

M. Sc. Biochemistry

Course structure

(Batch: 2020 Onwards)

Semester-I				
Sl. No.	Course Code	Course Title	Credits	(L-T-P)
1.	BCBE 706	Techniques in Biochemistry & Instrumentation	3(2-0-1)	(2-0-2)
2.	BCBE 708	General Biochemistry	3(2-0-1)	(2-0-2)
3.	CHEM 710	Quantitative Analytical Methods	3 (2-0-1)	(2-0-2)
4.	IM 720	General Microbiology	4 (3-0-1)	(3-0-2)
5.	MAS 511	Statistical Methods	3(2-0-1)	(2-0-2)
6.	MCE717	Molecular Biology	3 (2-0-1)	(2-0-2)
			Total Credits:	19

Semester-II				
Sl. No.	Course Code	Course Title	Credits	(L-T-P)
1.	BCBE 702	Intermediary Metabolism-I	3 (2-0-1)	(2-0-2)
2.	BCBE 730	Enzymology	3 (2-0-1)	(2-0-2)
3.	CSIT 701	Computer Orientation	3 (2-0-1)	(2-0-2)
4.	MAS 815	Experimental Design	3 (2-0-1)	(2-0-2)
5.	MCE 715	IPR & Biosafety	3 (3-0-0)	(3-0-0)
6.	BCBE 780	Seminar-I	1 (0-0-1)	(0-0-2)
7.	BCBE 899	Dissertation	02	(0-0-4)
			Total Credits:	18

Semester-III				
Sl. No.	Course Code	Course Title	Credits	(L-T-P)
1.	BCBE 705	Intermediary Metabolism-II	3 (3-0-0)	(3-0-0)
2.	BCBE 733	Animal Biochemistry	3 (2-0-1)	(2-0-2)
3.	BCBE 735	Plant Biochemistry	3 (2-0-1)	(2-0-2)
4.	BCBE 741	Nutritional Biochemistry	3 (2-0-1)	(2-0-2)
5.	BCBE 801	Immunology & Clinical Biochemistry	3 (2-0-1)	(2-0-2)
6.	CBBI 801	Bioinformatics	3 (2-0-1)	(2-0-2)
7.	BCBE 880	Seminar-II	1 (0-0-1)	(0-0-2)
8.	BCBE 899	Dissertation	06	(0-0-12)
			Total Credits:	25

Semester-IV				
Sl. No	Course Code	Course Title	Credits	(L-T-P)
1.	BCBE 899	Dissertation	22	(0-0-44)
			Overall Credits:	84

Course Syllabi

Semester-I

BCBE 706	Techniques in Biochemistry and Instrumentation	3(2-0-1)
-----------------	---	-----------------

- Centrifugation Techniques: Differential, zonal and density gradient, ultra, types of centrifuges and applications.
- Chromatography: Adsorption, partition, exclusion, ion exchange, affinity, H.P.L.C., G.L.C., column.
- Electrophoresis: Principles and applications, paper, gel, S.D.S., P.A.G.E., P.F.G.E., Isoelectric focusing.
- Molecular Biology Techniques: Isolation and purification of DNA, RNA, plasmid DNA, sequencing of proteins and nucleic acids, chemical synthesis of nucleotides, competent cell preparation and transformation, DNA foot printing, DNA fingerprinting, PCR.
- Immunological Techniques: RIA, ELISA, Flow cytometry.
- Radio isotopic and tracer techniques: Detection and measurement of isotopes (GM and scintillation counters), autoradiography.
- Biosensors: Types and uses.

List of Practical:

- Determination of pH using indicators.
- The separation of amino acids by paper electrophoresis.
- The validity of Beer's law for the colorimetric estimation of creatinin.
- Total chlorophyll estimation from the plant sample.
- Protein estimation- A. Biuret method, B. Lowry's method.
- Estimation of nucleic acid by electrophoresis.

- Scope and importance of biochemistry in agriculture; fundamental principles governing life. structural and functional origination of prokaryotic and Eukaryotic cells; Cell organelles their functions and fractionations
- Proteins: amino acid and peptides, Primary, secondary, tertiary and quaternary structures, structure function and evolutionary relationships, protein folding; allosteric proteins.
- Carbohydrates: monosaccharide, oligosaccharide, polysaccharide, proteoglycans, and glycoproteins;
- Lipids: fatty acids, acylglycerol, phospholipids, sphingolipids, cholesterol, and membranes; isoprenoids, eicosanoids, and their biological importance.
- Nucleic acids: bases, nucleotides, RNA and DNA; Different structural forms of DNA; denaturation, renaturation, and hybridization of DNA; different types of RNA;
- Definition, Classification, structures and functions of Vitamin, deficiency disorder
- Membranes- Transport phenomenon: bio-membranes, diffusion- passive and facilitated and active transport processes. Mechanism of ATP synthase and its regulation, malate aspartate shuttle.

