KADI SARVA VISHWAVIDYALAYA
GANDHINAGAR

M.Sc. BIOTECHNOLOGY

SYLLABUS

M.Sc. BIOTECHNOLOGY

KADI SARVA VISHWAVIDYALAYA, GANDHINAGAR

I SEMESTER

BT - 101 CELL AND MOLECULAR BIOLOGY

BT - 102 BIOPHYSICS AND INSTRUMENTATION

BT - 103 MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY

BT - 104 COMPUTER APPLICATIONS AND BIOSTATISTICS

BT - 105 LABORATORY

BT - 106 LABORATORY

II SEMESTER

BT – 201 GENETIC ENGINEERING

BT - 202 IMMUNOLOGY

BT - 203 BIOPROCESS TECHNOLOGY AND BIOCHEMICAL ENGINEERING

BT - 204 ENZYMOLOGY

BT - 205 LABORATORY

BT - 206 LABORATORY

III SEMESTER

BT - 301 PLANT BIOTECHNOLOGY

BT - 302 ANIMAL CELL SCIENCE AND TECHNOLOGY

BT - 303 MICROBIAL TECHNOLOGY

BT - 304 ENVIRONMENTAL BIOTECHNOLOGY

BT – 305 LABORATORY

BT – 306 LABORATORY

IV SEMESTER

BT - 401 PHARMACEUTICAL BIOTECHNOLOGY AND DRUG DESIGNING

BT- 402 PROJECT WORK

I SEMESTER

BT – 101: CELL AND MOLECULAR BIOLOGY

1. Cell as a unit of living organisms – Cellular organelles: Structure and functions, organization of cytoskeleton and nuclei.
2. Chromatin structure; Organization of nucleosome and chromosomes.
3. Molecular aspects of cell division and cell cycle.
4. Nuclear-cytoplasmic interactions.
5. DNA replication: Prokaryotic and eukaryotic DNA replication.
6. DNA repair and gene amplification.
7. RNA transcription and processing; transcriptional regulation in prokaryotes and eukaryotes.
8. Genetic code: Properties, codon usage patterns and codon bias.
9. Protein synthesis, protein modifications and secretion. regulation of protein synthesis.
10. Transposable genetic elements: Types and mechanisms of transposition.

Reference Books:

Cell Biology : DeRobertis and DeRobertis
Molecular biology of cell: B.Alberts et al
Cell and Molecular biology: G.Karp
Molecular Biology of the cell: J.D.Watson et al
Genes VII: B.Lewin

BT - 102: BIOPHYSICS AND INSTRUMENTATION

1. Introduction to biophysics: Molecular organization, different levels, organization of proteins – primary, secondary, tertiary and quaternary structures. Osmosis, diffusion and Donnan Equilibrium.-

2. Conformational analysis: Nucleic acids and their organization in living cells; Interactions of nucleic acids.

3. Methods in biophysical analysis: CD, ORD & fluorescence spectroscopy, Raman spectroscopy.

4. Separation and characterization of biomolecules using centrifugal, electrophoretic and chromatographic techniques.

5. Absorption and emission spectroscopy – principles and applications of Visible, UV, IR, AAS, NMR, ESR and MS spectroscopy.

6. Characterization of macromolecules using X-ray diffraction analysis.

7. Use of analytical microscopy in elucidating the structure-function relationship in prokaryotes: Electron microscopy, phase contrast and fluorescence microscopy and scanning tunneling microscopy.

8. Radio isotope techniques: Detection and measurement of radioactivity, Geiger Muller counters, Scintillation counting, Autoradiography and RIA; Applications of isotopes in biological studies.

Reference Books

Physical Biochemistry: David Freifelder.
Instrumental methods of analysis: Willard, Merrit, Dean and Settle.
Spectroscopy: D.R.Browning
Principles and techniques of practical Biochemistry: Wilson and Walker
Instrumental methods of analysis: D.A.Skoog

BT – 103: MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY

1. Microbial growth : The definition of growth; mathematical expression of growth, growth curve, measurement of growth and growth yields; Synchronous growth; Continuous culture; Growth as affected by environmental factors like temperature, acidity, alkalinity, water availability and oxygen; Culture collection and maintenance of cultures.

