SEMESTER I

Paper 1: MOLECULAR BIOLOGY (GMBT-101)

Course Objectives

This course is designed as such to target the knowledge and understanding of Nucleic acids and the experiments related to Genetics.

Course Contents

UNIT – I

Organization of genetic material - Packing of DNA in to chromatin - protein components of chromatin, histones, nucleosome organization. Solenoids loops, domains & scaffolds. Gene amplification, polytene chromosomes.DNA replication-apparatus, enzymes involved and mechanism.Replication at telomeres.DNA damage and repair mechanism.Nuclear genome.C - value paradox.Mitochondrial & plastid genomes and genes.Fine structure of the eukaryotic gene. Split genes. Different kinds of genes: overlapping, assembled, polyprotein & nested genes.

UNIT – II

Transcription in prokaryotes and eukaryotes. Mechanism of transcription, enzymes and transcription factors, zinc finger, leucine zipper mechanism. Maturation and processing of m-RNA, splicing, 5' end capping & 3' end tailing.RNA editing and transport.RNAi and small RNAs.

UNIT – III

Translation in prokaryotes and eukaryotes: Genetic code - properties of the genetic code, deciphering of the genetic code. Ribosome as a translation factory. t - RNA as an adaptor, its mode of function. Post translational modifications. Leader sequences & protein targeting.

UNIT – IV

Regulation of gene expression in prokaryotes - The operon concept, lac & tryp operons.Transcriptional control. Post translational control. Regulation in eukaryotes - Control by promoter, enhancer and silencers.Cis-trans elements.Environmental & developmental regulation.DNA methylation & gene expression.Chromatin structure & gene expression.

BOOKS RECOMMENDED:

1. Biochemistry by L.Stryer 5 Ed. (Freeman-Toppan)
2. Genes VIII by B.Lewin (Oxford)
3. Cell and Molecular Biology by E,D.P. De Roberties (International edition)
4. Molecular Biology by David Frefielder.
5. DNA Science by Carolin a Publishing Company.
6. Molecular Biology of the Gene by J.D.Watson et. al.,(Benjamin).
7. RNAi-Design and application by Basic (Springer).
8. Small RNAs-Analysis and Regulatory functions by Nellen (Springer).

Paper 2: ENZYMOLOGY AND METABOLISM (GMBT-102)

UNIT – I

Classification and Nomenclature of Enzymes.Enzyme kinetics. Factors affecting the rates of enzyme catalysed reactions. Assay of enzyme activity – units of enzyme activity. Multisubstrate
reactions. Enzyme – substrate (protein ligand) binding. Methods for measurement of km. Coenzymes, metalloenzymes, and isoenzymes with examples.

UNIT-II

Active site determination.Mechanism of enzyme action of Chymotrypsin & Trypsin, carboxypeptidase-A and ribonuclease A. Multienzyme systems.Covalent modification.Zymogen activation.Enzyme inhibition – Competitive, non-competitive and uncompetitive.Allosteric enzymes, Ribozymes and catalytic antibodies.

UNIT – III

Glycolysis, Glycogenolysis, glycogenesis, gluconeogenesis, HMP shunt path way and their regulation.Tricarboxylic acid (TCA) cycle, Glyoxylate cycle and its significance.Biosynthesis and oxidation of fatty acids.Metabolism of cholesterol.Ketone bodies.Biosynthesis of Heme and chlorophylls.

UNIT – IV

Protein turnover.General metabolic reactions of amino acids.Urea cycle.Nitrogen fixation.Essential and non-essential amino acids.Biosynthesis and degradation of aromatic and branched chain aminoacids.Inborn errors of amino acid metabolism.Biosynthesis of purine and pyrimidine nucleotides and their regulation.Catabolism of purines and pyrimidines.

BOOKS RECOMMENDED:

1. Principles of Biochemistry by A.L.Lehninger, 2 Ed. (worth).
2. Lehninger Principles of Biochemistry by Nelson, D and Cox, D. Macmillon Pub.
3. Biochemistry by L.Stryer 5 Ed. (Freeman-Toppan).
4. Text Book of Biochemistry by West et. al., (Mac Millan).
5. Principles of Biochemistry by Smith et. al., (Mc Graw Hill).
6. Harper's Biochemistry (Langeman).

Paper 3: MICROBIAL PHYSIOLOGY AND GENETICS (GMBT-103)

Course Objectives:

On the completion of this course the students will be able to describe following subject matters: Cycle: Mitosis and Meiosis: Control points in cell-cycle, Law of segregation & Principle of independent assortment This course is designed to understand the role and composition of various body fluids with reference to human body.

Course Contents

UNIT-I

Classification and cultivation of bacteria. Bacterial reproduction and growth curve. Preparation of bacteriological media.Staining techniques.Differences between gram positive and gram negative bacteria. Methods of sterilization, pasteurization an d disinfection. Microbiology of water, milk, air, soil and sewage.Microbes as path ological agents in plant and animals.Clinically important bacteria. Biohazards - safety precautions.

UNIT-II

Chemical nature and classification of bacteriophages.Parasitic and temperate phages. Plant and animal viruses – multiplication of viruses.General characteristics of T Phase, φx174, SV40, TMV.Clinically important viruses, retroviruses, HIV, Hepatitis B Virus and viral infections.General account of algae molds and yeasts.Economic importance of algae and fungi.Clinically significant protozoans.

UNIT – III

Microbial genetics: Recombination in prokaryotes, Transformation, conjugation, transduction and sexduction. Mapping of prokaryotic gene.Transposons, retrotransposons and mechanism of transposition.Viral genetics.Biology ofplasmids.Extra chromosomal inheritance.