List of Practical:

- Preparation of buffers,
- Nitrogen estimation by different methods,
- Separation of amino acids by TLC,
- Estimation of reducing and non-reducing sugars,
- Estimation of oil, iodine value,
- Saponification value and acid value, estimation of ascorbic acid,
- Estimation of riboflavin and thiamine.

- Introduction of Quantitative Analytical Methods.
- Errors, Precision & Accuracy in Analytical Methods.
- Classical Methods of Analysis- Gravimetric, Volumetric:- Neutralization titrations,, Complexometry & Iodometry.
- Electrochemical Methods- Redox Titrations, Potentiometry, Thermogravimetry, Voltammetry.
- Colorimetry, Spectrophotometry.
- Chromatography- Adsorption, Partition, Gel Filtration, Ion Exchange, Column Chromatography.

List of Practical:

- Volumetric Analysis- Neutralization Titrations, Redox Titrations, Complexometry, Iodometry, Potentiometry.
- Gravimetric Analysis
- Colorimetric and Spectrophotometry Analysis
- Column Chromatography, Ion Exchange Chromatography, Paper Chromatography, TLC

Reference Books:

1. Instrumental methods of Instrumental Analysis- B.K. Sharma.
2. Fundamentals of Analytical Chemistry- Skoog, West, Holler, Crouch.
3. Quantitative Organic / Inorganic Analysis – Vogel.
4. Quantitative Analysis- Day & Underwood.
5. Instrumental Methods of Analysis- Willard, Merritt, Dean & Settle.
6. Analytical Chemistry- Gary Christian.

IM 720	General Microbiology	4(3 – 0 – 1)
--------	----------------------	--------------

- History and scope of Microbiology
- General characteristics, classification, morphology and reproduction of Bacteria, Mycoplasma, Chlamydia, Rickettsiae, and Actinomycetes
- General characteristics, classification, morphology and reproduction of Fungi, Algae, Protozoa
- Control of microorganisms by physical and chemical agents

List of Practical:

- Familiarity with equipment and apparatus used in Microbiology
- Methods of isolation, purification and maintenance of microorganisms
- Staining techniques (Simple, Differential, Special) in bacteria
- Preparation of media and reagents and their sterilization
- Study of cultural and morphological characteristics of important groups of: Fungi, Algae, Protozoa
- Effect of physical agents (*viz.* temperature, osmotic pressure, UV radiation *etc.*) on microorganisms
- Effect of chemicals (*viz.* alcohol, phenol, halogens, heavy metals *etc.*) on microorganisms

Statistic, population parameter, frequency distribution frequency polygon, histogram, bar chart Arithmetic Weighted geometric and harmonic mean mode, median for grouped and ungrouped data, standard deviation, mean deviation and coefficient of variation, simple and multiple correlation coefficient, regression line, fitting equations to data by least square method, curve linear regression line, fitting equation to data by least square method. Test of significance, t, F, χ^2 test Distribution: Normal, Binomial and Poisson distribution, confidence interval Analysis of Variance; Definition, assumption, one way and two way classification with one per cell, probability theory.

Reference Books:

1. Introductory Statistics - P.S. Mann
2. Fundamental of Mathematical Statistics- Gupta to Kapoor
3. Fundamental of Mathematical Statistics – Gun Gupta & Das Gupta