2. Metabolic diversity among micro-organisms: Photosynthesis in microorganisms; Methanogenesis and acetogenesis; Nitrogen fixation; Hydrocarbon transformation.

3. Principles of thermodynamics and bioenergetics.

4. The mitochondrial respiratory chain, order and organization of carriers, proton gradient, iron-sulphur proteins, cytochromes and their characterization. Regulation of Respiration.

5. Biomembrances: Structure and Transport Processes

6. Carbohydrates: Glycolysis, citric acid cycle its function in energy generation and biosynthesis of energy rich bonds, Alternate pathways of carbohydrate metabolism. Gluconeogenesis, interconversion of sugars. Biosynthesis of Oligosaccharides.

7. Lipids: Fatty acid biosynthesis, Acetyl CoA carboxylase, Fatty acid synthase, desaturase and elongase. Fatty acid oxidation.

8. Amino acids: Biosynthesis and degradation of amino acid. Regulation of amino acids metabolism in microbial system.

9. Nucleic acid: Biosynthesis of purines and pyrimidines. Regulation of purines and pyrimidines biosynthesis. Structure and regulation of ribonucleotide reductase.

10. Antimicrobial agents : mode of action, resistance to antibiotics.

Reference Books:

Lehninger's Principles of Biochemistry: Nelson and Cox.
Biochemistry: L.Stryer
Microbial physiology: Moat and Foster
Biochemistry: Voet and Voet.

BT 104 : COMPUTER APPLICATIONS AND BIOSTATISTICS

1. Definitions and scope of Biostatistics : Variable in biology, collection, classification and tabulation of data. Graphical and diagrammatic representation, histogram, frequency polygon, frequency curve.

2. Descriptive statistics : Measures of central tendency – Mean (arithmetic, harmonic and geometric), Median and Mode. Measures of dispersion – Standard deviation and standard errors.

3. Elements of probability theory. Probability distributions – binominal, Poisson and normal distribution. Correlation coefficient. Simple linear regression. Probit and logit analysis.

4. Basic idea of significance test. Statistical hypotheses, types of errors, level of significance, Student's t, chi-square, goodness of fit and F tests.

5. History, development and types of computers: General awareness of computer systems – hardware and software (CPU and other peripheral devices, computer arithmetic, computer logic, programming languages – machine language, assembly language, higher level languages).

6. General awareness and use of popular software package for word processing, DBMS, spread sheets, graphics, statistical packages – SPSS, SAS, MINITAB, MATLAB etc.,

7. Bioinformatics: Introduction to bioinformatics. Use of nucleic acid and protein data banks – NCBI, EMBL, DDBJ, SWISSPORT. Multiple sequence alignment. Gene prediction. Genome analysis and phylogenetic prediction.

Reference Books :

D. H. Sanders Computers Today. Mc. Graw-Hill. Book Company.

C. Gibas and P. Jamback : Developing bioinformatics computer skills. O'Reilly Associates.

J. Peek, G. Todino & J. Straug Learning the unix operating system. O'Reilly Associates.

P. Baldi & S. Brunak. Bioinformatics A machine learning approach. M. I. T. Press.

A. D. Bzxevanis and B. F. F. Onellette Bioinformatics : A Practical guide to the analysis of lienes and Proteins.

S. Misenes and S. A. Krawetz (Eds.) Methods in molecular biology Vol. 132. Bioinformatics Methods and protocols.

S. C. Gupta. Fundamentals of Statistics. Himalaya Pub. House.

J. Medhi. Statistical Methods An introductory text. New Age International (P) Ltd. Publishers.

P. S. S. Sudar Rao & J. Richard. An introduction to biostatistics. Prentice Hall of India. N. Delhi.

BT 105 & BT 106 – Practicals related to the theory will be conducted

II SEMESTER

BT – 201: GENETIC ENGINEERING

1. Concept and emergence of r-DNA technology, preparation and purification of total cell DNA, plasmid DNA and bacteriophage DNA. Basic techniques involved in rDNA technology. Generation and cloning of DNA fragments. Restriction enzymes, cDNA preparation. Generation of genomic and cDNA libraries. Solid phase synthesis of DNA, linkers, polylinker, adapter, etc. Covalent linkage of DNA fragments to vector molecules.