UNIT-IV

Genetics of Eukaryotes: Gene & Environment, Genotype and phenotype, Mendel's experiments, Dominance relationships. Multiplealleles, Gene Interaction, Gene mutations, Sex determination,
Sex linkage, Linkage and recombination in diploids.Tetrad analysis. Elements of gene mapping, Pedigree analysis

BOOKS RECOMMENDED:

1. Text book of Microbiology by Pleczar and Reid (Mc Graw Hill).
2. Microbiology by Tortora, Funk & Case.
3. Microbiology by Prescott.
4. Principles of Genetics by Sinnet et.al, (Mc Graw Hill).
5. Principles of Heridity by Robert Tumarin.
6. Genetics by M.W.Strick Berger (Mac Millan).
7. Cell and Molecular Biology by E,D.P. De Roberties (International edition).

Paper 4: GENETIC ENGINEERING (GMBT- 104)

Course Objectives

"At the end of this course, genetic engineering the students will be able to describe: • Vectors and Enzymes, Plasmids, Cosmids, Phasemids, Transposons, Artificial Vectors • Sticky and Blunt Ended ligation methods, Homopolymer tailing method, Gene transfer in Prokaryotes and Eukaryotes, Strategies of gene transfer, blotting techniques, DNA sequencing methods • Applications of Molecular markers; RAPD and RFLP • Golden Rice, Bt Cotton, Antisense RNA technology, Production of transgenic mice • Gene therapy, Merits and demerits of GMOs

Course Contents

UNIT-I

Isolation of DNA and RNA. Restriction mapping, DNA sequencing by chemical and enzymatic methods. Nucleic acid blotting – southern and northern blotting.DNA cloning. Enzymes used in genetic engineering : Restriction endonucleases - types, nomenclature and properties. DNA polymerase-I, polynucleotide kinase, DNA ligase, terminal nucleotide transferase, Reverse transcriptase, alkaline phosphatase, S1 nuclease.

UNIT-II

Salient features of cloning vectors, types of cloning vectors - plasmids, cosmids, phages (lamda and M13 phages), animal (SV40, Baculo) and plant (CMV) viruses, Artificial chromosomes-YACs and MACs. Ligation of foreign DNA to vectors - cohesive and blunt end methods - homopolymer tailing and adaptors. Preparation of gene libraries and c-DNA libraries.

UNIT – III

Techniques of gene transfer - transformation , transfection, micro injection, electroporation, lipofection and biolistics. Selection of r-DNA clones and their expression. Nucleic acid probes, colony and fluorescent in-situ hybridization.

UNIT – IV

Polymerase Chain Reaction and its applications.DNA micro array technology. Applications of genetic engineering in agriculture, animal husbandry, medicine and in industry. Genomics-genome sequencing by shot gun and hierarchical method. Genome annotation – identification of genes, promoters and exon – intron boundries.

BOOKS RECOMMENDED:

1. Recombinant DNA technology by Watson et. al., (Scientific American Books).
2. Genes-VIII by Benjamin Lewin.(Oxford).
3. Principles of Gene Manipulation by Old and Primrose.(Blackwell).
4. DNA Science by Carolin a Publishing Company.
5. From genes to clones by Winneker.
6. From genes to genomes concepts and applications of DNA technology by Jeremy W dale and Malcolm von Scrantz, Weil publications
7. Molecular Biotechnology by Glick.
8. Genetic Engineering by Sandhya Mitra.
9. Genomes by T.A. Brown

List of practical based on theory papers (Semester-I)
GMMT LAB-101

1. Determination of pKa and preparation of buffer solutions,
2. Measurement of absorption maxima.
3. Demonstration of Beer-Lambert Law and study of its validation
4. Estimation of protein by Biuret, Bradford, Lowry and UV methods
5. separation of lipids by TLC, Quantitative estimation of Vit C and Vit E,
6. Assay of enzymes of clinical importance like amylase, phosphatases and aminotransferases.
7. Estimation of serum cholesterol, creatine, uric acid, triacylglycerides, HDL, LDL, bilirubin, blood sugar and serum electrolytes (Na+, K+ and chloride)
8. Urine analysis for abnormal constituents.
9. Assay of amylase from Saliva.
10. Assay of trypsin.
11. Assay of acid-phosphatase from potato.
12. Assay of Lipase from serum.
13. Assay of Catalase from liver.
14. Time course of enzyme activity
15. Effect of pH and determination of optimum pH.
16. Effect of temperature on enzyme activity and calculation of energy of activation.
17. Effect of substrate concentration on enzyme activity and determination of Km.
18. Effect of metal ions on enzyme activity.
19. Purification of an enzyme.

List of practical based on theory papers (Semester-I)
GMMT LAB-102

1. Preparation of liquid and solid media for growth of microorganisms.
2. Slants and Stab cultures, Isolation and maintenance of microorganisms by plating, streaking and serial dilution methods.
3. Biochemical characterization of selected microbes.
4. Simple staining and Grams staining.
5. Acid fast and spore staining.
6. Microscopic examination of bacteria, yeast and molds.
7. Growth of a microorganism and growth curve.
8. Analysis of water for portability and determination of MPN.
9. Microbiological examination of milk.
10. Isolation of RNA from yeast.
11. Estimation of RNA using orcinol reagent and by UV spectrophotometry.
12. Isolation of DNA from microbial, plant and animal sources.
13. Estimation of DNA using diphenylamine reagent and by UV spectrophotometry.
14. Enzyme induction in E.Coli.
15. Isolation of plasmid DNA.
16. Digestion of plasmid DNA with restriction endonucleases.
17. Separation of DNA fragments by Agarose gel electrophoresis.
18. Elution of DNA from agarose gels.
19. Ligation of DNA fragments.
20. Bacterial transformation and identification of transformants.