- **Introduction to Nucleic Acids:** Historical development of molecular biology, nucleic acids as genetic material. Nucleic acid structure, chemical and physical properties of nucleic acids, spectroscopic and thermal properties of nucleic acids, DNA supercoiling. Concept of genes and genome, genome complexity, genome organization in prokaryotes and eukaryotes, chromatin structure and function, repetitive and non-repetitive DNA, satellite DNA central dogma, genome editing.
- **Synthesis of Nucleic Acid:** Modes of replication, DNA polymerases, topoisomerases, DNA ligase, model of replisome, semi conservative replication in prokaryotes and eukaryotes, inhibitors of replication, DNA damage and repair. Basic principles of transcription, transcription initiation, elongation and termination, RNA processing, RNA interference, siRNAs, miRNAs and other ncRNAs, DNA/ RNA editing. Regulation of transcription, reverse transcription.
- **Protein Synthesis:** Ribosomes structure and function, organization of ribosomal proteins and RNA genes, genetic code, aminoacyl-tRNA synthetases. Initiation, chain elongation and termination of translation, energetics, inhibitors of translation. Post translational modifications of nascent polypeptide, protein targeting and turnover, regulation of gene expression in prokaryotes and eukaryotes, nucleases and restriction enzymes.
- **Gene Manipulation:** Importance, Sanger method, High-Throughput Sequencing (HTS) techniques, applications of DNA sequencing. Vectors, isolation of genes, recombinant vector, selection of recombinants, characterization and expression of cloned DNA, transformation, transgenesis, mutation, molecular mechanism of mutation, site directed mutagenesis, *in vitro* mutagenesis. Polymerase chain reaction (PCR), expression cloning, gel electrophoresis, molecular markers, macromolecule blotting and probing, arrays (DNA array and protein array) – principles and application.

List of Practical:-

- Isolation and purification of DNA and RNA
- To check the purity of isolated DNA and RNA
- Restriction fragmentation of genomic DNA
- Separation of oligos by agarose gel electrophoresis
- Southern blotting experiments
- Northern blotting experiments
- Cloning of DNA fragment in vector
- Selection of recombinant
- SSR analysis of DNA
- cDNA synthesis using RT- PCR
- Basic tools in bioinformatics analysis

Semester-II

BCBE 702	Intermediary Metabolism I	3(2-0-1)
-----------------	----------------------------------	-----------------

- Bioenergetics: Energy & its- transformation in living systems ; Thermodynamic principles; concept of free energy changes in biochemical reactions, Electro-chemical gradient, energy rich compounds. Introduction to metabolism: methods to study metabolism.
- Carbohydrate metabolism: Introduction to digestion and absorption of carbohydrates. Catabolism of carbohydrates: Glycogenolysis, glycolysis, fermentation. TCA, ETS, Energy aspects, HMPS. Anabolism: Biosynthesis of structural polysaccharide. Eg.-peptidoglycon, chitin. Anabolic role of TCA cycle (anapleurotic reactions), gluconeogenesis, glycogenesis, glyoxalate cycle, regulation of carbohydrate metabolism.
- Lipid metabolism: Introduction to digestion and absorption, oxidation and biosynthesis of fatty acids. Phospholipids: energy aspects, importance and regulation Biosynthesis of biologically important lipids: biosynthesis of sterols, glycolipids, prostaglandins, prostacyclins, and thromboxins. Energy aspects, regulation and importance.
- Oxidative phosphorylation, introduction to electron transport, chain structure localization. Components, oxidative phosphorylation, ATP formation.

List of Practical:

- Determination of lactic acid from milk.
- Estimation of total carbohydrates from potato by anthrone method.
- Extraction of glycogen from liver.
- Extraction of starch from potato.
- Determination of citric acid from citrus fruits.
- Determination of lactose from milk.
- Determination of fat in milk.
- Determination of acid value/peroxidation/ saponification no. of fats.
- Separation of carbohydrate lipid by TLC.

- Introduction of enzymes: General properties and significance, classification and nomenclature. Terms and definition in enzymology, co-factors, coenzymes, active site concept, isoenzymes, allosteric enzymes, marker enzymes, multienzyme complex, ribozyme, abzyme, synzyme, extremozyme, therapeutic enzymes and immobilized enzymes, pseudoenzymes, enzyme promiscuity *etc.*
- Enzyme kinetics: steady rate kinetics, Derivation of Michaelis-Menten equation using steady state/equilibrium kinetics, plots of Lineweaver-Burke, Hanes, Eadie-Hofstee *etc.* Mechanism of bisubstrate and multisubstrate enzyme catalyzed reaction, Enzyme inhibitors, mechanism of enzyme action-lysozyme, chymotrypsin, alcohol DH. metal activated enzymes and metalloenzymes
- Regulation of enzyme activity: Covalent modification, allosteric model concerted and sequential, cooperativity and feedback inhibition.
- Enzyme Technology: Commercial production of enzymes, immobilization of enzymes, example of enzyme engineering, application of enzyme (therapeutic uses, analytical uses, manipulated uses *etc.*), uses of enzyme reactors.
- Isolation, purification and localization of enzymes. Various methods to estimate the enzyme activity.