2. DNA transactions in Microbes: Transformation, transduction and conjucation. Cloning vectors – Plasmids, cosmids, λ, phagemids, yeast artificial chromosomes. Introduction of DNA/RNA in bacteria, yeast, fungi and in other eukaryotic host systems.

3. Selection and screening of recombinant clones: Direct and indirect methods. Probe preparation (radiolabelling and non radiolabelling). Methods based on Nucleic acid homology (Southern, northern, western, southern-western, subtractive, colony and plaque hybridization, *in situ* chromosomal hybridization, chromosomal walk, etc.). *In vitro* translation.

4. Characterization of cloned DNA : Restriction mapping. DNA sequencing. Polymerase Chain Reaction. DNA fingerprinting, RFLP.

5. Expression of cloned DNA : Expression vectors. Expression in heterologous system.

6. Modification of cloned DNA : Site directed mutagenesis. Secretion of cloned product.

7. Applications of recombinant DNA technology : Transgenic animals. Gene therapy. Transgenic plants. Pharmaceutical products.

8. Safety of recombinant DNA technology : Restriction and regulation for the release of GMOs.

Reference Books :

Recombinant DNA : Watson *et. al.*
Genetic engineering : Sandya Mitra
Principles of gene manipulation : Old & Primrose
Gene cloning : T. A. Brown
Molecular Biology Lab fax I & II : T. A. Brown

BT – 202 : IMMUNOLOGY

1. Overview of the immune system: innate and adaptive immunity, cells and organs of immune system, antigens and super antigens, epitopes, antigen- antibody interactions- agglutination, precipitation, complement fixation, immunofluoresence, ELISA immunoglobulins – structure and function.

2. BCR, TCR, generation of diversity. MHC, antigen processing and presentation.

3. Complement system.

4. Cell mediated immune responses. Activation of T and B lymphocytes. Cytokines and their role. Hypersensitivity.

5. Autoimmunity. Transplantation. Immunity to infectious agents. Tumour immunology. AIDS and other immunodeficiencies.

6. Hybridoma technology and other experimental systems.

7. Vaccines and immunomodulators

Reference Books:

Essential Immunology : Ivan Roitt.
Kuby Immunology : Goldsby, Kindt and Osborne.
Immunology : Roitt, Brostoff, Mole.
Introductory Immunology : Huw Davies.

BT – 203 BIOPROCESS TECHNOLOGY AND BIOCHEMICAL ENGINEERING

1. Introduction to bioprocess technology.

2. Screening, preservation and improvement of industrially important microorganisms

3. Raw material and media formulation for fermentation process

4. Influence of environmental factors on growth and product formation.

5. Elements of biochemical engineering: Bioreactor design. Batch, fed batch and continuous cultivation. Solid state cultivation. Sterilization of media reactor and air. Agitation and aeration and mass transfer of oxygen. Inoculum development, addition and sampling. Growth kinetics: Microbial growth cycle, measurement of growth, growth kinetics. Control of process parameters: measurement of process parameters like pH, temperature, DO, foam etc. Instrumental in process control, two position and proportionate control, biosensors and enzyme probes, microprocessor based control systems. Scale up of bioprocesses. Downstream processing: Cell separation, cell disintegration, product. purification. Effluent treatment.

