acids- importance, classification, structure, physical and chemical properties of amino acids; peptide bond formation

1.3. Proteins- importance, structure of proteins- primary, secondary, tertiary and quaternary

1.4. Lipids- importance, classification- simple lipids (triacylglycerides & waxes), complex lipids (phospholipids & glycolipids), derived lipids (steroids, terpenes & carotenoids)

1.5. Nucleic acids :structure and chemistry of DNA (Watson and crick) and RNA(TMV) Structure and forms of DNA (A, B and Z)

1.6. Enzymes- importance, classification and nomenclature; Michaelis-Menton Equation, factors influencing the enzyme reactions; enzyme inhibition (competitive, uncompetitive & mixed), co-enzymes

Unit 2: Bioenergetics

2.1 Glycolysis, Tricarboxylic Acid (TCA) Cycle,
2.2 Electron Transport, Oxidative Phosphorylation
2.3 Gluconeogenesis and its significance
2.4 Transamination and Oxidative deamination reactions of amino acids
2.5 B-Oxidation of Fatty acids
2.6 Glyoxalate cycle.

Unit 3 : Fundamentals of Microbiology

3.1 Historical development of microbiology and contributors of microbiology

3.2 Microscopy: Bright field microscopy, Dark field microscopy, Phase contrast microscopy, Flourescent microscopy, Scanning and Transmission electron microscopy

3.3 Outlines of classification of microorganisms

3.4 Structure and general characteristics of bacteria and virus

3.5 Disease causing pathogens and symptoms (Eg: *Mycobacterium*, *Hepatitis*)

3.6 Structure and general characteristics of micro-algae and fungi

Unit 4: Culture and identification of microorganisms

4.1 Methods of sterilization- physical and chemical methods

4.2 Bacterial nutrition nutritional types of bacteria, essential macro micro nutrients and growth factors.

4.3 Bacterial growth curve-batch and continuous cultures, synchronous cultures measurement of bacterial growth-measurement of cell number and cell mass.

4.4 Factors affecting bacterial growth

4.5 Culturing of anaerobic bacteria and viruses

4.6 Pure cultures and its characteristics

PRACTICALS

BS306: BIOCHEMISTRY AND MICROBIOLOGY

1. Preparation of normal molar, molal solutions.
2. Preparation of buffers (acidic, basic ,neutral)
3. Qualitative tests of sugars, amino acids and lipids
4. Estimation of total sugars by anthrone method
5. Separation of amino acids by paper chromatography
6. Estimation of proteins by biuret method
7. Sterilization methods
8. Preparation of microbiological media (bacterial, algal & fungal)
9. Isolation of bacteria by streak, spread and pour plate methods
10. Isolation of bacteria from soil
11. Simple staining and differential staining (gram's staining)
12. Bacterial growth curve
13. Technique of micrometry(ocular and stage)

Spotters:

1. Osazone
2. Globular protein
3. Lock and key model
4. Completive inhibition
5. RUBISCO
6. ATP synthase
7. Autoclave
8. Laminar air flow
9. Tyndalization
10. Bacterial growth curve
11. Hot air oven
12. Serial dilution technique

REFERENCE BOOKS

1. Lehninger Principles of Biochemistry By: David L. Nelson and Cox
2. Biochemistry By: Rex Montgomery
3. Harper's Biochemistry By: Robert K. Murray
4. Enzymes By: Trevor Palmer
5. Enzyme structure and mechanism By: AlanFersht
6. Principles of Biochemistry By: Donald J. Voet, Judith G.Voet, Charlotte W.Pratt
7. Analytical Biochemistry By: Cooper
8. Principles and techniques of Biochemistry and Molecular Biology Edited By: Keith Wilson and John Walker
9. Experimental Biochemistry: A Student Companion by: Sashidhar Beedu et al.
10. Practical Biochemistry By: Plummer
11. Biology of Microorganisms by: Brock, T.D. and Madigan, M.T.
12. Microbiology by: Prescott, L.M., Harley, J.P. Klein, D.A.
13. Microbiology by: Pelczar, M.J, Chan, E.C.S., Ereig, N.R.
14. Microbiological applications by: Benson