List of Practical:

- Soluble protein estimation
- Enzyme assay by taking any model enzyme
- Isolation and purification of any model enzyme
- Study of the effect of enzyme and substrate concentrations on enzyme activity
- Determination of K_m and V_{max}
- Determination of pH and temperature optima
- Effect of inhibitors on enzyme activity
- Determination of pH and temperature stability of enzyme
- Electrophoretic analysis of isozymes.

CSIT 701	Computer Orientation	3(2-0-1)
-----------------	-----------------------------	-----------------

- Information Concepts
 - a. Data and Information
 - b. Information System: Application, Elements, Types
- Computer Basics
 - c. Definition, Characteristics & Application of Computers
 - d. Computer Hardware: I/O Devices, Memory, CPU
 - e. Software Concepts
- Operating System
 - f. DOS
 - g. Windows
- Application Software
 - h. MS Word
 - i. MS Excel
 - j. MS Access
 - k. MS Power Point
 - l. Adobe Reader
- Computer Programming
 - m. Algorithm & Flowchart
 - n. Introduction to 'C' Language
 - i. History
 - ii. Input & Output Statements
 - iii. Variables & Constants
 - iv. Expressions & Operators
 - v. Control Statements
 - 1. Branching Statements (if, if- else, Nested if)
 - 2. Looping Statements (while, do-while, for)
 - vi. Functions & Arrays
- Internet Concepts & Search Engine.
- Application of statistical packages.

Reference Books:

1. J.B. Dixit, "Fundamentals of Computers & Programming in 'C' ", Laxmi Publications(P) Ltd.
2. Yashavant Kanetkar, "Let us C", BPH Publications
3. E. Balaguruswamy, "ANSI C", TMH

- Introduction to Intellectual Property: Intellectual property and its Classifications: Patents, Copyright, Trademarks and Related Rights, Industrial Design, Geographical Indications, Traditional Knowledge, Protection of New GMOs; International framework for the protection of IP. Intellectual Property as a factor in R&D; IPs of relevance to Biotechnology; Case Studies of Diamond vs Chakravarty, Harvard Oncomouse; Introduction to History of GATT, WTO, WIPO and TRIPS.
- Basics of Patents: Types of patents; Indian Patent Act 1970; Recent Amendments; Filing of a patent application; Precautions before patenting-disclosure/non-disclosure; WIPO Treaties; Budapest Treaty; Patent Cooperation Treaty and Implications; Role of a Country Patent Office; Procedure for filing a PCT application. Concept of 'prior art'; Patent databases; USPTO, EPO., *etc.*
- Patent filing and Infringement: Patent application- forms and guidelines, fee structure, time frames; Types of patent applications: provisional and complete specifications; International patenting-requirement, procedures and costs; Publication of patents-gazette of India, status in Europe and US Patenting by research scholars, lecturers and scientists University/organizational rules in India and abroad. Financial incentives, Patent infringement-meaning, case studies e.g. Basmati rice, neem and turmeric Patents.
- Biosafety: Introduction; Historical Background; Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines - Government of India; Definition of GMOs and LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC *etc.* for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of National Regulations and relevant International Agreements including Cartagena Protocol

- **Analysis of variance technique:** Definition & assumptions, One way classification, Two way classification with more than one observation per cell.
- **Designs of Experiment:** Principles of Experimental Design, Randomized Block Design (R.B.D), Latin Square Designs (L.S.D), CRD, Missing Plot Technique in R.B.D & L.S.D. Critical-difference (C.D), Split plot design.
- **Factorial Experiments:** 2^2 , 2^3 , 3^2 , & 3^3 , factorial-designs. (Yates method of Analysis), 2×3 & 2×4 factorials. Durcan's Multiple Range Test. Newman's Kuel's Test
- **Sampling Techniques :** Simple Random Sampling, Stratified Random Sampling & Systematic Sampling.