6. Bioprocess economics

7. Enzyme technology: Immobilization of enzymes, enzyme reactors & bioconversion.

Reference Books :

Principles of Fermentation Technology : Whitekar & Stanbury
Comprehensive Biotechnology : Murray Moo Young
Methods in Industrial Microbiology : Sikyta
Industrial Microbiology – A.H.Patel
Industrial Microbiology – Casida

BT – 204 ENZYMOLOGY

1. Units of activity, Specific activity of enzyme and Methods of enzyme assay.

2. Enzyme specificity. Unisubstrate enzyme kinetics; Factors affecting the rate of enzyme catalyzed reactions forms and derivation of M.M. equation; Significance of V_{max} and K_m.

3. Enzyme inhibition – type of inhibition; Competitive, non competitive and uncompetitive kinetics.

4. Enzyme catalytic efficiency – Factors associated with catalytic efficiency such as proximity, orientation-distortion or strain, and base nucleophilic catalysis with equation.

5. Protein ligand binding; co-operativity, Hill and Satchard plots. Protein sequencing.

6. Immobilized enzymes and their industrial application effect of partition on kinetics and performance with particular emphasis on change in pH and hydrophobicity.

7. Allosteric enzymes; Sigmoidal kinetics and their physiological significance; Symmetric and sequential modes for action of allosteric enzymes and their significance.

8. Multienzyme system : Occurance, isolation and their properties; Polygenic nature of multienzyme systems. Mechanisms of action and regulation of pyruvate dehydrogenase and fatty acid synthatase complex. Coenzymes and co-factors.

9. Detailed mechanism of catalysis of serine proteases, ribonuclease and triose phosphate isomerase.

10. General mechanism of enzyme regulation; Feedback inhibition and feed forward stimulation; Enzyme repression, induction and degradation; Control of enzymatic activity by products and substrates; Reversible and irreversible covalent modifications of enzymes. Introduction to enzyme engineering and its applications.

Reference Books:

Fundamentals of Enzymology : Nicholes C. Price and Lewis Stevens, Oxford Univ. Press.
Enzyme Structure and mechanism : Alan Fersht, Reading, USA.
Understanding Enzymes : Trevor Palmer
The chemical kinetics of enzyme action : K. J. Laider and P. S. Bunting, Oxford University Press, London.

BT 205 & BT 206 – Practicals related to the theory will be conducted

III SEMESTER

BT - 301: MICROBIAL TECHNOLOGY

1. General concept of Microbial biotechnology.

2. Principles of exploitation of microorganisms, primary and secondary metabolism

3. Microbial production of : Antibiotics : Penicillin, streptomycin; Enzymes : proteases, amylases, Organic acids : Citric acid, acetic acid; Vitamins : Vit B_{12}, B_2; Amino acids : Glutamic acid, Lysine; Alkaloids; Alcohol, beer, wine, sake; Polysaccharides

4. Food and dairy products: Single cell protein; Cheese, bread and yogurt

5. Mushroom cultivation

6. Steroid transformation

7. Biofertilizers and biopesticides

8. Biopolymers and bioplastics

Reference Books:

Biotechnology : Rehm and Reid.
Comprehensive biotechnology : Murray Moo Young.
Industrial Microbioplogy – A.H.Patel
Industrial Microbiology - Casida

BT – 302 PLANT BIOTECHNOLOGY

1. Conventional plant breeding. Introduction to cell and tissue culture; Tissue culture as a technique to produce novel plants and hybrids.

2. Tissue culture media (Composition and Preparation). Sterilization and agents of sterilization used in tissue culture labs.

3. Initiation and maintenance of callus and suspension cultures; Single cell clones. Organogenesis; Somatic embryogenesis; Transfer and establishment of whole plants in soil. Shoot tip culture; Rapid clonal propagation and production of virus-free plants. Embryo culture and embryo rescue.

4. Protoplast isolation, culture and fusion; Selection of hybrid cells and regeneration of hybrid plants; Symmetric and asymmetric hybrids, cybrids.

5. Anther, pollen and ovary culture for production of haploid plants and homozygous lines.

6. Somaclonal variation. *In vitro* mutation – Sexual incompatibility and male sterility.

7. Cryopreservation; Slow growth and DNA banking for germplasm conservation.

8. Plant transformation technology – Basis of tumour formation; Hairy root; Features of Ti and Ri plasmids; Mechanisms of DNA transfer; Role of virulence genes; Use of Ti and Ri as vectors; Binary vectors; Use of 35S and other promoters; Genetic markers; Use of reporter genes; Reporter gene with introns; Use of scaffold attachment regions; Methods of nuclear transformation; Viral vectors and their applications; Multiple gene transfers; Vector-less or direct DNA transfer; Particle bombardment, electroporation, microinjection; Transformation of monocots; Transgene stability and gene silencing.

9. Application of plant transformation for productivity and performance – Herbicide resistance, insect resistance, Bt genes, Non Bt like protease inhibitors, alpha amylase inhibitor, virus resistance, coat protein mediated disease resistance, disease resistance, RIP, antifungal proteins, thionins, PR proteins, nematode resistance, abiotic stress.

10. Molecular marker aided breeding – RFLP maps, linkage analysis, RAPD markers, microsatellites, SCAR (Sequence Characterized Amplified Regions), SSCP (Single Strand Conformational Polymorphism), AFLP, QTL, map based cloning, molecular marker assisted selection.

11. Chloroplast transformation – Advantages, Vectors, Success with tobacco and potato.

12. Metabolic engineering and industrial products – Plant secondary metabolites, Control mechanisms and manipulation of phenylpropanoid pathway, shikimate pathway; alkaloids.

13. Green house and green home technology.

Reference Books:

Plant biotechnology – J Hammond, *et. al.*, Springer Verlag.
Plant cell and tissue culture for production of food ingredients – T J Fu, G Singh, *et. al.*
Biotechnology in crop improvement – H S Chawla.
Practical application of plant molecular biology – R J Henry, Chapman & Hall.
Elements of biotechnology – P K Gupta.
An introduction to plant tissue culture – M K Razdan.
Plant propagation by tissue culture : The technology (Vols. 1 & 2) – Edwin George.
Handbook of plant cell culture (Vols. 1 to 4) – Evans *et. al.*, Macmillan.
Plant tissue and cell culture – H E Street, Blackwell Scientific.
Cell culture and somatic cell genetics of plants (Vols. 1 to 3) – A K Vasil, A. Press.
Plant cell culture technology – M M Yeoman.
Plant tissue culture and its biotechnological applications – W Bary, *et. al.*, Springer Verlag.
Principles of plant biotechnology: An introduction to genetic engineering in plants – S H Mantell, *et. al.*
Advances in biochemical engineering / Biotechnology – Anderson, *et. al.*
Applied and fundamental aspects of plant cell tissue and organ culture edited by Reinert & Bajaj Y P S, Springer Verlag.
Plant cell and tissue culture – S Narayanswamy, Tata Mc Graw Hill Co.

BT – 303 ANIMAL CELL SCIENCE AND TECHNOLOGY

1. Structure and organization of animal cell.

2. Equipments and materials for animal cell culture technology.

3. Introduction to the balanced salt solutions and simple growth medium.

4. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium. Role of carbon dioxide. Role of serum and supplements. Serum and protein free defined media and their application.

5. Primary and established cell line cultures.

6. Measurement of viability and cytotoxicity.

7. Biology and characterization of the cultured cells, measuring parameters of growth.

8. Basic techniques of mammalian cell culture *in vitro*; disaggregation of tissue and primary culture; maintenance of cell culture; Cell cloning and cell separation. Cell synchronization. Cell transformation.

9. Scaling up of animal cell culture. Stem cell cultures, embryonic stem cells and their applications.

10. Cell culture based vaccines. Somatic cell genetics. Organ and histotypic cultures. Three dimensional culture and tissue engineering.