Reference Book:

1. Fundamentals of Applied Statistics (Volume II:-Gupta & Kapoor
2. Agricultural Statistics: S.R.S Chandel

Semester-III

BCBE 705	Intermediary metabolism II	3 (3-0-0)
-----------------	-----------------------------------	------------------

- Amino acid catabolism: introduction to digestion and absorption, amino acid degradation pathways and their mode of degradation- Transamination, oxidative deamination, deamination and importance. Urea cycle, formation of excretory products, linking to TCA cycle and regulation.
- Amino acid biosynthesis: overview, biosynthesis of essential amino acids- tryptophan, tyrosine, valine, lysine. Biosynthesis of non-essential amino acids: glycine, serine, cystine, threonine, phenylalanine, histidine, proline, arginine.
- Purine & Pyrimidine nucleotide metabolism: introduction, *denovo* and salvage pathways of purine and pyrimidine nucleotide biosynthesis. Catabolism of purine and pyrimidine nucleotides. Biosynthesis of nucleotide coenzymes.

List of Practical:

- Parametric analysis of section of protein-dye.
- Determination of protein from milk.
- Fractionation of egg proteins.
- Quantification of serum proteins by honey method.
- Estimation of protein from leaf tissue.
- Isolation of DNA from plant /bacterial sample.
- Quantification of DNA.
- Isolation of RNA from bacterial/ plant tissue.

- Fundamental Immunology: Basic terminology: Antigen, antibody, lymphokines, cytokines, hapten, adjuvant, immunogen, pathogen, epitopes, paratopes, *etc.* specific and nonspecific immune response, humoral and cell mediated immunity. Cells of adaptive immune response- B & T cell. Cells of innate immune response- macrophages, phagocytes, mast cells, dendritic cells, granulocytes, agranulocytes.
- Organ of immune system- 1. Primary lymphoid organs, 2. Secondary lymphoid organs
- Defense mechanisms- 1. Inflammation, 2. Phagocytosis
- Generation of antibody diversity, clonal selection hypothesis definition idiotopes, idiotypes, allotypes, structure and function of M.H.C(both class 1 & class 2), chemistry of antigen –antibody interaction, precipitation & agglutination.
- Structure and function of natural killer cells, super antigens, cells-mediated cytotoxicity(A.D.C.C), the complement system (both classical & alternative pathways). experimental assessment of A.D.C.C i.e. by C.M.L, M.L.R and graft vs. host reaction .
- Primary B&T-cells immunodeficiencies, auto immunity hypersensitivity, structure of t-cells receptor and comparison with antibody molecule.
- Techniques of immunology, immunoelectrophoresis (one dimensional and two dimensional), ELISA, RIA, Immunofluorescence, western immuno blotting, biochemistry of cancer & AIDS.

List of Practical:

- Preparation of blood smears
- Separation of serum & plasma
- Qualitative test for assessment of different constituent of plasma/seven
- Separation of plasma proteins (*i.e.* fibrinogen, globulin and albumin)
- Determination of E.S.R of the given blood sample
- Preparation of antigens from blood
- Determination of the blood group
- Determination of the haematocrit value of any blood sample
- Use the widal kit for rapid quantitative slide test.

- Concepts of Blood and Body fluids-Biochemical composition of blood groups, blood clotting, physiological function of blood, buffering action of blood, kinds other body fluids.
- Concepts of respiratory and excretory systems physiology.
- Metabolism of foreign compounds, Water and electrolytes, acid-base balance trace elements and vitamins.
- Gastrointestinal physiology-Digestion of food ruminants and non-ruminants absorption of food, bioactive peptides and functional oligosaccharides
- Immune systems, immunoglobulins, monoclonal antibodies, formation of antibody, antibody diversity, complement system – classical and alternate, major histocompatibility complexes, cell mediated immune response, mechanisms of immunity.
- Animal Hormones-Origin, site of action, biochemical mechanism of hormone action, feed-back mechanism of hormonal secretion.
- Biochemistry of specialized tissues – connective tissue, skin, muscle, nervous tissue and blood and other body fluids.

List of Practical:

- Separation of serum and plasma from blood
- Preparation of blood film and study of different types of cells
- Total count of red blood corpuscles (R.B.Cs.)
- Total count of white blood corpuscles (W.B.C.)
- Differential count of white blood corpuscles (W.B.C.)
- Determination of the Haematocrit value of the blood samples
- Determination of haemoglobin by Sahli's method
- Determination of hemoglobin by cyanmethemoglobin method
- Determination of blood sugar by Folin-Wu method
- Determination of Urea in serum/plasma
- Determination of Urinary Creatinine