11. Embryo technology.

12. Transgenic animals. . Measurement of cell death. Apoptosis.

13. IPR and IPP, GLP.

Reference Books :

Freshney, R. I.:Culture of Animal Cells. Wiley-Liss.
Masters, J. R. W. (ed): Animal Cell Culture – Practical Approach, , Oxford Univ. Press.
Basega, R. (ed): Cell Growth and Division : A Practical Approach. IRL Press.
Butler, M and Dawson, M. (eds.).: Cell Culture Lab Fax, Eds., Bios Scientific Publications Ltd., Oxford.
Clynes, M. (ed).: Animal Cell Culture Techniques. Springer.
Mather, J.P and Barnes, D. (eds). : Methods in Cell Biology, Vol. 57, Animal Cell Culture Methods. Academic Press.

BT – 304 ENVIRONMENTAL BIOTECHNOLOGY

1. Environment : Basic concepts and issues.

2. Environmental Pollution : Types of pollution, Methods for measurement of pollution; Methodology of environmental management – The problem solving approach and its limitations.

3. Air pollution and its control through biotechnology

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4. Water pollution and its control : Water as a scarce natural resource, Need for water management, Measurement of water pollution, Sources of water pollution, Waste water collection, Waste water treatment – Physical, chemical and biological treatment processes.

5. Microbiology of waste water treatments: Aerobic process, Activated sludge, Oxidation ditches, Trickling filters, towers, rotating discs, rotating drums, oxidation ponds.

6. Anaerobic processes: Anaerobic digestion, Anaerobic filters, Up flow anaerobic sludge blanket reactors.

7. Treatment schemes for waste waters of dairy, distillery, tannery, sugar, antibiotic industries.

8. Microbiology of degradation of Xenobiotics in environment: Ecological considerations, decay behaviour & degradative plasmids; Hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides.

9. Bioremediation of contaminated soils and waste land.

10. Biopesticides in integrated pest management.

11. Solid wastes: Sources and management (Composting, wormiculture and methane production).

12. Global environmental problems: Ozone depletion, UV-B, Green house effect and acid rain, their impact and biotechnological approaches for management.

Reference Books :

Waste water treatment for pollution control. 2nd edition. Arceivala.
Environmental Microbiology. R. M. Maier, I. L. Pepper & G. P. Gerba
Comprehensive Biotechnology Vol. – 4. Murray Moo Young.
Biotechnology. Rehm and Reid.

BT 305 & BT 306 – Practicals related to the theory will be conducted

IV SEMESTER

BT -401 PHARMACEUTICAL BIOTECHNOLOGY AND DRUG DESIGNING

1. The Drug Development Process.

2. The Drug-Manufacturing Process.

3. Therapeutic Proteins and nucleic acids.

4. Pharmacological, Microbial, Recombinant, Biochemical and Molecular level screening systems and their construction strategies.

5. Receptor versus enzyme mediated drug action. SAR and its quantitative description. QSAR. Molecular principles in agonist and antagonist action.

6. Thermodynamic and structural principles. Objectives and approaches in the native ligand modification. Molecular graphic and dynamical methods in peptide and protein mimicry. Morphinans versus Enkephalins: paradigm example of a peptido-mimetic. Other illustrative examples from current literature.

7. Drug design by receptor site fit. Active site simulations using PDB structure data and homology modeling. Graphical and computational active site fits exploiting small structure data libraries, and commercial softwares.

8. Concept of Perturbation Free Energy and its practical applications. Rational design of enzyme inhibitors.

9. Enzyme catalytic principles: A recapitulation. Affinity Labels. Illustrative examples. Principle of Suicide Inactivation; design strategies, scope and limitations. Illustrative examples to cover hydrolases, PLP based enzymes, isomerases and redox enzymes.

Practicals related to the theory would be conducted

BT- 402 DISSERTATION WORK

The students of M.Sc Biotechnology should carry out a dissertation work for at least 16 weeks in a reputed lab or institute and should defend their work in front of a selected committee in their last semester.