- Photosynthesis: significance of photosynthesis, ultra structure of chloroplast, photosynthetic pigments. Light absorption phenomenon, Carbon reduction in C3, C4 and CAM plants, electron transport and photorespiration, Bacterial Photosynthesis,
- Biosynthesis of structural carbohydrates, storage proteins and lipids, sucrose-starch inter-conversion
- Basic concepts of nitrogen and sulphur metabolism: biological nitrogen fixation, nitrate assimilation in plants, sulphur chemistry and function, reductive sulphate assimilation pathway, sulphated compounds
- Phytohormone: Different classes of phytohormones, their biosynthesis and mode of action. Biochemistry of fruit ripening – ripening process, cell wall degrading enzymes, role of ethylene and regulation of ethylene production.
- Secondary Metabolites: Biochemistry and significance of plant secondary metabolites – phenolics, terpenoids, alkaloids, cyanogenic glycosides and glucosinolates, effect of biotic and abiotic factors on plant metabolism and plant defense system.

List of Practical:

- Fractionation of cell organelles
- Analysis of plants and plant product for various constituents.
- Extraction and identification of sugars from plants, fruits and vegetables.
- Extraction and determination of amino acids and protein.
- Extraction and determination of carotenoids, anthocyanin, chlorophylls, lycopene, curcumin *etc.*
- Qualitative tests of secondary metabolites (alkaloids, sterols *etc.*)
- Determination of polyphenols /phenolics
- Estimation of glucosinolates • Estimation of cyanogenic compounds
- Assay of PAL/SOD /PPO/LOX

- Basic concepts: Function of nutrients. Measurement of the fuel values of foods. Direct and indirect calorimetry. Basal metabolic rate: factors affecting BMR, measurement and calculation of BMR. Measurement of energy requirements. Specific dynamic action of proteins.
- Elements of nutrition: Dietary requirement of carbohydrates, lipids, proteins and dietary fibers. Biological value of proteins. Concept of protein quality. Protein sparing action of carbohydrates and fats. Essential amino acids, essential fatty acids and their physiological functions. Prebiotics and Probiotics, Anti Nutritional Factors and Food Toxins
- Minerals: Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper.
- Vitamins: Dietary sources, biochemical functions Biologically active forms of vitamins, deficiency diseases associated with vitamin.
- Detoxification: Definition site phases, of detoxification. Biochemical role of water.
- Biochemical features some diet related disorders like protein-calorie malnutrition diabetes, cardiovascular disease goiter anemia *etc.*

List of Practical:

- Estimation of amylose and amylopectin
- Estimation of resistant starch
- Estimation fatty acid
- Estimation of phenols in plant tissue/sample
- Estimation of carotenoids
- Estimation of amylase, trypsin and chymotrypsin inhibitor activities
- Estimation of Vitamin C in fruits
- Estimation of reducing & non reducing sugar in fruits
- Estimation of protein contents
- Estimation of dietary fibre
- Determination of limiting amino acids
- Estimation of phytate/ oxalate
- Estimation of total antioxidant activity by different methods
- Estimation of curcumin

- Introduction to Bioinformatics, philosophical, directional and application oriented background of bioinformatics.
- HGP - influence area in Bioinformatics, Application in different industries, and its Indian scenario, as a business, problem and future aspects.
- Information network - Internet, web Browser and address (NCBI, EBI *etc*).
- Databases - information resources for Proteins and Genomics.
SRS, Algorithms, Alignment.
- Phylogenetic Analysis: Fundamental of Phylogenetic model, Tree interpretation - Paralogues and orthologues, Tree building and tree evaluation, Phylogenetic software.
Comparative Genome Analysis: Introduction, application, genome analysis and annotation.
- Molecular structure Prediction and visualization (X-ray crystallography/
NMR/Bioinformatics).
- Micro array data analysis.
- Different analysis packages and other Miscellaneous Tools *etc*.

List of Practical:

- Understanding Linux Operating System and Commands.
- Introduction to NCBI.
- Using Entrez to search Literature Databases.
- Retrieving DNA sequence from GenBank and analyzing various formats of the data stored.
- Retrieving Protein sequence from GenPept (NCBI) and Expasy.
- Analyzing Protein Sequences.
- Analyzing DNA sequence.
- Sequence alignment using BLAST (Basic Local Alignment Search Tool).
- Sequence alignment using FASTA.
- Multiple sequence alignment using ClustalW.
- Introduction to the structure database PDB.
- Visualization of the protein structure using VMD.
- Secondary structure prediction using GOR algorithm.