BT 105 and 106 - Practical Syllabus (First Semester)

1. Introduction to the laboratory, good lab practices.
2. Introduction to instruments and glassware that are routinely used in the laboratory.
3. Reactions of amino acids.
4. Reactions of carbohydrates.
5. Reactions of lipids.
6. Determination of pK value of amino acids.
7. Estimation of proteins by Lowry's method and UV spectrophotometer.
8. Estimation of carbohydrates by anthrone method.
9. Determining the iodine number and saponification value of lipids.
10. Paper chromatography of carbohydrates, 2D paper chromatography.
11. TLC of fatty acids/lipids.
12. Paper electrophoresis of amino acids.
13. Separation of proteins by SDS PAGE,
14. Separation of amino acids by Dowex - 50:
15. Gel Filtration: Determination Vo separation of Blue Dextran and Cobalt chloride or Protein and amino acid by Sepahdex-G10.
16. Mitosis and Meiosis – slides
17. Microtomy.
18. Staining: simple, Gram's, acid fast and spore staining.
19. Preparation of liquid and solid media for growth of microorganisms.
20. Isolation and maintenance of organisms by plating, streaking and serial dilution methods, slants and stab cultures and storage of microorganisms.
21. Isolation of pure cultures from soil and water.
22. Growth, Growth Curve, measurement of bacterial population by turbidometry and serial dilution methods.
23. Effect of temperature, pH, carbon and nitrogen sources on growth.
24. Microscopic examination of bacteria, yeast and molds. Study of the organisms by Gram's, acid fast and spore staining.
25. Assay of antibiotics and demonstration of antibiotic resistance.
26. The effect of hypertonic, hypotonic and isotonic environment of human RBC.
27. Plasmolysis and preparation of sealed and unsealed RBC ghosts.
28. Introduction to MS office software, covering word processing, spreadsheets and presentation software.
29. Computer-oriented statistical techniques: Frequency table of single discrete variable. Bubble sort, computation of mean, variance and standard deviation, t-test, correlation coefficient.
30. Bioinformatics

BT 205 and 206 - Practical Syllabus (Second Semester)

1. Isolation of DNA from plant source
2. Isolation of DNA from animal source
3. Isolation of DNA from bacteria
4. Isolation of DNA from plasmid
5. Agarose gel electrophoresis
6. Restriction digestion of DNA
7. Ligation of DNA
8. Preparation of competent cells
9. Transformation of E.coli
10. Southern blotting.
11. Isolation of casein from milk
12. Separation of amino acids by paper chromatography
13. Separation of proteins by SDS PAGE
14. Western blotting
15. Isolation of an enzyme from a plant source
16. Estimation of DNA
17. Isolation of proteolytic bacteria
18. Isolation of amylolytic bacteria
19. Isolation of lipolytic bacteria
20. Isolation of antibiotic sensitivity
21. Isolation of antibiotic resistant mutants
22. Blood grouping
23. ELISA
24. VDRL test
25. WIDAL test
26. Immunizing a rat
27. Ouchterlony technique
28. Production of wine
29. Immoblization of cells
30. Antimicrobial activity of certain plant extracts.

BT 305 and 306 - Practical Syllabus (Third Semester)

1. Isolation of chromosomal DNA from plant source
2. Isolation of chloroplast DNA
3. Estimation of DNA
4. Agarose gel electrophoresis
5. Surface sterilization
6. MS medium
7. Cell viability testing
8. Development of Callus cultures
9. Microchamber Culture of plant cells
10. Organogenesis
11. Isolation of plant protoplasts
12. Isolation and culture of animal cells
13. Microbial Production of antibiotics
14. Microbial Production of vitamin B12
15. Testing MPN of water
16. Estimation of biological oxygen demand
17. Estimation of chemical oxygen demand
18. Isolation of bacteriophages
19. Isolation of coli forms from water
20. Isolation of Ascorbic acid producing bacteria
21. Visiting waste water treatment plants/ Industries/ Institutes.